



FORESTRY



JPPSC
JHARKHAND



STATE FOREST SERVICE

2024 - 25

Detailed
Syllabus Based
study material

+

Linkage of
Concepts with
PYQs

+

Infused with
Infographics &
Maps

Module - 3

- Tribology
- Joint Forest Management (JFM)
- Forest Ecology, Climate change & Pollution
- Forest Certification & EIA
- Tree Improvement, & Seed Technology
- Forest Soil, Soil Conservation & Afforestation of difficult sites
- Watershed Development

Congratulations

To all our successful candidates in

MPPSC STATE FOREST SERVICE

1
Rank



Ankur Gupta

Comprehensive
Forestry Course

2
Rank



Ubhay Singh Parihar

Comprehensive
Forestry Course

3
Rank



Rajveer Shrivastava

Comprehensive
Forestry Course + CIGP

5
Rank



Sanjeet Yadav

Comprehensive
Forestry Course + CIGP

6
Rank



Satyam Kumar Tripathi

Comprehensive
Forestry Course + CIGP

7
Rank



Baljeet Singh

Comprehensive
Forestry Course + Test
Series + CIGP

10
Rank



Prabhanshu Pawar

Test series

11
Rank



Vijay Singh Solanki

Comprehensive
Forestry Course + CIGP

13
Rank



Pankaj Chouhan

Comprehensive
Forestry Course

11 Out of 13 Total
Selections in

वन परियोजना क्षेत्रपाल 2022

1
Rank



Sumit Gupta

Comprehensive
Forestry Course + CIGP

2
Rank



Arun Sharma

Comprehensive
Forestry Course

4
Rank



Chandramohan Dhakad

Comprehensive
Forestry Course

6
Rank



Bhuvnesh Chouhan

Comprehensive
Forestry Course

7
Rank



Naman Jain

Comprehensive
Forestry Course

8
Rank



Devanshu Sharma

Comprehensive
Forestry Course

08 Out of 13 Total
Selections in

वन परियोजना क्षेत्रपाल 2021

INDIAN FOREST SERVICE (MAIN) EXAM

FORESTRY

MODULE - 3



EDITION : 2024 – 25

☎ +917223970423

🌐 Hornbillclasses.com

Gole ka mandir, Morar, Gwalior (MP) 474005

SYLLABUS

- ❖ **TRIBOLOGY** : Tribal scene in India; tribes, the concept of races, Principles of social grouping, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programs.
- ❖ **JFM** : Details of steps involved such as the formation of Village Forest Committees, Joint Forest Participatory Management. Principles, objectives, methodology, scope, benefits and role of NGOs.
- ❖ **ENVIRONMENTAL CONSERVATION AND BIODIVERSITY**
 - Environment** - components and importance, principles of conservation, impact of deforestation; forest fires and various human activities like mining, construction and developmental projects, population growth on environment.
 - Pollution** - types, global warming, greenhouse effects, ozone layer depletion, acid rain, impact and control measures, environmental monitoring; concept of sustainable development. Role of trees and forests in environmental conservation; control and prevention of air, water and noise pollution. Environmental policy and legislation in India. Environmental Impact Assessment. Economics assessment of watershed development *vis-a-vis* ecological and environmental protection
- ❖ **TREE IMPROVEMENT AND SEED TECHNOLOGY** : General concept of tree improvement, methods and techniques, variation and its use, provenance, seed source, exotics; quantitative aspects of forest tree improvement, seed production and seed orchards, progeny tests, use of tree improvement in natural forest and stand improvement, genetic testing programming, selection and breeding for resistance to diseases, insects, and adverse environment; the genetic base, forest genetic resources and gene conservation in situ and ex-situ. Cost benefit ratio, economic evaluation.
- ❖ **FORESTS SOILS** : Classification, factors affecting soil formation; physical, chemical and biological properties.
- ❖ **SOIL CONSERVATION** : Definition, causes for erosion; types – wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of forests in conserving soils. Maintenance and build-up of soil organic matter, provision of lopping's for green leaf manuring; forest leaf litter and composting; Role of micro-organisms in ameliorating soils; N and C cycles, VAM.
- ❖ **WATERSHED MANAGEMENT** : Concepts of the watershed; the role of mini-forests and forest trees in overall resource management, forest hydrology, watershed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas; hilly and mountain areas; watershed management and environmental functions of forests; water-harvesting and conservation; groundwater recharge and watershed management; the role of integrating forest trees, horticultural crops, field crops, grass, and fodders.

Module - 3

CONTENTS



PART – I : TRIBOLOGY		
1.	Indian tribes	1 – 2
2.	Tribal Families & Marriages	3 – 5
3.	Kinship, Taboos & Totem	6 – 7
4.	Tribal Economy	8 – 9
5.	Tribal Development	10 – 11
6.	Census & Demography	12
PART – II : JOINT FOREST MANAGEMENT		
1.	JFM : Introduction	13 – 22
2.	PRA & RRA	23 – 28
3.	NGOs	29 – 30
PART – III : ECOLOGY & ENVIRONMENT		
4.	Climate change & Global warming	31 – 46
5.	Sustainable Forest Development	47 – 55
6.	Conservation	56 – 57
7.	Protected areas	58 – 63
8.	Bio-Geographic Zones	64 – 66
9.	Forest certification	67 – 70
10.	EIA	71 – 81
11.	Ozone depletion	82 – 88
12.	Pollution & related issues	89 – 112
13.	Carbon Cycle	113 – 117

PART – IV : TREE IMPROVEMENT		
14.	Introduction	119 – 123
15.	Variations	124 – 126
16.	Introduction of exotics	127 – 129
17.	Selection	130 – 139
18.	Seed production area	140 – 142
19.	Seed orchard	143 – 147
20.	Seed orchard management	148 – 150
21.	Hybridization	151 – 156
22.	Tissue culture	157 – 158
23.	Tree Seed technology	159 – 161
PART – V : FOREST SOIL		
1.	Forest Soil : Introduction	163 – 165
2.	Rocks & Its formation	166 – 170
3.	Weathering of rocks	171 – 173
4.	Soil formation	174 – 176
5.	Soil classification	177 – 180
6.	Soil physical properties	181 – 186
7.	Soil Chemical & Biological properties	187 – 191
8.	Afforestation of difficult sites	192 – 200
9.	Watershed management	201 – 218

TRIBOLOGY

2023	<ul style="list-style-type: none"> Enlist the Problems Faced by the tribal communities in India [P1/7(a) 10 M].
2015	<ul style="list-style-type: none"> Enumerate and discuss the factors responsible for restricting tribal population in the national parks [P2/8(c) 10 M].
2014	<ul style="list-style-type: none"> Name different tribes of India State-Wise and their specific Characteristics. How can we make use of their Traditional Knowledge in forest conservation (flora and fauna) ? [P1/8(a) 20 M].
2013	<ul style="list-style-type: none"> Give the fundamental Characteristics of the tribal economy in India [P1/5(b) 8 M].
2011	<ul style="list-style-type: none"> Write short notes on (i) Tribal economy, (ii) Chola Naickans, (iii) Gujjars, (iv) Gonds [P1/5(b) 10 M]. Discuss the Characteristics which are shared by the diverse tribal groups all over India [P1/6(d) 10 M].
2010	<ul style="list-style-type: none"> How can we make use of the Traditional Knowledge of the major tribes of India in forest conservation (both flora and fauna) ? [Linked Q P1/1(b) i 10 M].

JOINT FOREST MANAGEMENT (JFM)

2024	<ul style="list-style-type: none"> Elucidate the impact of Joint Forest Management on the conservation of natural forests and improvement of rural environment [P1/7(c) 10 M]. What is Eco-Development Committee (EDC)? Explain its role in forest conservation and mitigation of human-wildlife conflict [P2/3(c) 10 M].
2023	<ul style="list-style-type: none"> Write a note on the gender issues in Joint Forest Management (JFM). [P1/5(d) 8 M]. What is Village Forest Committee? Explain its role in forest management. [P2/2(c) 10 M].
2022	<ul style="list-style-type: none"> “Participatory Forest Management is a success”. Illustrate with examples [P2/4(c) 10 M].
2021	<ul style="list-style-type: none"> How do the Ownership Rights of forests Influence the Success of joint forest management? [P1/5(b) 8 M].
2020	<ul style="list-style-type: none"> How does collaborative forest management ensure community and household resilience? [Linked Q P2/1(c) 8 M].
2019	<ul style="list-style-type: none"> Why are Participatory Rural Appraisal (PRA) techniques important for planning and execution of Joint Forest management (JFM) Activities? Explain the tools and techniques of PRA. [P1/6(a) 15 M].
2018	<ul style="list-style-type: none"> Explain the environmental and economic role of community forestry in India [P1/5(d) 8 M]. What are the Objectives of Joint Forest Management (JFM)? Give Methods used for preserving forest resources through JFM [P2/7(b) 15 M].
2017	<ul style="list-style-type: none"> Write in detail as to why the Joint Forest Management Policy was initiated and what are its

	Constraints in implementation? [P2/4(b) 15 M].
2016	<ul style="list-style-type: none"> Trace the History of JFM in India, narrate any one success story with details [P2/3(a) 15 M]. Describe the role of Corporate Social Responsibility (CSR) towards sustainable forest production through Public-Private Partnership (PPP) approach [P2/8(a) 10 M].
2014	<ul style="list-style-type: none"> Introduction of JFM in various states in India was found Positive in biodiversity conservation, discuss in details. [P2/1(d) 8 M].
2013	<ul style="list-style-type: none"> Describe constitution of JFM Network by MOEF, GOI with its terms of reference [P2/4(b) 7 M]. What entry point activities are recommended in joint forest management? [P1/5(d) 8 M].
2012	<ul style="list-style-type: none"> What shifts in attitude among Forest Personnel from the present are required for better success of Joint Forest Management? Discuss [P2/4(c) 10 M].
2010	<ul style="list-style-type: none"> How can we make use of the traditional knowledge of the major tribes of India in forest conservation (both flora and fauna) ? [P1/6(b) ii 8 M]. How can NGOs, Schools, Banks and Industry help to carry out an afforestation programme? [P1/8(c) 20 M].

