



FORESTRY



UPPSC
UTTAR PRADESH



STATE FOREST SERVICE
2025-26

Detailed
Syllabus Based
study material

+

Linkage of
Concepts with
PYQs

+

Infused with
Infographics &
Maps

Module - 4

- © Forest Management
- © Forest Mensuration
- © Yield Regulation
- © Remote sensing
- © Working Plan

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Module - 4

Syllabus



<p>Indian Forest Service (IFoS) [Paper 2 Section A]</p> <p>&</p> <p>Uttar Pradesh PSC State Forest Service Exam 2025-26 [Paper 2 Section A]</p>	<p>Forest Management and Management Systems : ♦ Objective, Principles, and techniques; ♦ Concept of Sustained Yield (its principle, scope, and limitation); ♦ Rotation, its types, and steps for reducing rotation age; ♦ Normal Forest; ♦ Growing Stock; ♦ Stand Structure and dynamics; ♦ Management of forest plantations, commercial forests, and forest cover monitoring. Approaches viz., (i) site-specific planning, (ii) strategic planning, (iii) Approval, sanction, and expenditure. (iv) Monitoring (v) Reporting and governance; Regulation of yield. [Covered in Module 3 : Details of steps involved such as formation of Village Forest Committees, Joint Forest Participatory Management]</p> <p>Forest Working Plan : ♦ Forest Planning, Evaluation, and monitoring tools and approaches for integrated planning; ♦ Multipurpose development of forest resources and forest industries development; ♦ Working Plans and Working Schemes, their role in nature conservation, bio-diversity, and other dimensions; ♦ Preparation and control. Divisional Working Plans, Annual Plan of operations.</p> <p>Forest Mensuration : ♦ Methods of measuring – diameter, girth, height and volume of trees; ♦ Form-factor; ♦ volume estimation of stand, current annual increment; mean annual increment, ♦ Sampling methods, and sample plots. ♦ Yield calculation; yield and stand tables.</p> <p>Remote Sensing : ♦ Forest cover monitoring through remote sensing, ♦ Geographic Information Systems for management and modelling.</p> <p>Other state PSC exams also have similar syllabi to the IFoS exam, such as the Bihar PSC State Forest Service (ACF) Exam (paper 1), Uttar Pradesh PSC State Forest Service [Paper 1, Section A]; Odisha PSC State Forest Service (Main) Examination [Paper 1 Section A]; Jharkhand PSC State Forest Service (Main) Examination [Paper 1].</p>
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Module - 4

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UPPSC STATE FOREST SERVICE (ACF/RFO) PYQs | 2017 – 2021
Forest Management + Working Plan