POLLUTION, CLIMATE CHANGE & ENVIRONMENTAL CONSERVATION

2024	<ul style="list-style-type: none"> What is the Greenhouse Effect? Define it. Describe in detail, accounts of its causes, sources and environmental impact [P1/5(e) 8 M]. Explain the concept of Sustainable Development of forests. How is it associated with the biodiversity, forest ecosystem conservation and forest ecosystem health? [P1/6(c) 15 M]. Critically analyse the impact of mining, construction projects and human population on Environmental Degradation. Analyse comparatively the management practices followed in India and China [P1/b) 15 M].
2023	<ul style="list-style-type: none"> Greenhouse Gases result in global warming. Discuss [P1/5(e) 8 M]. What is Environmental Impact Assessment (EIA)? Describe the activities involved and general procedure in EIA [P1/8(c) 15 M]. Write on Carbon Sequestration and discuss the role of afforestation in absorptions of carbon dioxide (CO₂) from atmosphere [P1/6(c) 10 M]. Write the components of vehicular air pollution and list the damages caused to roadside trees. [P2/5(c) 8 M]. What is deforestation? Discuss the impact of deforestation on the environment [Linked Q P1/6(c) 15 M].
2022	<ul style="list-style-type: none"> How do tree and shrub mass influence the mitigation of Particulate Matter and noise in urban settings? [P1/6(c) 10 M].
2021	<ul style="list-style-type: none"> What is the relationship between air pollutants and climate change? How does forest vegetation abate different types of pollutants? Describe Air (Prevention and Control of

	<p>Pollution) Act, 1981 in relation to pollution management. Suggest name of suitable plant species. [P1/7(a) 15 M].</p> <ul style="list-style-type: none"> • Explain the role of trees and forests in Environmental conservation [Linked Q] P1/6(a) 15M]. • What are the impacts of COVID-19 pandemic on environment and biodiversity [P1/5(a) 8]. • What is REDD+? How does clean development mechanism help in sustainable management of forests? (8m) [P2/5(c) 8 M]. • What is the role of forest plantations in Carbon Sequestration? (10 m) [P2/7(c) 10 M]. • Describe the criteria and indicators of Sustainable Forest Management [P2/1(a) 8 M].
2020	<ul style="list-style-type: none"> • Explain the methods of Environmental Impact Assessment [P1/8(b) 15 M]. • What is the significance of Afforestation and Reforestation to the ecosystem? How are the National Afforestation Programme, Green India Mission and Forest Fire Prevention and Management Scheme helping in restoration of forests? [P2/7(a) 15 M].
2019	<ul style="list-style-type: none"> • List out the greenhouse gases that contribute to Global Warming. What are the effects of global warming? Explain the role of trees and forests in combating environmental degradation. [P1/7(b) 15 M]. • Explain the concept of Sustainable Development. Discuss in brief the agenda for sustainable development. [P1/8(b) 10 M].
2018	<ul style="list-style-type: none"> • Write the salient features of the Solid Waste Management Act, 2000 and 2016. What new initiatives have been taken in the solid waste management rules, 2016? [P1/5(e) 8 M]. • Write about the pre- and post-Environmental Impact Assessment (EIA) of any mining area of India. Does GIS help in EIA? Write the name of the software used in Environmental Impact Assessment for the mining areas [P1/6(b) 10 M]. • What is Sustainable Development? Write about the criteria and indicator of sustainability fulfilling the needs and demands of growing population of India [P1/8(b) 10 M].
2017	<ul style="list-style-type: none"> • Comment on the possible Impact of Greenhouse Gases on the global environment [P1/5(d) 8 M].
2016	<ul style="list-style-type: none"> • Define Global Warming. Explain in brief the principle behind greenhouse effect. Write the consequences of global warming on forest, wildlife and the human health. [P1/6(b) 20 M]. • What are the objectives of carrying out EIA. Discuss sequentially, the different phases of an EIA study. [P1/6(c) 10 M]. • How are “Environment”, Environmental pollutant” and “Hazardous substance” narrated in environment (protection) act, 1986? [P1/7(b) 10 M].
2015	<ul style="list-style-type: none"> • What is the penalty prescribed in section 15 of the environmental (Protection) act, 1986 for contravention of the provisions of the environmental act, rules and orders? [Linked Q P1/5(c) 8 M]. • Write the Chemistry of Ozonosphere and list the adverse effects of ozone layer depletion [P1/6(c) 10 M]. • Briefly explain the process of acid rain formation and its adverse effects on buildings and aquatic bodies [P1/7(c) 10 M]. • What is Arsenic Pollution? Discuss the strategies to mitigate it [P1/8(c) 10 M].

	<ul style="list-style-type: none"> Growth and productivity of forest plants are affected by different types of air pollutants. What are those? Suggest suitable remedies [P2/6(d) 10 M]. Narrate how Sustainable Forestry accounts for the ecological, economic, social and cultural values of forests. Give your opinion [P2/7(b) 15 M].
2014	<ul style="list-style-type: none"> What do you understand by the term Greenhouse Gases? Explain how these gases disturb the ecological balance of nature and suggest suitable remedies. [P1/7(d) 10 M]. Why is a balance between production, social and environmental objectives necessary in Sustainable Forest Management plans? [P2/7(a) 20 M].
2013	<ul style="list-style-type: none"> What is Global Warming? Discuss how it disturbs the ecological balance of nature, and suggest suitable remedies. [P1/6(a) 20 M]. Explain the following – (i) Criteria pollutant, (ii) Pollutant standard index, (iii) Severance tax, (iv) Smog. [P1/6(b) 2 ½ × 4 = 10 M]. How would you view the Indian initiatives for Sustainable Forest Management? Discuss [P2/1(c) 8 M].
2012	<ul style="list-style-type: none"> No Direct Question
2011	<ul style="list-style-type: none"> Write short notes on – (i) Carbon Sequestration, (ii) Riparian buffers, (iii) Forest decline, and (iv) Nitrate pollution. [P1/7(c) 2 ½ × 3 = 7.5 M]. What are the effects of particulate Air Pollutants on the regeneration of a forest ecosystem? Discuss. [Linked Q P2/7(b) 10 M].
2010	<ul style="list-style-type: none"> Discuss the following - Rio conference [5 M]. How is Forest Certification done in developed countries? Comment on its present status in India. [P2/6(d) 10 M]. Write on tree species for smoke and dust pollution control [Linked Q P1/7(c) 5 M].

TREE IMPROVEMENT + SEED TECHNOLOGY

2024	<ul style="list-style-type: none"> Compare the Clonal Seed Orchard and Seedling Seed Orchard. Which one is preferred to get increased genetic gain? [P1/5(d) 8 M]. What do you mean by Mating Design? Describe the complete pedigree designs with their utilities [P1/6(a) 15 M]. Explain the genetics of Disease Resistance. Describe the methods of breeding for disease resistance in tree crops [P1/8(a) 15 M].
2023	<ul style="list-style-type: none"> Explain the following – (a) __, (b) __, (iii), (iv), (v) Ortet and Ramet [Linked Q P1/4(c) 15 M]. Discuss the significance of Exotics in Tree Improvement. Name four exotic tree species [P1/5(b) 8 M]. Define Heritability and its types. How does Narrow Sense Heritability differ from Broad Sense Heritability? [P1/7(c) i 10 M]. Discuss the scope and future of hybrids in applied tree improvement [P1/7(c)ii 10 M]. Discuss the Significance of Variation in tree improvement [P1/8(b) 10 M].

2022	<ul style="list-style-type: none"> Why is Conventional Breeding that has a much better role to play in genetic improvement of trees not given much importance in research? [P1/5(e) 8 M]. What are the objectives of Progeny Testing? Discuss the advantages and disadvantages of different methods of progeny testing [P1/8(b) 15 M]. Discuss the <i>important considerations</i> that are made before choosing a tree improvement approach [P1/8(c) 10 M].
2021	<ul style="list-style-type: none"> What are the advantages and disadvantages of Tree-Breeding Methods over biotechnological methods? [P1/7(c) 10 M]. Give an overview of forest genetic resources and Gene Conservation Programmes in India. Suggest effective practices for sustainable management for quality improvement in Indian Forests. [P1/8(a) 15 M].
2020	<ul style="list-style-type: none"> What is meant by Accompanied and Unaccompanied Clonal Seed Orchards? Why are the gains from the two types so different? [P1/5(a) 8 M]. Describe the advantages, peculiar problems and various Steps in Tree Improvement. [P1/7(a) 15 M].
2019	<ul style="list-style-type: none"> What are the Objectives of tree improvement? Explain in Details the Five Essential Steps of tree improvement [P1/5(e) 8 M]. Define : (i) Variation, (ii) Selection differentiation, (iii) Selection intensity, (iv) Heritability. How do you increase the genetic gain for a given trait in tree breeding? [P1/6(b) 15 M]. Name the Two Phases of tree improvement. as a tree breeder, how do you use these two phases simultaneously to meet the short-term demand of wood-based industries and the long-term demand of establishing seed orchards for a given tree species [P1/8(a) 15 M].
2018	<ul style="list-style-type: none"> Write in brief on the criteria of selection of tree for resistance to adverse environments for high quality timber production [Linked Q P1/5(a) 8 M]. How would you develop Tree Improvement Programmes for raising productivity in forestry? [P1/8(d) 10 M]. What is the importance of Heritability and how can genetic gain be estimated in tree improvement programme? [P1/6(d) 10 M]. Describe incomplete Mating Designs used in tree improvement [P1/7(b) 10 M]. What are the different Selection Methods used by the tree breeders? [P1/7(d) 10 M]. Explain seed production and certification system in Indian forestry [P1/6(c) 10 M].
2017	<ul style="list-style-type: none"> Write in brief on Advanced Generation tree improvement. [P1/5(a) 8 M]. Explain General Combining Ability (GCA), Specific Combining Ability (SCA) and their utility [P1/5(b) 8 M]. What are Seed Production Areas (SPA)? Explain the purpose of establishing them. Briefly highlight the advantages and disadvantages of SPA. List the steps involved in establishing SPA. [P1/7(a) 20 M]. List the different components of Phenotypic Variation. How are they important for tree breeders? [P1/8(c) 10 M].
2016	<ul style="list-style-type: none"> List the basic causes and kinds of Variations in tree populations. [P1/5(a) 8 M].

	<ul style="list-style-type: none"> Define Provenance. Discuss the role of Provenance trial in tree improvement and mention different phases of a Provenance trial [P1/6(a) 10 M]. Define the Seed Orchard. Write types of seed orchard. List the various aspects considered prior and after establishment of seed orchards for its management. [P1/8(a) 20 M].
2015	<ul style="list-style-type: none"> How can magnitude and Type of Variability be manipulated to obtain good gains in some tree characteristics? [P1/5(d) 8 M]. Suggest suitable steps to select Exotic Species or provenances for plantations. [P1/6(d) 10 M]. As a community of Interbreeding Individuals, what parameters would need to be known to describe a population of forest trees? [P1/7(d) 10 M]. Comments upon the relationship of General Combining Ability and breeding value in forest tree improvement programmes. [P1/8(d) 10 M].
2014	<ul style="list-style-type: none"> Discuss the Role of Provenance Tests in tree improvement [P1/1(b) 8 M]. State genetic drift. Discuss Hardy-Weinburg law with its significance [P1/3(b) 10 M]. Explain the possible causes of genetic variation in forest trees [P1/5(b) 8 M]. Discuss the important factors while planning of Seed Orchard [P1/7(c) 10 M].
2013	<ul style="list-style-type: none"> Write a note on Pollen Dilution Zone in seed orchard. Discuss various factors affecting their effectiveness. What are the options available in lieu of pollen dilution zones? [P1/8(b) 10 M]. What is Genetic Drift? State and discuss Hardy-Weinberg law with its significance [P1/7(d) 10 M]. Describe the operational use of vegetative propagation in tree improvement [Linked Q P1/8(c) 10 M]. How is the knowledge of Forest Genetics essentially needed for the management of forest plantations? Explain [P2/3(a) 15 M].
2012	<ul style="list-style-type: none"> Discuss the <i>use of tree improvement</i> in natural forest and stand improvement [P1/5(h) 5 M]. Write short notes on – [P1/8 4 × 5 = 20 M]. <ul style="list-style-type: none"> (b) Breeding Arboretum (c) Seed Orchard, (d) Distinction between Selection Intensity and heritability (h) Exotics in Indian forestry
2011	<ul style="list-style-type: none"> Discuss the importance of Tissue Culture Techniques as a tool in tree improvement. [P1/5(e) 10 M]. Describe the Regression Selection Method for plus tree selection in uneven-aged stand. [P1/8(a) 10 M]. Describe the various approaches for obtaining Genetically Superior Seed, giving advantages of each [P1/8(b) 10 M]. Discuss the statement, even in large experiments with many families, Heritabilities are not estimated without error (10 m). [P1/8(c) 10 M].
2010	<ul style="list-style-type: none"> Strategies for conventional tree improvement programme [P1/5(g) 5 M].

	<ul style="list-style-type: none"> • Discuss the following – (i) selection as a method of tree improvement, (ii) Selection Intensity affects the genetic gain. [P1/6(a) 10 M]. • What do you understand by the term “Provenance Trial”? Explain the stepwise procedure for this trial followed in a forest species. [P1/8(a) 10 M]. • Discuss the possibilities of Biotechnological Interventions in tree improvement programmes (10m). [P1/8(b) 10 M].
--	---

FOREST SOIL, ITS CONSERVATION & WATERSHED MANAGEMENT

2024	<ul style="list-style-type: none"> • Describe in brief the types of forest soils existing under diverse ecological zones. Suggest suitable techniques for the conservation measures followed under ravines, water logged, hot deserts and coastal areas [P1/8(b) 10 M]. • Explain the concept of soil biological fertility. Suggest a suitable plan for the restoration of soil biological fertility through the use of eco-friendly sources [P1/8(c) 15 M]. • Briefly describe the current scenario of the Saline and Alkaline Soils in India. Draw a management plan using suitable plant species [P1/5(b) 8 M]. • What is the role of Watershed Development plan in India? Describe its guidelines framed for better implementation. Briefly write on the watershed mission project [P1/6(b) 10 M].
2023	<ul style="list-style-type: none"> • How does moisture influence the soil formation and growth of vegetation? [P1/5(c) 8 M]. • Explain the theory of humus formation predominant in forested vegetation [P1/6(b) 10 M]. • Explain the benefits of Watershed Management [P1/7(b) 10 M].
2022	<ul style="list-style-type: none"> • How does C: N ratio of plant residue in soil influence the rate of decomposition and nitrogen availability to plants? [P1/5(d) 8 M]. • How does Watershed Influence the ecology and socio-economic development of a region? [P1/5(c) 8 M]. • Give a detailed profile of a soil showing various zones and explain the function of each soil zone [P1/7(c) 10 M]. • Explain the principles of Bioengineering measures for soil and water conservation. Write in brief four common bioengineering techniques for hill and slope stabilization works using plants [P1/7(a) 20 M]. • Discuss the components of Desert Ecosystem. Write steps to control shifting of sand dunes [Linked Q P2/6(b) 15 M].
2021	<ul style="list-style-type: none"> • How does soil organic matter decomposed influence forest productivity? [P1/5(d) 8 M]. • Explain the terms – (a) Cation Exchange Capacity, (b) Salinity & Alkalinity [P2/5(a) 8 M]. • How can Watershed Management enhance and promote sustainable integrated water resource management? [P1/5(c) 8 M]. • How do you differentiate a springshed from a Watershed? Explain how a healthy springshed can ensure a better hydrological cycle of an area [P1/7(b) 15 M].
2020	<ul style="list-style-type: none"> • Write short notes on the following – (a) Soil texture and structure, (b) Soil organic matter, (c) Carbon nitrogen ratio. [P1/8(c) 15 M].

	<ul style="list-style-type: none"> • What is the different soil type found in India? Identify five tree species growing each in Alluvial soils, red soils, Black cotton soils and Arid and desert soils. [P1/7(b) 15 M]. • Define afforestation. Discuss in brief the afforestation techniques, including the choice of species, for ravine lands [P1/3(a) 10 M]. • What are the roles of forest in Watershed Management? [P1/5(c) 8 M].
2019	<ul style="list-style-type: none"> • Soil is an interface of air, minerals, water and life. Comment [P1/5(c) 8 M]. • What are the Paedogenic Process? Explain the important process of soil formation [P1/8(c) 15 M]. • Write the characteristics of Watershed. Explain the factors affecting watershed management [P1/6(c) 10 M]. • What are the characteristics of Saline and Alkaline Soils. Explain the reclamation of saline and alkaline soils with suitable tree species [P1/7(a) 15 M].
2018	<ul style="list-style-type: none"> • Write in detail about the influence of Parent Rock in the distribution of tree species [Linked Q P1/5(c) 8 M]. • Write the Soil-Water Relationship of any forest area. Describe the influence of water table in the growth and development of tree species. [P1/7(a) 10 M]. • What are the measures to be taken into consideration during preparation of earthen Check Dam in the forest areas? [P1/5(b) 8 M]. • What is Hydrology? Describe the role of hydrology in planning and management of watershed development. Does tree species improve the infiltration rate, soil temperature, water level and hydrological cycle? Justify with few examples [P1/8(a) 10 M].
2017	<ul style="list-style-type: none"> • What are the various methods adopted to conserve the soil on sloping areas? Explain in brief. [P1/7(b) 10 M]. • Where are Cold Deserts found in India? Explain site characteristics encountered in a cold desert and steps suggested to overcome problems in their afforestation [Linked Q P1/3(a) 10 M]. • Describe the technique of Sand Dune Fixation in the thar desert. Also mention the choice of species for plantation [P1/3(b) 15 M]. • What is Water Harvesting? List the different methods of water harvesting and suggest various practices for efficient use of conserved water [P1/8(a) 20 M].
2016	<ul style="list-style-type: none"> • Write distinguish features of Saline Alkaline Soil [P1/5(b) 8 M]. • Explain Types of Rocks based on formation and minerals based on chemical compositions [P1/5(d) 8 M]. • Write the characteristics of Cold Desert. Discuss soil working and planting techniques for cold desert [Linked Q P1/1(d) 8 M]. • Define Watershed. Describe tree-based models for reclamation of degraded hills [P1/8(c) 10 M].
2015	<ul style="list-style-type: none"> • Why is a lot of emphasis laid on research relating to soil conservation? Discuss [P1/5(b) 8 M]. • Describe different textural classes of soil and the way they affect plant growth. [P1/6(b) 10 M].

	<ul style="list-style-type: none"> Why is Saline-Alkaline Soil considered problematic? can you suggest any procedure to make it suitable for plant growth? [P1/7(b) 10 M]. Good Watershed Management must consider the social, economic and environmental sustainability, and institutional factors. Comment [P1/8(a) 10 M].
2014	<ul style="list-style-type: none"> Specific problem of Coastal Land and Hot Deserts [Linked Q P1/2(b) iv 5 M].
2013	<ul style="list-style-type: none"> What is Watershed Management? Explain its objectives and role in rural development [P1/8(d) 10 M]. What are the specific problem of the following wasteland? suggest at least 3 species for planting in each of them (20 m) – (a) Hot desert, (b) Saline alkaline soil, (c) Wetland, (d) Cold desert. [P1/2(a) 5 × 4 = 20 M].
2012	<ul style="list-style-type: none"> Explain different process of soil erosion. Briefly describe them giving examples as to how the vegetation including trees can help in conserving soil and water [P1/7(b) 10 M]. Describe briefly the afforestation techniques adopted for Ravenous Lands of Yamuna giving suitable species [P1/5(f) 5 M]. Give suitable forestry techniques for the reclamation of Salt Affected Soils [P1/6(b) 8 M]. How shelterbelt and wind breaks are helpful in Sand Dune Stabilization and desert control? [P1/5(a) 5 M]. Discuss afforestation of inland sand dunes by giving their distribution, site conditions, planting techniques and species suitable in such areas [P1/5(e) 5 M]. Describe the afforestation in an undulating community land situated in the catchment, of a small water reservoir [P1/6(d) 5 M]. List the Pioneers flora of sand dunes under – [Linked Q P2/5(b) 8 M]. <ul style="list-style-type: none"> (a) On dunes, (b) Spread out sand, and (c) Stabilized dunes.
2011	<ul style="list-style-type: none"> Explain the various applications of geo-textiles for soil conservation [P1/5(c) 10 M]. Write short notes on – (ii) Riparian Buffer [P1/7(c)ii 2½ M]. Discuss the factors to be considered for efficient Recycling of Harvested Water [P1/8(d) 10 M]. Discuss strategies and plans adopted for the treatment of catchment areas [Linked Q P2/3(b) 10 M]. Discuss the factors that inhibit tree growth in Alkali and Saline Soils. How is alkali soil managed for tree species plantation? Write scientific names of four tree species suitable for plantation in Alkali soils [P2/6(a) 20 M].
2010	<ul style="list-style-type: none"> “Among the causes of soil erosion some are manageable” comment [P1/7(b) i 5 M]. Difference between erodibility and erosivity [P1/7(c) ii 5 M]. What are Saline and Sodic Soils ? [P1/7(d) i 5 M]. Mention ten species (Scientific name) of trees tolerant to salinity [P1/7(d) ii 5 M].