Year	Questions
2021	<p>निम्नलिखित प्रत्येक का उत्तर लगभग 150 शब्दों में दीजिए / Answer the following in about 150 words each.</p> <p>— वन प्रबन्ध योजना मानचित्र पढ़ते समय आप क्या क्या सूचनाएँ पाते हैं, उन्हें सूचीबद्ध करो। Enumerate the information's you get while reading the forest management plan map [P2/1(a) 8 M]</p> <p>— कार्य योजना कोड में निर्देशित विभिन्न प्रकार के नियंत्रण प्रपत्रों का वर्णन करो। Describe the various types of the control forms as given in the working plan code [P2/1(c) 8 M]</p> <p>— "पातन कूप" से आप क्या समझते हैं? स्पष्ट करो। / What do you mean by the "Felling Coupe"? Illustrate [P2/1(e) 8 M]</p> <p>राष्ट्रीय वर्किंग प्लान कोड के अनुसार वन क्षेत्र में जैव विविधता का आंकलन कैसे करते हैं? विस्तार से स्पष्ट करो। Explain in detail how to assess the biodiversity of a forest area as given in the National Working Plan Code [P2/2(a) 20 M]</p> <p>कैंपा योजना क्या है? उ.प्र. संयुक्त वन प्रबन्ध नियमावली के मुख्य प्रावधान क्या है? / What is CAMPA scheme? What are the main provisions of the U.P. Joint Forest Management Rules? [P2/7(b) 20 M]</p>
2020	<p>निम्नलिखित प्रत्येक का उत्तर लगभग 150 शब्दों में दीजिए / Answer the following in about 150 words each:</p> <p>— वन प्रबंध में आवर्तन का क्या अर्थ है? वनों के प्रबंध में इसके महत्व को स्पष्ट करें / What is meant by rotation in forest management? Explain its importance in management of forests [P2/1(a) 8 M]</p> <p>वानिकी प्रबंध में स्थल विशिष्ट तथा रणनीतिक योजनाओं के अंतर को विस्तार से उचित उदाहरण देते हुए स्पष्ट कीजिए। Explain in detail the difference between site specific and strategic planning in forest management, giving suitable examples [P2/2(a) 20 M]</p> <p>वानिकी प्रबंध में मानचित्रों का उपयोग कैसे होता है? किस प्रकार व किस स्केल के मानचित्र, वन प्रबंध के विभिन्न प्रयोजनों के लिए उपयोग होते हैं? कंटूर मानचित्र क्या है? अक्षांश व देशान्तर से क्या अभिप्राय है? / How maps are used in forest management? What types and scales of maps are used for different purposes in forest management? What is a contour map? What is meant by latitude and longitude? [P2/3(b) 20 M]</p> <p>किसी वन की कार्य व्यवस्था (वर्किंग स्कीम) का क्या अर्थ है? नियमित "कार्य योजना" तथा "वार्षिक कार्यान्वयन योजना" से यह किस प्रकार भिन्न है? कार्य योजना किसी वन क्षेत्र की जैव विविधता को कैसे प्रभावित करती है? / What is meant by a working scheme of a forest? How is it different from a regular "working plan" and "annual plan of operation"? How does working plan impact biodiversity conservation in a forest area? [P2/4(b) 20 M]</p>
2019	<p>निम्नलिखित प्रत्येक का उत्तर लगभग 150 शब्दों में दीजिए / Answer the following in about 150 words each</p> <p>— वनों के वैज्ञानिक प्रबन्धन के लिए कार्य योजना महत्वपूर्ण है। कथन का समालोचनात्मक परीक्षण करें। Working plans are important for scientific management of forests. Critically examine the statement [P2/1(b) 8 M]</p> <p>— वानिकी में प्रयुक्त विभिन्न नमूना चयन विधियों का वर्णन करें। Describe various types of sampling methods used in Forestry [P2/1(d) 8 M]</p> <p>सामान्य वन को परिभाषित कीजिए। सामान्य वन की मुख्य विशेषताओं का उल्लेख कीजिए। सामान्य वन से सतत् प्राप्ति के लिए किन मूल नियमों का पालन किया जाता है? / Define normal forest. Give the principal characteristics of normal forest. State the basic rules which guide the sustained yield for a normal forest [P2/2(b) 20 M]</p> <p>रेखाचित्र की सहायता से माध्य वार्षिक वृद्धि एवं वर्तमान वार्षिक वृद्धि में सम्बन्ध स्थापित कर वन प्रबन्ध में इसके योगदान का वर्णन करें / With the help of diagram, establish relationship between Mean Annual Increment and Current Annual</p>

CHAPTER 1

Chapter outline

- 1.1 Historical Background
- 1.2 Definition
- 1.3 Scope
- 1.4 Goals & Objectives of Forest Management
 - ✿ General Objectives
 - ✿ Special Objectives
- 1.5 Principles of Forest Management
- 1.6 Peculiarities of Forest management
 - ✿ Comparison of forest enterprise with others
 - ✿ Ways to overcome these peculiarities
- 1.7 Private Forest
 - ✿ Global scenario
 - ✿ Comparison
- 1.8 Exercise

INTRODUCTION

1.1 HISTORICAL BACKGROUND

Britishers look over our natural forest resource as a source of timber to feed the growing demand of the British royal navy and industries like railway sleepers, power-supply poles, domestic furniture demands, etc. Therefore, they start managing our forest resources just like agriculture practices over the vast natural area through –

- (a) Establishing a monopoly over the production and harvesting of timber resources,
- (b) Production should be sustainable in the sense of harvesting an equal amount of wood annually or periodically (and not in the modern sense of sustainability).
- (c) Exploiting timber without giving much importance to its negative impact on the wildlife habitat, tribal economy, local watershed, and forest ecology.

To handle this, they compiled the contemporary European knowledge of various subjects of forestry, including silviculture systems and yield regulation, with some modified and original Indian versions in a linear structural format to systematize knowledge that make them easy to train next-generation foresters. That's why we often see this type of outdated content in our Indian academic textbooks.

However, this colonial legacy remained continued till the 1970s. as there were few major changes happening in Indian perspectives.

- Raise of many International and national organizations working on forest and wildlife sectors after the Stockholm conference (1972) on the human environment.
- Legislative changes : like shifting forest and wildlife subjects from the state list to the concurrent list (1976), passing the Wildlife protection act (1972), Water Act (1974), Forest conservation act (1980), Air act (1981), environment protection act (1986), Biodiversity conservation and many more.
- Achieved food security after the success of the green revolution. Therefore, the need to prioritize food production over forestry remains

no more.

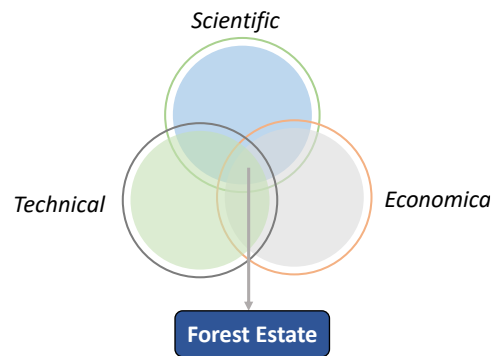
- Achieved food security after the success of the green revolution. Therefore, the need to prioritize food production over forestry remains no more.
- The emergence of new threats like Global warming and climate change, Deforestation, increasing the destructive effect of exotic species, watershed destruction, flooding issues, etc.
- Policy-related changes like the promotion of Participatory Forest management and forest rights acts.
- Biodiversity conservation and forest genetic resources.

All of these lay down the foundation of our policy shifting from a *production forestry* point of view to *protection forestry*. And even in the case of production forestry areas, we started considering the impact of harvest practices on the *local ecology and biodiversity, Wildlife, watershed, Tribal livelihood, and Carbon sequestration ability* of forest. These lay down the foundation for more smooth and sustainable regulation of forest resources with *strategic* and *Tactical harvest planning*.

1.2 DEFINITION

Forest management is the *practical application* of the *scientific, technical, and economic principles* of forest estate to achieve *certain objectives*.

In the broadest sense, forest management is a process that effectively integrates the biological, social, and economic factors which influence the decisions leading toward the implementation of one or more specified objectives.



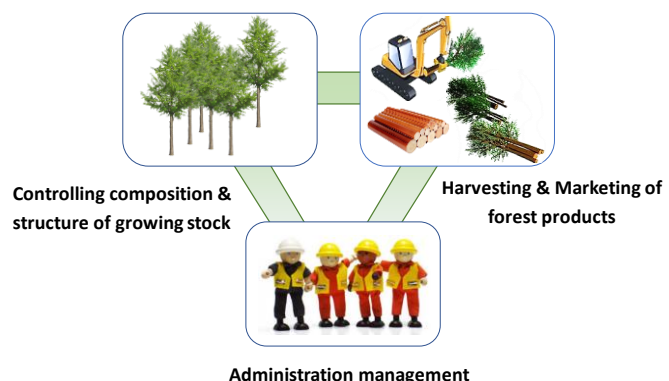
[FAO define - Forest Management deals with the overall administrative, economic, legal, social, technical, and scientific aspects related to natural and planted forests. It implies various degrees of deliberate human intervention, ranging from actions aimed at safeguarding and maintaining the forest ecosystem and its functions to favouring specific socially or economically valuable species or groups of species for the improved production of goods and services].

1.3 SCOPE

Controlling the structure & composition of growing stock - through Site-selective tending operations, Choice of species, Regeneration methods, stand manipulation and Protection measures, etc.

Harvesting to the marketing of produce : by preparing a proper Logging Plan, adopting suitable transportation methods, Marketing / Auctioning of produced, and Revenue management.

Administration of forest property : Monitoring and control of works, Labour management and their welfare, Economy efficiency.



CHAPTER 2

Chapter outline

2.1 Territorial Classification

- ✿ Block, Compartment & Sub-compartment
- ✿ Forest management by compartment; its advantages and types.
- ✿ Compartment history.
- ✿ Compartment description.