Since prehistoric times, India has been a country of multi-racial community, spread throughout the Indian peninsula with its definite cultural variations and level of development. Among them, many groups are still in a primitive state and are very weakly affected by so-called modernization. Therefore, those people are called *aboriginals*, and the popular names we often used for them are Vanvasi, Pahari (in HP, UK), Adimjati (Primitive People), Adivasi (Indigenous People), Anusand Janajati (Scheduled Tribes (ST)), etc.

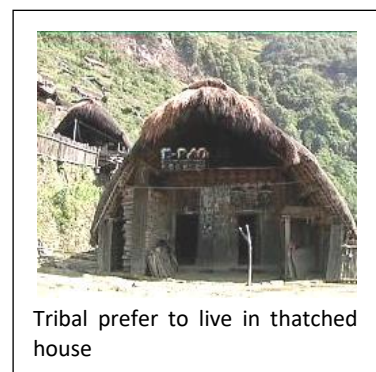
1.1 DEFINITION

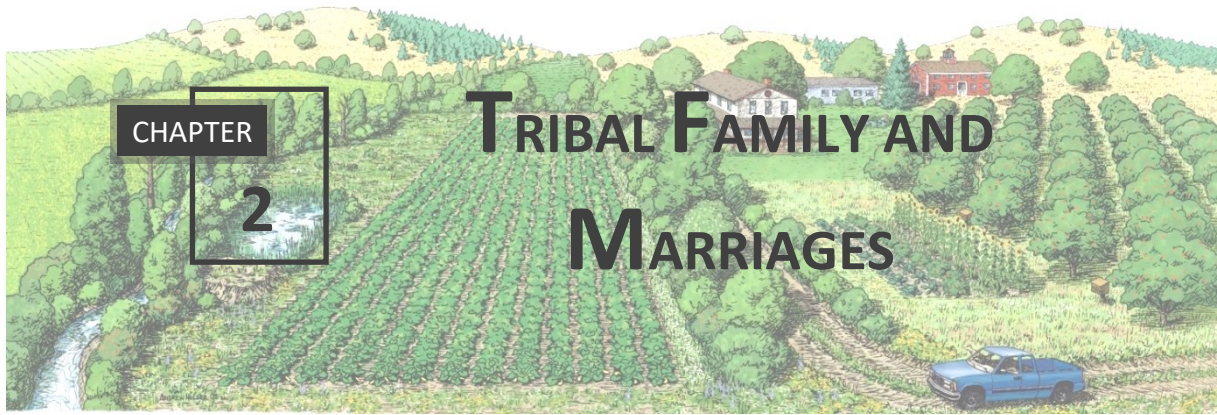
- The tribe is a collection of families bearing a common name, a common living homeland, members of which speaking the same languages and observed certain taboos regarding marriages and occupations.
- A tribe is a group speaking a common dialect and inhabiting a common territory.
- A tribe is a small isolated, closely-knit society.

The term 'tribe' is derived from the *Latin* word '*tribus*' which is used by the Romans for a social group of poor people among its citizens.

1.2 CHARACTERISTICS OF THE INDIAN TRIBE

- *Definite territory* - members of a tribe occupy a common and well-defined territory, *i.e.*, the Bheria tribe of MP lives in the Patalkot (Chindwada district).
- All the members of a tribe *speak a common language* or dialect but *usually lack script*, *i.e.*, Koru by the Koru tribe, Gondi by Gonds, etc. [The Santhali has its own script called *Chikiscript*].
- The members of a tribe are claimed to be *originated from a common ancestor* and blood related to each other.
- Have *common folk arts* & culture, *common religion*, beliefs, **customs**, **Taboos**, and myths.
- Names have *common types of surname*.
- *Common occupation* primarily *depends upon the forest* for their livelihood. Hunting and food gathering are common practices.
- Shows *strong social and political unity*. Govern by their own laws through tribal assembly to maintain peace, justice and punish if someone violates customs. Generally, Mukhia commands the tribe with the help of the body of warriors and tribal assembly, and his decisions are final.
- Habitation in *remote and inaccessible forest areas*, Illiteracy.





A family is a small social unit consisting of fathers, mothers, and their children who are related to each other by kinship relationships based on marriage, blood, or adoption. A tribal family is the nucleus of all social structures and still continues to be the most stable association and institution of human society. It plays a vital role in the development of an individual's personality and the process of socialization.

2.1 CHARACTERISTICS OF A TRIBAL FAMILY

- The family has a limited size (usually 4 to 6 members), and all are emotionally attached with a sense of responsibility amongst their members.
- Have common language, surname & male have the same gotra.
- The husband and wife are permanent sexual partners.
- Some members of a family are bread earners, and some are dependent.
- Family is the center of education for children.

The term '*family*' has origin from the *latin* word '*Famulus*', which means a *servant*.

2.2 TYPES OF TRIBAL FAMILIES

► Based on the form of marriage

- (a) Monogamous : 1 husband and one wife
- (b) Polygamous : 1 husband and > 1 wife, *i.e.*, Bhil
- (c) Polyandrous : >1 husband and one wife, *i.e.*, Toda* of Nilgiri, Khasa* of Jaunsar (UK).

► Based on the nature of ancestry and property inheritance

- (a) Patrilineal family : The ancestry of a family is determined by the male line or father and property rights inherent and distributed among the males, *i.e.*, most of the tribal communities in India.
- (b) Matrilineal family : when the ancestry of a family is determined by the female line or mother and property rights inherent and distributed among the females, *i.e.*, Khasi tribe*.

► Based on the inheritance of the name

- (a) Patronymic family : when the children inherit the name of their father
- (b) Matronymic family : when the children inherit the name of their mother, *i.e.*, Khasi tribe*.

► Based on nature, the couple moved after marriage



3.1 KINSHIP

Man is social by nature and establishes many types of relationships with a number of individuals, usually initiated by genetic or blood relationships.

Importance : (1) It creates groupings, and (2) it provides guidelines for interaction (behaviours) among persons in these social groupings.

► TYPES OF KINSHIP

- *Affinal kinship* : it is based on marriage. The most affinal relationship is the one between husband and wife.
- *Consanguineous kinship* : kinship based on descent, commonly known as blood relation, *i.e.*, Father-son, Mother-son, etc.

► DEGREE OF KINSHIP

- Primary kin or 1st-degree kin (पहली पीढ़ी) – are those who are directly related to each other, *i.e.*, Mother-Father, Brother-sister.
- Secondary kin or 2ⁿ degree kin are not directly related to one another but through primary kins, *i.e.*, Grandfather and grandson, Grandma, grandson, cousins, etc.
- Tertiary kin – your brother/sister-in-law is your 3rd- degree kin.

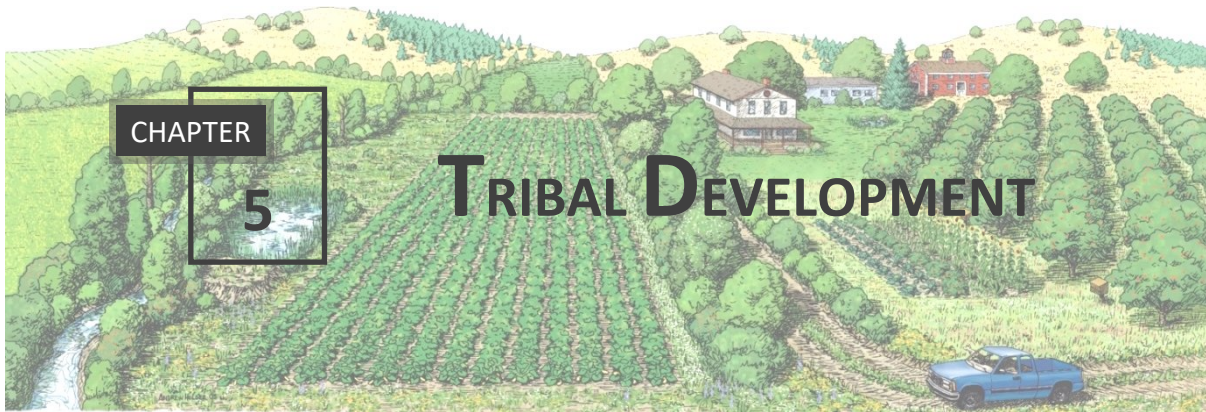
► KINSHIP BEHAVIOUR

- **Avoidance** : means that two kins, generally of the opposite sex, should avoid each other. In almost all societies, avoidance rules prescribe those men and women must maintain a certain amount of modesty in speech, dress, and gesture in a mixed company. Thus, a father-in-law should avoid daughter-in-law. The Purdah system in the family in the North illustrates the usage of avoidance.
- **Existence of Matrimonial System** : The wife had to stay at his husband's residence.
- **Joking relationships** : just opposite of avoidance, here involve a particular combination of friendliness and antagonism between individuals, *i.e.*, Bhabhi-Dewar.

3.2 TABOO

Each society has its own belief system that takes roots from its past history and cultural identity. This belief system affects all factors of human life, including health, ritual, marriage, caste, culture, social, religion, conversation, etc. Tribals are no exception to it.





Tribal communities continue to be vulnerable even today, not because they are poor and illiterate compared to the general population, but their inability to negotiate and cope with the consequences of their integration with the mainstream economy, society, cultural and political systems. The requirements of planned development brought with them the dams, mines, industries, and roads, all located on tribal lands. Tribal institutions and practices were forced into an uneasy coexistence.