2.2 Administrative (Organisational) classification.

- ✿ Central level
- ✿ State level

2.3 Management (Silvicultural) classification

- ✿ Working circle, and its types
- ✿ Felling series
- ✿ Coupe
- ✿ Cutting section

2.4 Felling series under different silviculture systems

- ✿ Clear felling system
- ✿ Shelterwood system
- ✿ Selection system

2.5 Exercise

FOREST ORGANIZATION

In 1806 the government of Madras appointed Captain Watson as the first conservator of forest, which laid the foundation of modern-day forests administration. It was further strengthened with the establishment of the Indian Forest Service in 1867. For a *better description, administration, management, and record-keeping*, forest areas are generally divided into 3 major categories. These categories are –

- Territorial classification or system
- Administrative (or Organizational) structure
- Management (or Silvicultural) classification

2.1 TERRITORIAL CLASSIFICATION

At range level, a forest area is divided into Blocks, Compartments, and Sub-Compartments based on its executive and protective functions.

- ▶ **Forest Block** : In general, A forest range is divided into 15 to 30 blocks, which are the main territorial divisions. A block usually has a distinct clear-cut boundary all around marked by numbered pillars and has its Local proper name, i.e., Haldwani block.
- ▶ **Compartment** : A forest block is divided into several compartments, which are the permanently defined forest territorial Units for the purposes of administration and record.
 - A compartment is a **permanent, recognized geographically unit of forest land** forming on the basis for planning, prescription, monitoring, and permanent record of all forest operations.
 - Use Arabic numbers 1, 2, 3, etc. for their naming
 - It is the **smallest permanent working plan unit** of management, Its Boundaries are chosen carefully on the ground and marked on the map. The boundaries are formed either by natural features such as ridges, valley bottoms, streams or artificial fire lines, etc.

CHAPTER 3

Chapter outline

- 3.1 Sustainable Yield
 - ✿ Way to achieve
 - ✿ Advantages.
 - ✿ Disadvantages/Limitations
 - ✿ Relationship with Normal Forest.
- 3.2 Progressive Yield.
 - ✿ Concept/Principle
 - ✿ Advantages
- 3.3 Sustainable Yield v/s Progressive Yield
- 3.4 Exercise

SUSTAINABLE YIELD

[EVEN FLOW]

In Europe, forestry emerged as a profession and national forests were created based on the belief that unregulated markets would result in forest devastation. It was believed governments must own or regulate forests to perpetuate timber resources. This belief is still widely held and is the basis for extensive public forest ownership in Europe, India, and elsewhere. The profession of forestry began somewhere in Germany several centuries ago. Before the industrial revolution, forest management practised by professional foresters had spread from Germany to most other parts of Europe and the world.

A common forest management philosophy like the concept of sustained yield, yield regulation, and many other associated ideas emerged in this environment that continues to have a major and most unfortunate impact on forestry today.

3.1 SUSTAINABLE YIELD

[Concepts/Principle] It is the theoretical equilibrium concept, and according to it, a forest should be managed in such a way that the *annual or periodic* (when the period is short) *removal* of mature timber does not exceed the annual or periodic *stock growth* under the *existing environmental conditions*, and at a given *intensity of management*, without *harming its renewable process* and *productivity* of the forest area. In other words, Sustainable yield can be expressed as the allowable cut which may differ slightly from net increment (*i.e.*, gross increment minus natural losses due to fire, wind, epidemics, etc.) depending on the growing stock and distribution of age-classes.

[Definition] The regular and fixed supply of the desired forest produce with its full capacity without harming the *productivity* of forest crop or soil is called sustainable yield.

MAXIMUM SUSTAINABLE YIELD

The maximum sustainable yield (MSY) is defined as the *highest average yield* one can harvest from the forest over an indefinite period.

CHAPTER 6

Chapter Outline

6.1 Introduction

- ✦ Definition
- ✦ Importance of GS

6.2 Estimation of GS.

- ✦ Total enumeration
- ✦ Sampling
- ✦ By MAI
- ✦ By Yield Table
- ✦ Numerical examples
- ✦ Flury's Constant
- ✦ NGS from Uniform system
- ✦ NGS from Selection system

6.3 Reducing factor

6.4 Comparison of GS

6.5 Exercise

GROWING STOCK

Growing Stock is the sum (Number or volume) of a total of trees growing in a forest or a specific part of it, which has more than a certain diameter at breast height (DBH).