► **SOCIO-ECONOMIC AND CULTURAL PROBLEMS OF TRIBALS**

- Problems related to the forest – rapidly decreasing natural resources, climate change and erratic rainfall, misuse of rights, and concessions by some.
- Agricultural still in primitive phase & irrigation issue
- Illiteracy and Poverty
- Health issues & alcoholism
- Inadequate employment opportunity and Bondage labor
- Lack of credit and market facility = Indebtedness.
- Land alienation
- Exploitation of tribals by Middle-man, Traders, contractors, and NGO gang.
- Migration for employment
- Poor governance & corruption
- Displacement due to developmental programs.

► **SOLUTION**

- To save their rights : give special status to the tribal area and socio-cultural linked programs, promoting the proper implementation of forest right act.
- Economic development through -
 - * IPR and bio-prospecting
 - * Geotagging of their produce
 - * fair and festivals like Bhagoria haat, Hornbill festival of Nagaland, etc., to promote cultural tourism, ecotourism, etc.
 - * Joint forest management & promotion of cottage industry.
 - * Marketing their products through Flipkart/Amazon.
 - * Promotion of social forestry and agroforestry on their own land.
 - * Promotion of forest-based cottage industry, collection of MFP in a sustainable manner.
 - * Agriculture development programs like solar pumps for irrigation.

CHAPTER 1

Chapter outline

- 1.1 Historical Background
 - ✿ Success stories
- 1.2 Objectives of JFM adoption
- 1.3 Salient features of JFM
- 1.4 JFM structure
 - ✿ JFMC
 - ✿ Eco-dev. Committee
 - ✿ Powers of FPCs
- 1.5 Formation of a JFMC
 - ✿ Introduction
 - ✿ Approval
 - ✿ Formation of JFMCs and Executive committees
- 1.6 Legal back-ups to the JFM
- 1.7 Causes of Poor performance of JFMCs [Constraints]
- 1.8 Role of JFM
- 19 Exercise

JOINT FOREST MANAGEMENT

Joint Forest Management (JFM) is an approach and program initiated by the *National Forest Policy of 1988*. Under this, the state forest departments support local forest-dwelling and forest fringe communities to protect and manage forests by sharing the costs and benefits of the forests with them. Communities organise themselves into a JFM Committee to preserve and manage nearby forests, guided by locally prepared guidelines and micro-plans.

JFM is a *participation of the local community* in the management of forest

1.1 HISTORICAL BACKGROUND

In 1931, **Van Panchayats** in Uttarakhand started participating in forest management, as the remote Himalayan region where creating hardness to the forest department because of the poor Cost-benefit ratio.

Later, the Forest Department of **West Bengal** successfully started a pilot project in the **Arbari***** village (hilly area) during 1971–72, and it was a major success.

Followed by Haryana and Odisha, but all these (WB, HR, Odisha, etc.) were pilot projects or individual efforts of some dedicated forest officers and had no forest policy or legal back-ups.

Other similar efforts, *i.e.*, Forest Cooperatives in the Madras Presidency (the 1900s) and cooperative Forest Societies in Kangra (1940s, earlier Punjab, now Himachal Pradesh). Woodlots on panchayat lands under Social Forestry (the 1980s - with Revenue sharing agreements).

The actual initiative by MoEFCC on JFM started with the **National Forest policy – 1988***** on its past experiences, followed by the **Guideline of 1990***** to utilize forest wealth to improve local livelihoods. This guideline explains how the forest committee was formed, its powers & functioning, NWFP sharing %, etc. *This guideline forms the basic foundation of JFM in India. That's why most Academicians consider this as the year of initiation of JFM in India.*

- To increase transparency & accountability in the forest department
- Economic empowerment of tribal people and job creation. Eliminating the issue of shifting cultivation by adopting alternative farming, *i.e.*, tree farming.
- More effective management of forest resources.
- Speedily achieving ecological needs, INDC, and other aims/targets.
- More effective managing issues of forest degradation, soil erosion, deforestation, and wildlife conservation through people's actions.

1.3 SALIENT FEATURES OF JFM

The JFM has institutionalized people's participation in each and every stage of the decision-making process and helps to manage forestlands jointly.

- The JFM provides a common structure for consultation and negotiations between the forest department and the local people and assures legalized access for the local communities to forestlands.
- It facilitates the benefit-sharing mechanism and ensures livelihood opportunities for the local community.
- The JFM process encourages local people to protect the forest from fire, grazing, and other illegal activities.
- The JFM process facilitates the involvement of local people in all decision-making processes.

1.4 STRUCTURE OF JFM

In general, the basic structure of JFM comprises a village-level committee called - *The Forest Protection Committee* or *Van Samrakshana Samiti* (VSS). These bodies include (a) a "*General Body*" and (b) a "*Forest Management Committee*" (FMC) - a *core Executive* elected by the General Body to discharge the assigned functions.

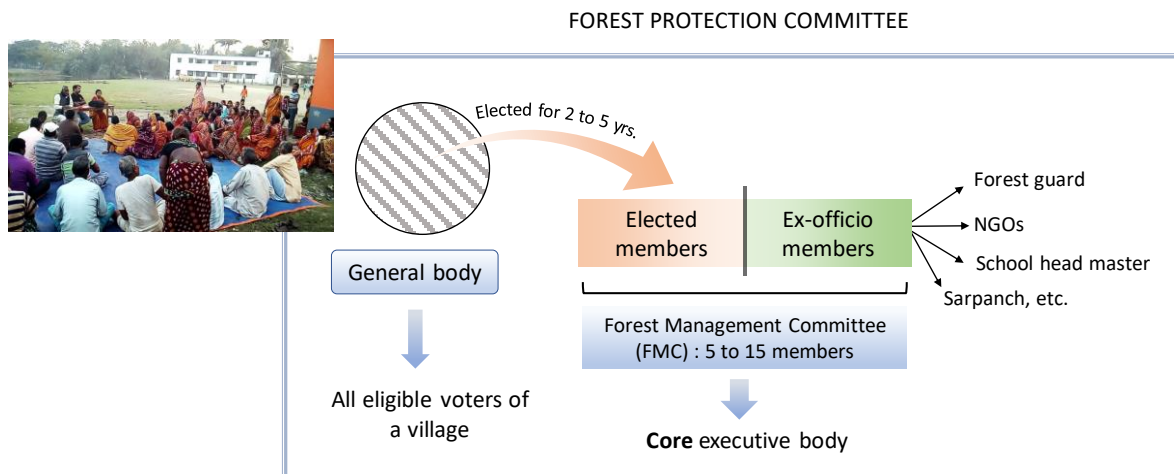


Figure : Forest management committee structure in **Madhya Pradesh**

- The General Body comprises eligible members of the village. The eligibility criteria for membership vary from State to State. In most states, adults are eligible for joining the General Body. The General Body elects the local community representatives in the Executive Committee.
- The Executive Committee has elected members from **5 to 15**. It *also includes ex-officio, non-elected members drawn from the Forest Departments, local NGOs, village schools, village administrative and development officers, and representatives of the Gram or Mandal Panchayats* [Vary with states].

CHAPTER 3

Chapter outline

- ▶ Need of NGOs IN JFM
- ▶ Activities undertaken by NGOs
- ▶ Issue with NGOs

Non-Governmental Organizations (NGOs)

Non-governmental organizations (NGOs) refer to not-for-profit organizations that pursue activities to relieve suffering, promote the interests of the poor, protect the environment, provide essential social services, or undertake community development.

- These organizations are not a part of the government, have legal status, and are registered under the specific Act (Societies Registration Act, 1860 in India).
- In India, based on the law under which they operate and the kind of activities they take up, civil society groups can be classified into the following broad categories -
 - Registered Societies formed for specific purposes
 - Charitable Organizations and Trusts
 - Local Stakeholders Groups, Microcredit, and Thrift Enterprises, Self Help Groups.
 - Professional Self-Regulatory Bodies
 - Cooperatives
 - Bodies without having any formal organizational structure
- ▶ **NEED OF NGOs IN JFM** : NGO's plays a significant role in JFM. They are members of VFC. They are involved in all the conservation and preservation activities. They improve the relationship between the department and the village people. They act as a moderator.
 - NGO acts as a buffering layer between the forest department and local peoples.
 - NGO's promote awareness about the importance of forests among the people.
 - They improve the confidence-building between the people and forest department officials.
 - They provide beneficial information to forest officials for the protection and improvement of forests.
 - They conduct many awareness and training camps in forest villages.

CHAPTER 4

Chapter outline

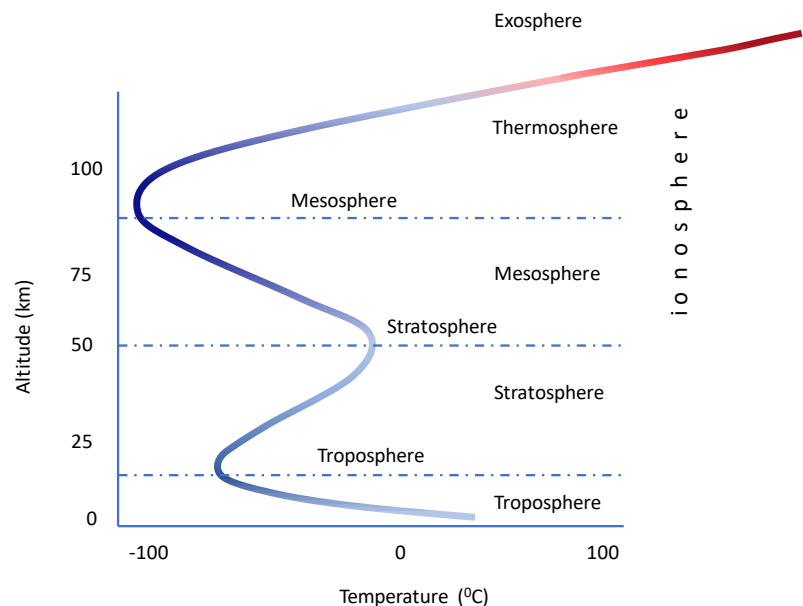
- 4.1 Structure and component of environment
- 4.2 Climate change & Global warming
- 4.3 Climate change & its effect
- 4.4 Effect of Climate change on India
- 4.5 Mitigation & Adaptation strategies
- 4.6 Global response to climate change
- 4.7 India's response
- 4.8 Exercise

CLIMATE CHANGE & GLOBAL WARMING

The word 'environment' is most commonly used to describe Nature and means the *sum of all living and non-living things surrounding an organism or group of organisms*. The environment includes all elements, factors, and conditions that impact the growth and development of certain organisms. The environment includes biotic (all surrounding living organisms) and abiotic factors (light, temperature, water, atmospheric gases combine with biotic factors) that influence observed organisms.