Figure : Growing stock also known as **Forest Capital**

The concept of growing stock is relative, and what one can include in it and what cannot depend upon one's views and objects of forest management. I mean, if our object of forest management is the production of timber, then we count trees of specific diameter only (above specific DBH). If our forest management objectives are carbon capturing and storage, we estimate all above-ground and underground biomass in growing stock; it includes all trees, climbers, stumps, leaf litter, underground roots, etc.

IMPORTANCE OF GROWING STOCK

Periodic estimation of the growing stock is essential for developing national policies and strategies for sustainable use of the forest resources.

- Provides information about (i) the volume of wood available inside forests, (ii) Current Forest carbon storage and carbon sinking potential, (iii) the tangible economic value of forests. This will help in forest certification, carbon trading, and fulfilling our INDC's obligations (2.5 to 3 billion tonnes of carbon sink storage).

CHAPTER 10

Chapter Outline

- 10.1 Introduction
 - ✿ Definition
 - ✿ Methods of forest cover monitoring
 - ✿ Why forest cover monitoring is so vital?
 - ✿ Limitations
- 10.2 Forest Cover Classification
- 10.3 Forest Survey of India
 - ✿ Mandate
- 10.4 Forest Fire Monitoring
- 10.5 Exercise

FOREST COVER MONITORING

SYLLABUS

Forest cover monitoring. Approaches *viz.*, (i) site-specific planning, (ii) strategic planning, (iii) Approval, sanction, and expenditure. (iv) Monitoring (v) Reporting and governance.

10.1 INTRODUCTION

Forest Cover : All lands more than 1 hectare in an area with tree canopy density of 10 % or more, irrespective of land ownership, use, and legal status.

Forest Cover Monitoring : it is the process to check or record forest cover regularly by using modern tools to understand the scenario and effects of various causes over forest cover.

Remote Sensing : This is the technique of acquiring information about some property of an object with the help of recording devices such as a camera, laser, radiofrequency receiver, radar system, etc., without any physical contact with them.

METHODS OF FOREST COVER MONITORING

► **Traditional Methods** : Collecting and assessing data manually. The use of airborne remote sensing, including balloons and Dakota aircraft, has been limited. We relied on this method until 1981 when FSI began developing and using space-based remote sensing.

Issues with this ?

- Less effective, time-consuming, and too expensive.
- The majority of aerial remote sensing data is recorded in the black and white spectrum. Because of this, it is virtually impossible to identify invasive species, detect stress on the forest ecosystem, and trees species these days.

CHAPTER 14

Chapter Outline

14.1 Introduction

- ✿ Concept
- ✿ Needs
- ✿ Definition
- ✿ Objectives
- ✿ Scope
- ✿ Salient features

14.2 Brief History

14.3 Working plan period

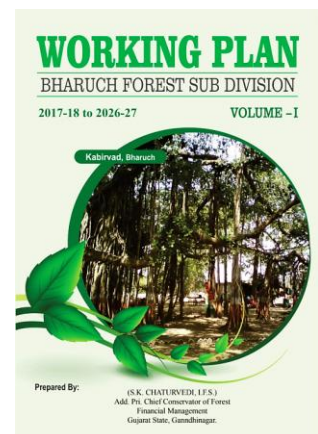
14.4 Exercise

WORKING PLAN

[INTRODUCTION]

14.1 INTRODUCTION

CONCEPT : Let's suppose we wanted to start a commercial forest enterprise, similar to an agriculture one. In that case, we would need systematic planning for it, right from the preparation of the site and regrowth of the vegetation to the final felling and marketing of the harvested products. Since forest crop is not a seasonal or annual crop like wheat and its rotation can be less than 40/50 years + Apart from this production, we also have other protective, socio-economic development for tribals and wildlife conservation purposes. To accomplish all these goals, we need a brief but detailed fact-based plan that can manage, regulate, control, and direct our operations for at least the next 10 to 15 years.



NEED

- It is common for foresters/IFoS officers to get transfer after 2/3 years (\pm promoted, retired, or die); then who would remember which treatment they have already given to the local forest stand and which is not?
- Forests are also facing high biotic pressure, soil erosion, climate change, and fire incidences. Therefore, they must also be managed in a certain way (in a sustainable manner) with long-term planning.
- Wildlife is also a component of the forest ecosystem; we cannot leave them or drive them out of the area.
- CAMPA plantation and REDD⁺ type initiatives give much attention to the prevention of forest degradation.

Therefore, we needed a written document to establish a sustainable plan based on ground-based observations, all needed facts, and scientific principles, so no one can affect our continuity of operation, whether officer

INTRODUCTION

The term mensuration has traditionally been defined as a branch of mathematics that deals with the measurement of lengths, areas, and volumes. In forestry, it encompasses determining dimensions, form, weight, growth, volume, health, and age of trees, individually or collectively.

► **Definition** : Forest mensuration is the branch of forestry that deals with the determination of dimensions (*i.e.*, diameter, height, volume), form, age, and increment of a single tree, stand, or a whole forest, either standing or after felling.

► **OBJECTIVES**

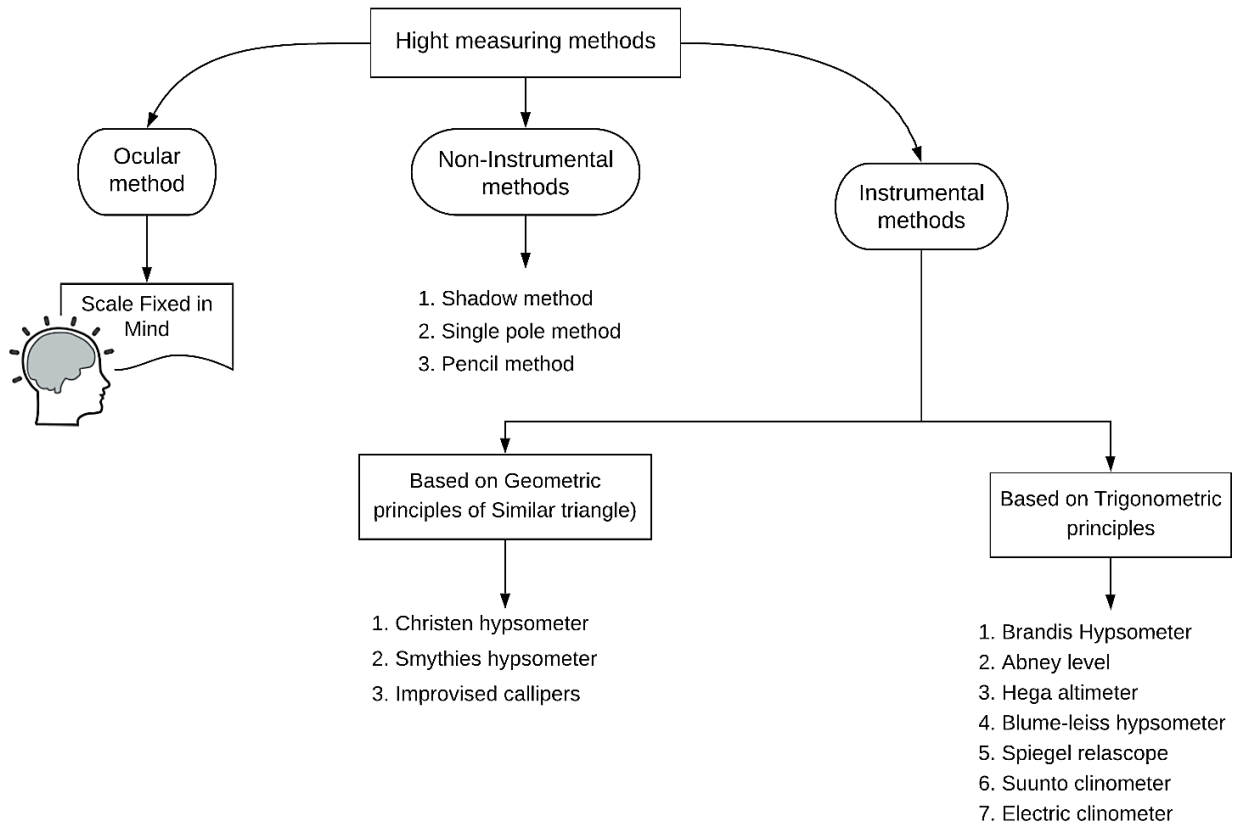
- **The basis for sale** : Before any sale, the forest department estimates the quality and quantity of timber and other forest products and prices them accordingly.
- **For research** : (a) quantifying stand characteristics (volumes, weights, etc.), measuring past growth, and predicting the future growth of individual trees or stands. (b) To obtain a specific size or quality timber as per the requirement of our industries, after giving them a type of silvicultural treatment. Mensuration here helps us in assessing the effects of silvicultural treatments on stand growth, its quality, and productivity.
- **For forest management** : To properly manage the forest land at the ecosystem level, we have to know how much wood is standing in the forest, its structure, composition, productivity, carrying capacity, and carbon sequestration. We also need to measure them for carbon trading, *forest certification*, and making a "*zero-carbon*" *economy* based.
- **For planning** : For the future need of the nation and its industries, *i.e.*, working plan.
- Prediction also is an important aspect of forest measurements. For instance, the weight of a standing tree cannot be measured directly, but it can be predicted using easily measured tree attributes such as diameter at breast height and total tree height.