4.1 STRUCTURE AND COMPONENT OF ENVIRONMENT

There are four main spheres of the environment : the lithosphere, the hydrosphere, the atmosphere, and the biosphere. These correspond to the rocks, the water, the atmosphere, and the life. Environment therefore refers to the study of Earth, air, water, living creatures, and their mutual relationships.

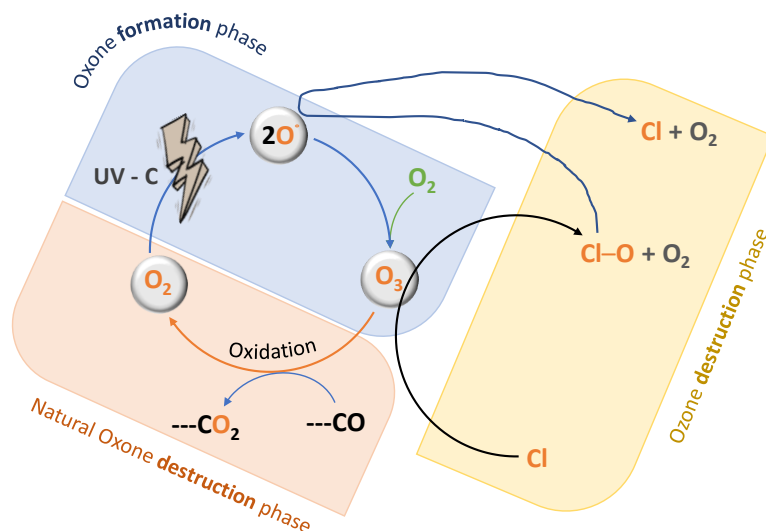


Note : In the chapter locality factors, we already refer to various environmental factors. It is unnecessary to go into more detail here. Any traditional book can be used for more information.

IFoS 2015 : Write the *chemistry of ozonosphere* and list the adverse effects of ozone layer depletion (10 m).

Hints : Ozone occurs both in Earth's upper atmosphere and ground level. Majorly, it is found naturally in stratosphere (11-50 km from earth surface) at altitude of 17 to 25 km called ozonosphere.

Reactions for the *formation and destruction* of ozone



Effect of ozone layer depletion

- Effects on Human Health : Ozone layer depletion increases the amount of UV-B that reaches the Earth's surface and causes non-melanoma skin cancer and cataracts.
- Effects on Marine Ecosystems – reduced survival rates of planktons.
- Effects on Biogeochemical Cycles
- Effects on Materials

4.2 CLIMATE CHANGE & GLOBAL WARMING

The term "*climate change*" refers to *long-term changes in temperatures and weather patterns*. Shifts may occur naturally, for example, due to variations in the solar cycle. Since the 1800s, humans have been the main driver of climate change, primarily due to burning fossil fuels such as coal, oil, and gas. Burning fossil fuels has worsened the atmospheric balance since the industrial revolution.

PRINCIPLE

The global warming in the atmosphere is based on the same principle on which the greenhouse work (a heat-trapping shade used in temperate and cold countries to grow the vegetable). This greenhouse traps the solar energy from the Sun in the form of a short wave and keeps the greenhouse warm through the night by stopping the escape of heat energy and thus protecting the vegetation in the greenhouse.

The greenhouse effect is the naturally occurring phenomenon in which gases occurring in the atmosphere traps the terrestrial heat, thus keeping the Earth warm enough for the survival of living things.

Gases that can potentially trap heat energy are called *greenhouse gases*. Some of these gases are as follows :

CHAPTER 5

Chapter outline

- 5.1 Definition
- 5.2 Historical background
- 5.3 Concept of Sustainable development
- 5.4 Elements of Sustainable development
- 5.5 Why practice sustainable forest management
- 5.6 Standards for the SFM
- 5.7 Who develops standards and how
- 5.8 International initiatives
- 5.9 Indian initiatives

SUSTAINABLE FOREST DEVELOPMENT

In recent years, environmental issues have attracted a tremendous amount of attention worldwide. It was the Brundtland Commission report in 1987 and the Rio summit in 1992 that sparked major motivation. This interest is focused mainly on sustainable ways to better management of resources and carry out the development in a harmonious fashion in relation to the environment. Although, the world needs new development to run its economies and to make progress. This puts pressure on us to think about how we can manage our resources in a sustainable way. This resulted in the institution of new legislation originating from national and international sources where potential adverse effects of future development activities are tried to mitigate or avoid at the planning stage. Environmental impact assessment (EIA) is such an example that assesses the impacts in advance.

5.1 DEFINITION

Sustainable forest management (SFM) is defined as a *dynamic and evolving concept*, which aims to *maintain and enhance the economic, social, and environmental values* of all types of forests, for the benefit of present and future generations. Forests and trees, when sustainably managed, make vital contributions both to people and to the planet, bolstering livelihoods, providing clean air and water, conserving biodiversity, and responding to climate change (F.A.O.)

‘Sustainable forest management is the process of managing forests to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services, without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment.’ (ITTO, Criteria, and Indicators for Sustainable Management of Natural Tropical Forests, 1998)

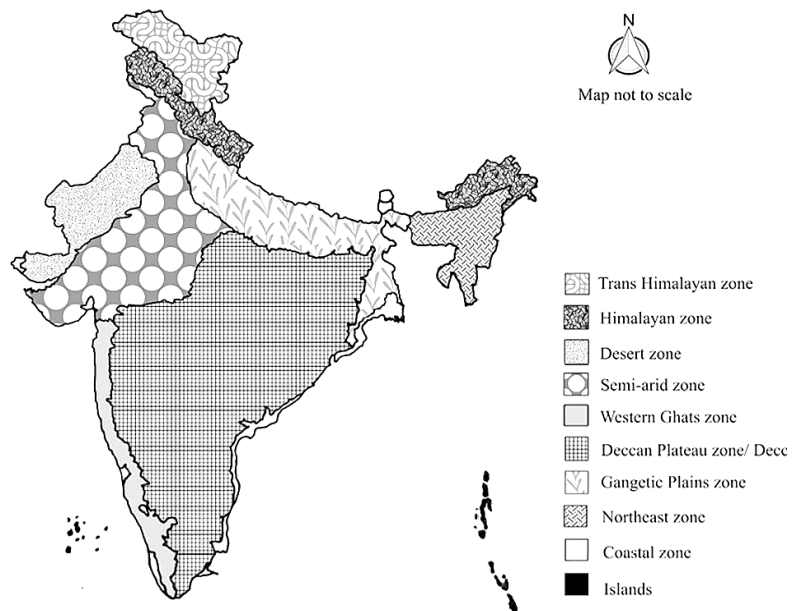
CHAPTER 8

Chapter outline

BIOGEOGRAPHIC ZONES OF INDIA

Biogeography is the study of the distribution of species and ecosystems in geographic space and through geological time. The biogeographic zone is a large distinctive unit of similar ecology, biome representation, community, and species. A *biotic province* is a secondary unit within a biogeographic zone, giving weight to particular communities separated by dispersal barriers or gradual change in environmental factors. A wide range of latitudes and longitudes and varied climatic regimes have resulted in an astounding range of biophysical environments, ecosystems, and habitats in India.

The biogeographic zones of this country are –



1. Trans-Himalayan zone
2. Himalayan zone
3. Desert zone
4. Semi-arid zone
5. Western ghats zone
6. Deccan plateau zone (or Deccan Peninsula)
7. Gangetic plains zone
8. Northeast zone
9. Coastal zone and
10. Islands

CHAPTER 9

FOREST CERTIFICATION

FOREST CERTIFICATION

Forest certification is a process that involves *monitoring, tracing, and labelling* of *timber, wood, pulps, and non-timber forest products*. The objective of forest certification is to evaluate the quality of forest management practices from environmental, social, and economic perspectives against a set of agreed standards.

HISTORY

- The first forest certification scheme, the *Smart Wood* program, was launched by the *Rainforest Alliance* in 1989. This program aimed to promote Sustainable Forest Management (SFM) practices in tropical forests, particularly in *Indonesia*. However, this concept of forest certification gained wider recognition and popularity after the Earth Summit, held in Rio de Janeiro, Brazil, in 1992. At this conference, many countries and organizations recognized the importance of SFM and agreed to work towards promoting it.
- In 1993, the *Forest Stewardship Council (FSC)* was established as an international, non-governmental organization in *Bonn, Germany* with the aim of promoting responsible forest management worldwide via timber certification. The FSC developed a certification scheme that included *Environmental, Social, and Economic* criteria to ensure that forests were managed in a sustainable way. Its present director is Kim Carstensen. Council was developed 10 Principles and 56 Criteria for forest stewardship.



10 FSC Principles (here, only 7 given)

- *Comply with all applicable laws, regulations, treaties, conventions and agreements together.*
- Maintain or improve the social and economic *well-being of workers*
- Uphold *Indigenous Peoples' right* of ownership and use of forest resources
- Manage their products and services in a way that maintains or improves their *long-term economic viability, social benefits, and environmental benefits.*
- Monitoring and assessment – to *demonstrate progress towards management objectives.*
- Maintenance of *high conservation value forests* – to maintain or enhance the attributes which define such forests.
- To make sure that plantation and management activities are in accordance with FSC Principles and Criteria

CHAPTER 13

CARBON CYCLE

13.1 EXERCISE

IFoS 2021 : What is the role of forest plantations in *Carbon Sequestration*? (10 m)

✿ Discuss the role of forest for *carbon sequestration* [Odisha Civil (Main) 2015 | 20 Marks]

IFoS 2020 : Why is *carbon cycle important* ? How do human activities affect carbon cycle? (10 m).

IFoS 2018 : What is *carbon sink* ? How do forest soils act as important carbon sinks? (8 m).

IFoS 2015 : Why is *carbon recycling important* ? What are its influences on climate? Discuss your points for or against (10 m).

IFoS 2012 : Write short notes on - *Source-sink relationship* with respect to carbon cycle (5 m).