► **SCOPES**

- For contractors, Sawyers, Transporters, and millers – to know the volume and quantity of timber.
- For a forester – for better wildlife management, estimating the carbon sequencing capacity of the forest.
- Recreational and eco-tourism purposes.

► **ACCURACY-RELATED ISSUES DURING MEASUREMENT** : Accuracy depends upon -

3.2 HEIGHT MEASUREMENT METHODS WITH ITS PRINCIPLES



3.2.1 OCULAR METHOD

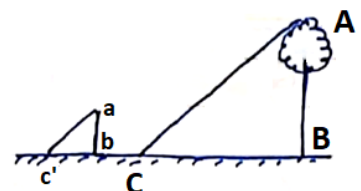
With experience, a height scale is set in our mind, on the basis of which we can estimate the average height of a tree. For example, by looking at a tree, a man can say that this is a tree of 10 meters or 12 meters in height. But, definitely, he would never say that it is a tree with a height of 2 m or 3 m.



3.2.2 NON-INSTRUMENTAL METHODS

Based on the principle of "Similar triangle"

► **SHADOW METHOD** : in this method, a pole of convenient length is fixed on the ground, and its height above the ground is measured. The length of the shadow of the pole and the tree was also measured. Now the height of the tree can be measured by -



$$\frac{AB}{ab} = \frac{BC}{bc'}$$

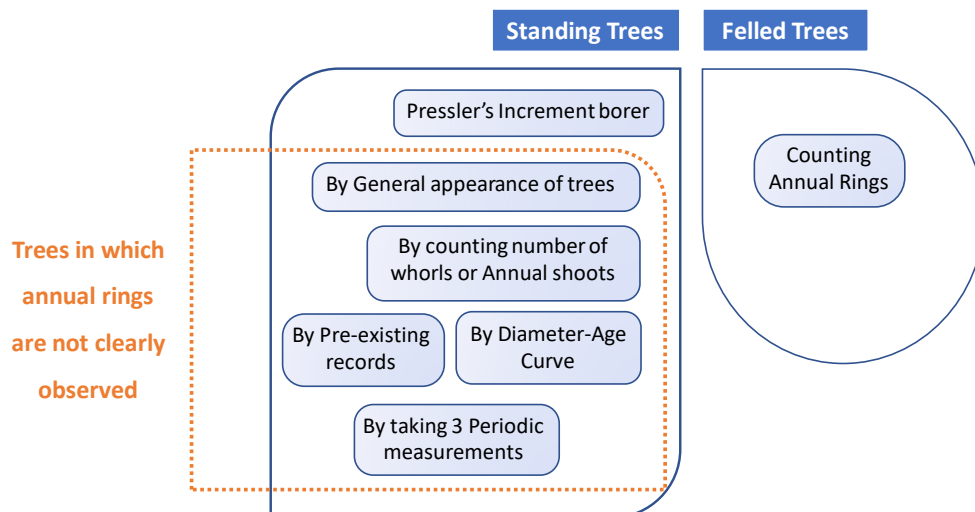
Constraints of this method

AGE OF TREES

► WHY DID WE REQUIRE TO ESTIMATE AGE ?

- To estimate the rate of forest wood capital formation.
- To determine the time required for particular volume formation

► METHODS



7.2 CALCULATING AGE OF STANDING TREE

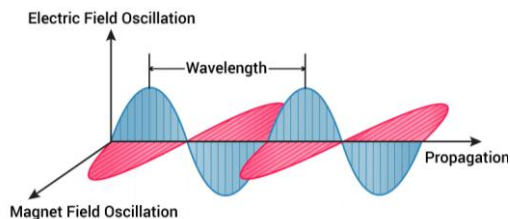
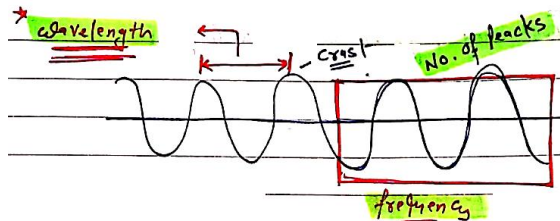
- **From existing records** : in the case of trees raised by plantation, the records of the year of such operations are very helpful in finding the age of trees.
- **From general appearance** : the age of a standing tree can also be found by ocular estimation, but it requires the skill of a high level.
 - Size and shape of the crown – in some species size and shape of the crown changed with increasing age, *i.e.*, *Pinus roxburghii* has a conical crown in the early stage, and it became rounded as the tree grows older.
 - Younger has a high tapering rate while older have low tapering + Size of the stem.
 - Colour and condition of barks – in *Shorea robusta*, younger trees have rough, crooked and darker bark than the old one which has lighter and smooth bark.



Figure : A record board of plantation work. Which give us information about the species sown or planted, year and time of planting, method of planting and various given treatments.

AERIAL PHOTOGRAPHY

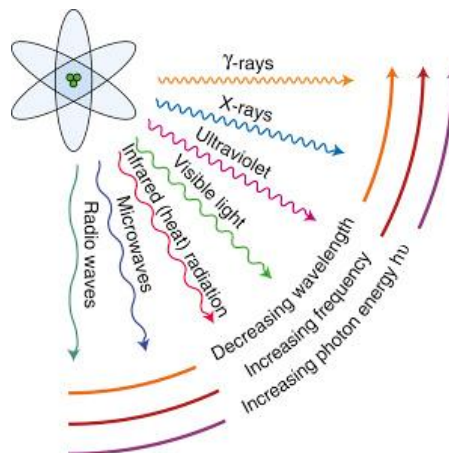
► EMR PROPERTIES



► **FREQUENCY** : No of Peaks passing through a fixed point in space per unit time.

► SPECTRUM BANDS

SPECTRUM	WAVELENGTH
Cosmic rays	$< 10^{-7} \mu\text{m}$
gamma	$10^{-7} - 10^{-4} \mu\text{m}$
x-rays	$10^{-4} - 10^{-2} \mu\text{m}$
uv. Rays	$10^{-2} - 0.4 \mu\text{m}$
visible	$0.4 - 0.76 \mu\text{m}$
infrared	$0.76 - 10^2 \mu\text{m}$
micro wave	$10^2 - 10^6 \mu\text{m}$
radio wave	$> 10^6 \mu\text{m}$



Solar radiation passed through the Atmosphere before it reached the earth's surface, so the Gas particles, dust, and clouds reflect, absorb, or scatter certain bands' wavelength. The part of EMR that is very less affected by Atmosphere or virtually have NO affected is called **ATMOSPHERIC WINDOW**. Example : $0.3 - 0.75 \mu\text{m}$, $1.2 - 1.34 \mu\text{m}$ and $3.5 - 4.16 \mu\text{m}$. These spectra are very useful in remote sensing.

► **ATMOSPHERIC EFFECTS ON RADIATION** : scattering, absorption, transmission & reflection.

► **SENSORS (Camera)** :

- **TYPES** : on the basis of the EMR spectrum that they used -
 - **Visible radiation** : Camera, Panoramic camera, etc.
 - **Infrared region** : Optical mechanical scanner
 - **Microwave region** : SLAR – Side looking airborne radar
- **LENS** : Narrow-angle (Cover angle below 60°), Normal angle (60° to 75°), Wide-angle (75° to 100°), and Super wide angle (over 100°).

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