✿ Explain the role of *afforestation* in *carbon sequestration* [Odisha Forest Service (Mains) 2015 | 20 Marks]

13.2 CARBON CYCLE

Carbon is the foundation of all life on Earth, required to form complex molecules like proteins and DNA. This element is also found in our atmosphere in the form of carbon dioxide (CO₂). Carbon helps to regulate the Earth's temperature, makes all life possible, is a key ingredient in the food that sustains us, and provides a major source of energy to fuel our global economy.

The carbon cycle describes the *process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere*. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change.

On Earth, *most carbon is stored in rocks and sediments*, while the rest is located in the ocean, atmosphere, and in living organisms. These are the reservoirs, or sinks, through which carbon cycles. Carbon is released back into the atmosphere when organisms die, volcanoes erupt, fires blaze, fossil fuels are burned, and through a variety of other mechanisms. In the case of the ocean, carbon is continually exchanged between the ocean's surface waters and the atmosphere or is stored for long periods of time in the ocean depths.

IMPORTANCE OF CARBON CYCLE

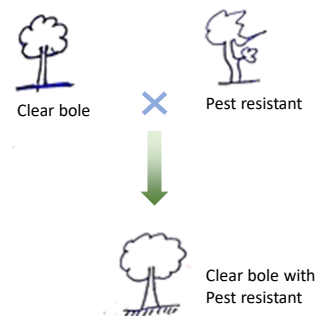
- The carbon cycle is *vital to life on Earth*. Studying the movement of *carbon energy* helps us to understand the *working of forest ecosystems* and the factors that influence it.
- Carbon dioxide *traps the long-wave radiation* from the Earth, *causing temperatures to rise*. Understanding the absorption and release of carbon dioxide is crucial in comprehending climate dynamics and predicting global warming.

TREE IMPROVEMENT

INTRODUCTION

Tree improvement is the process of improving the genetic quality of a tree species. It is also referred to as genetic improvement. The process involves selecting the best trees in a population and using them as parents for the next generation of trees. The goal is to produce trees that are better adapted to their environment and have desirable characteristics such as faster growth, better form, and resistance to pests and diseases.

- **Genetics** is a branch of biology that deals with the study of heredity and variation.
- **Heredity** : It is the transmission of genetic characteristics from parents to the offspring. It deals with the phenomenon of 'like begets like', *i.e.*, human babies are like human beings in overall traits.
- **Variation** : Individuals of the same species have some differences; these are called variations, *i.e.*, Dogs come in many different sizes, People have many different hair colours, etc.
- **Forest Genetics** : Branch of forestry deals with the study of heredity and variation in a forest tree.
- **Tree Breeding** : Tree breeding is the application of genetic, reproductive biology, and economic principles to the genetic improvement and management of forest trees.
- **Tree Improvement** : Improvements in overall yield & quality of forest produce by combining silviculture, tree breeding, and forest management [The *Silvicultural tool* deals with the *genetic makeup* of trees]
- ▶ **Heritability** : it is a statistic used in the fields of breeding and genetics that *estimates the degree of variation in a phenotypic trait in a population due to genetic variation between individuals in that population.*



- Heritability is the degree to which progeny resemble their parents. Heritability is the proportion of the total phenotypic variation controlled by genetic rather than environmental factors.
- Values come in between 0 (Zero) to 1. "0" indicates the sampling population has only environmental variations, and there are no genetic variations in the inbreeding population. In contrast, "1" Indicates absolute genetic variations without any environmental effects.

Types of heritability

IFoS 2023 : Define **heritability** and its types. How does Narrow Sense Heritability differ from Broad Sense Heritability? [10 M]

IFoS 2019 : Define - (iv) **Heritability** (2.5 m).

IFoS 2018 : What is the importance of **heritability** and how can **genetic gain** be estimated in tree improvement programme? (10 m).

SELECTION METHOD

Selection means the process of assessing and choosing genotypic and phenotypic superior tree species in a natural or planted forest, often based on the growth rate, tree form, and site adaptation traits.

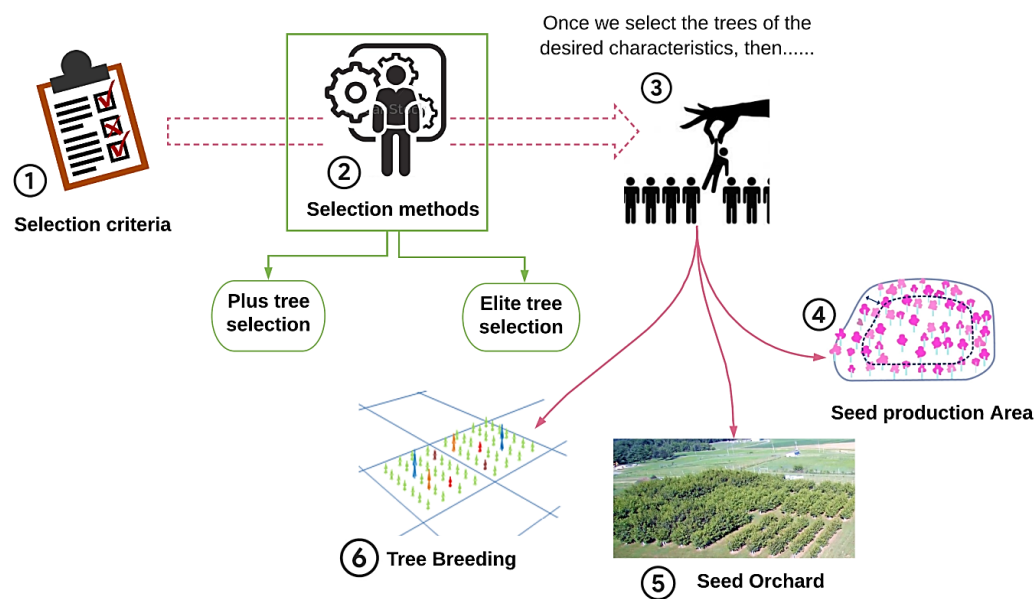


Figure 17.1 : Steps in tree improvement program

17.1 SELECTION CRITERIA

Sometimes, we do not obtain trees that possess the essential characteristics we need, even among exotic species. In such instances, we must undertake the development of these types of plants to fulfill our specific industrial requirements. However, prior to commencing a selection process for tree improvement endeavors, it is crucial to be aware of the desired requirements or characteristics that we intend to incorporate into a newly developed species. These may include properties such as insect-pest resistance, rapid growth rate, straight timber, high lignification, thornlessness, and other attributes based on our particular needs.

SELECTION CRITERIA FOR A TIMBER SPECIES

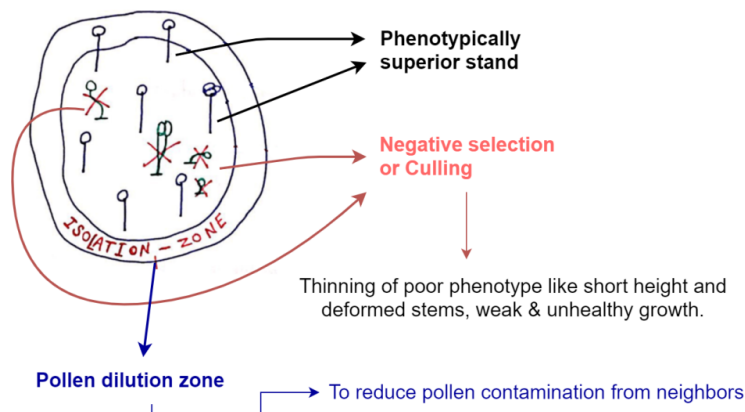
- Large size tree (in height)
- No forking,
- Fast-growing,
- Small and narrow crown,
- Straight and clean bole, thin-bark,
- Self-pruning habit,
- High insect-pest resistance,

SEED PRODUCTION AREAS

The seed production area is a *phenotypically superior stand* of important *commercial forest tree* species in the *Permanent Forest Estate*, consisting of *vigorously growing trees* upgraded by *thinning of poor phenotypes* and treated and managed in such a manner as to *produce large quantities of seed*.

Another definition - The seed production area is a phenologically superior stand made up of *vigorously healthy trees*, upgraded by thinning to remove poorer phenotypes and treated and managed to cause *abundant seed production*. Seed stands are a stage before the formation of a seed orchard.

Furthermore, the seed production area is a *natural or planted stand* or group of stands, set aside, periodically rouged, and treated to stimulate seed production. The genetic quality of the seed is not known.



PURPOSE

- To ensure the continuous supply of larger quantities of high-quality seeds with the known origin for our Afforestation/reforestation and other plantation works. Until such time the seed orchards come into production.
- Reduce harvesting pressure from wild populations.
- Reduce collecting costs
- Increase reliability of supply and enable seed bank stockpiling (including of seed of species that are rare or difficult to collect in the wild).
- Providing opportunities for alternative land use like windbreaks, soil improvement, etc., with income generation.

ADVANTAGES

- Increase reliability of supply and enable seed bank stockpiling (including of seed of species that are rare or difficult to collect in the wild).
- Reduce harvesting pressure from wild populations.

FOREST SOIL

[INTRODUCTION]

1.1 WHAT IS SOIL ?

Soil is the *unconsolidated mineral material on the immediate surface of the earth* that serves as a natural medium for the growth of land plants.

Forest soil is a portion of the earth's surface that serves as a medium for the growth and sustenance of forest vegetation.

PEDON ?

A *pedon* is a 3-dimensional smallest unit or volume of soil that contains all the soil horizons of a particular soil type with 1 m² at the surface and extends to the bottom bedrocks of the soil.

Term Soil is derived from the *Latin* term – *Solum*, which means *Floor****

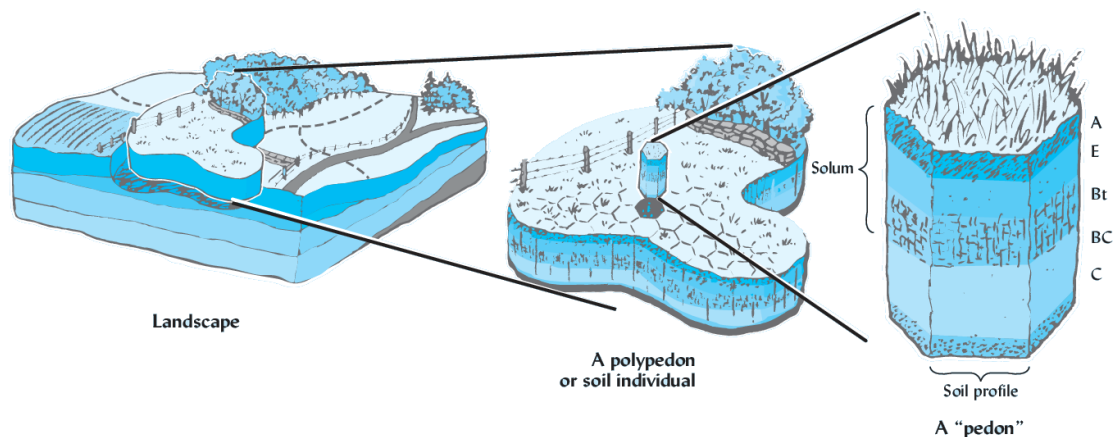


Figure 1.1 : Pedon is a natural body of soil that is large enough to allow classification of the soil.

PEDOLOGY : Pedology = Pedon + Logos = Greek word

↓ ↓
 Soil/Earth Study

Pedology is the study of *soil genesis*, *classification*, and *mapping*/description of soil for land use planning. Therefore, it is helpful in forestry, forest road construction, and land capability classification.

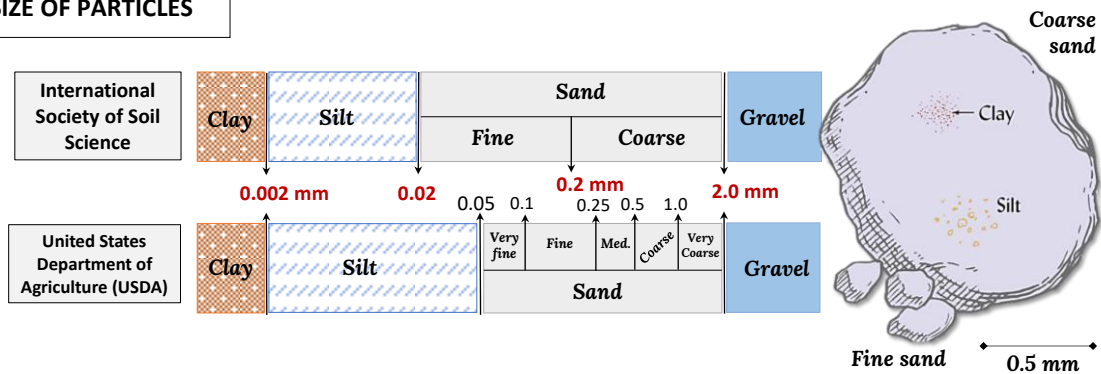
- *Soil genesis* : the mode of origin of soil with particular reference to the processes and soil-forming factors responsible for the development of solum or true soil.
- *Soil survey* : consists of morphological examination, description, classification, and mapping of soils in their natural environment.
- *Soil classification* : is the process of logical grouping based on the properties and characteristics of representative units (pedon).

SOIL PHYSICAL PROPERTIES

6.1 SOIL TEXTURE

The *relative percentage of sand, silt, and clay in the soil*^{***}. Where *sand and silt work as a skeleton* of soil in which *clay particles fill as flesh*. The size of particles in mineral soil is not subject to change (*i.e.*, by cultural practices). Therefore, this composition is considered a permanent feature and a *basic property* of soil. Mechanical analysis of soil separates, *i.e.*, the percentage of sand, silt, and clay done by the *hydrometric method*.

SIZE OF PARTICLES



- ✎ Clay particle size : <math>< 0.002\text{ mm}</math>^{***}
- ✎ Soil texture refers to the relative amounts of sand, silt, and clay, and it directly affects a soil's *cohesion*, *adhesion*, and *plasticity*. Clay soils have a characteristically *fine/heavy texture*.
- ✎ **Loam soil** – (a) best suitable soil for agriculture purposes, (b) it contains *sand, silt and clay minerals in an equal property*^{***} proportional and *not in equal percentage*.
- ✎ **Soil texture determination methods** : (a) Feel methods – Ball formation, Ribbon formation. (b) Laboratory method – Mechanical analysis.

6.2 SOIL STRUCTURE

The *arrangement of primary soil particles*^{***} and their aggregation into a certain definite pattern is called soil structure.

Primary soil particles : Sand, Silt, clay

Types

- **Plate-like** : arrangement of soil aggregates in a thin horizontal plane like plates or lamina, *i.e.*, Alluvial soil.
- **Prism or Columnar-like** : vertically oriented aggregation or pillars. Occurs in the B horizon of clay soil in *arid* and *semi-arid* regions (Salt-affected soil).
- **Block-like** : aggregation shape like a block of the irregular face. Found in *Humid zone*.

AFFORESTATION OF DIFFICULT SITES

CONTENT

1. Hot desert and shifting sand dunes
2. Acidic soil
3. Saline alkaline area
4. Ravine land
5. Cold desert
6. Coastal land
7. Wetland
8. Mined area

8.1 HOT DESERT AND SHIFTING SAND DUNES

- **DISTRIBUTION** : The total area of hot desert in India is ~~31.7~~ **31.7 million hectares**, 61 % of which lies in Rajasthan.

Types	2008 - 09	2015 – 16 (% to TGA)
Ravines Sand	3165 km ²	3121 km ² (0.09)
Coastal Sands	709 km ²	671 km ² (0.02)
Desertic sand	8323 km ²	8191 km ² (0.25)

(Source : Westland Atlas of India 2019)



- **LOCALITY FACTORS** : Mean annual rainfall = 100 mm to 450 mm. The rainfall in these regions is irregular, and droughts are frequent.

- **Temperature** : 48 °C in may-June to 15°C during winter, even sometimes it goes below freezing point at several places.
- **Wind** : 100 to 150 km per hour are experienced during summer.
- **Soil** : Sandy in character with a well-developed *hardpan* of *calcium carbonate* at varying depths. Desert soils are purely mineral soils obtained by the mechanical disintegration of rocks. **Characteristics** : (i) Very low organic matter, (ii) High percentage of soluble salts, (iii) Low nutrient status, particularly nitrogen, (iv) High pH and calcium carbonate, (v) Structureless and coarse-textured,

IFoS 2022 : Discuss the components of desert ecosystem. Write steps to control shifting of sand dunes (15 m)

IFoS 2017 : Describe the technique of *sand dune fixation* in the thar desert. Also mention the choice of species for plantation (15 m).

IFoS 2013 : What are the specific problem of the following wasteland ? suggest at least 3 species for planting in each of them – (a) Hot desert.

IFoS 2012 : Describe the technique of Sand Dune Fixation in the Thar Desert. Also mention the choice of species for planting (15 m).

Congratulations

To all our successful candidates in

INDIAN FOREST SERVICE (IFOS) 2023



1
AIR

Ritvika Pandey

Forestry Comprehensive
Course



3
AIR

Swastic Yaduvanshi

Forestry Comprehensive
Course



5
AIR

Vidyanshu Shekhar Jha

Forestry Comprehensive
Course + Test Series



6
AIR

Rohan Tiwari

Forestry Comprehensive
Course



10
AIR

Shashank Bhardwaj

Forestry Comprehensive
Course + Test Series



14
AIR

Ankan Bohra

Forestry Comprehensive
Course



16
AIR

Prachi Gupta

Forestry Comprehensive
Course



17
AIR

Raj Patoliya

Forestry Comprehensive
Course + Test Series



23
AIR

Vineet Kumar

Forestry Comprehensive
Course



27
AIR

Jatin Babu S

Forestry Comprehensive
Course



28
AIR

Gaurav Saharan

Test Series



37
AIR

Yash Singhal

Forestry Comprehensive
Course



41
AIR

Nitish Pratik

Forestry Comprehensive
Course



50
AIR

VAASANTHI P.

Test Series



54
AIR

Sourabh Kumar Jat

Forestry
Comprehensive Course



56
AIR

Ekam Singh

Forestry Comprehensive
Course + Test Series



57
AIR

Kunal Mishra

Forestry Comprehensive
Course



58
AIR

Atul Tiwari

Forestry Comprehensive
Course



60
AIR

Aman Gupta

Forestry Comprehensive
Course + Test Series



61
AIR

Sanket Adhao

Forestry Comprehensive
Course



63
AIR

Preeti Yadav

Forestry Comprehensive
Course



65
AIR

Nihal Chand

Forestry Comprehensive
Course + Test Series



66
AIR

Shashikumar S. L.

Forestry Comprehensive
Course



67
AIR

Dhino Purushothaman

Forestry Comprehensive
Course



68
AIR

Diwakar Swaroop

Forestry Comprehensive Course



72
AIR

Rajesh Kumar

Forestry Comprehensive Course



74
AIR

Krishna Chaitanya

Forestry Comprehensive Course



75
AIR

Harveer Singh Jagarwar

Forestry Comprehensive Course



76
AIR

Akash Dhanaji Kadam

Forestry Comprehensive Course



78
AIR

Himanshu Dwivedi

Forestry Comprehensive Course



80
AIR

Sumit Dhayal

Forestry Comprehensive Course



82
AIR

Priyadarshini

Forestry Comprehensive Course + Test Series



91
AIR

Suchet Balkal

Forestry Comprehensive Course



93
AIR

Harshad Hinge

Test Series



96
AIR

Maharshi Kumar

Forestry Comprehensive Course



97
AIR

Akash Kumar

Forestry Comprehensive Course



104
AIR

P R Sarbajit

Forestry Comprehensive Course



105
AIR

Pawan K. Meena

Forestry Comprehensive Course



110
AIR

Keshav Prasoon

Forestry Comprehensive Course + Test Series



111
AIR

Nagabhushana S

Forestry Comprehensive Course



113
AIR

Shewale Vyankatesh G.

Forestry Comprehensive Course



123
AIR

Chandra Bhushan

Forestry Comprehensive Course



127
AIR

Shubham Kanoujia

Forestry Comprehensive Course + Test Series



128
AIR

Harsh Verma

Forestry Comprehensive Course + Test Series



134
AIR

Gaugin Gyanendra Singh

Forestry Comprehensive Course

64 Out Of **147** Total Selections In

Indian Forest Service (IFoS) 2023