



FORESTRY



UPPSC

UTTAR PRADESH



STATE FOREST SERVICE

2025-26

Detailed
Syllabus Based
study material

+

Linkage of
Concepts with
PYQs

+

Infused with
Infographics &
Maps

Module - 2

- ⦿ Mangroves Forest
- ⦿ Cold desert vegetation
- ⦿ Silviculture System
 - Clear felling system
 - Shelterwood System
 - Selection System
 - Accessory, Coppice & other Systems
- ⦿ Important Indian Tree Species
- ⦿ Agroforestry
 - Agroforestry policy 2014
 - Social Forestry
 - Urban Forestry

MPPSC State Forest Service 2023



Rank - 1

Shashank Jain

Comprehensive Forestry Course + CIGP



Rank - 3

Jyoti Thakur

Comprehensive Forestry Course + CIGP



Rank - 4

Shivam Gautam

Comprehensive Interview Guidance Programme



Rank - 5

Nitin Patel

Comprehensive Forestry Course + CIGP



Rank - 6

Ravi Kumar

Comprehensive Interview Guidance Programme + Test Series



Rank - 7

Ankur Gupta

Comprehensive Forestry Course



Rank - 8

Deependra Lodhi

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Rank - 9

Kapil Chauhan

Comprehensive Forestry Course



Rank - 10

Alok Kumar Jhariya

Comprehensive Forestry Course + CIGP



Rank - 11

Tarun Chouhan

Comprehensive Interview Guidance Programme + Test Series



Rank - 12

Raghvendra Thakur

Comprehensive Forestry Course + Test S. + CIGP

11 Out of **12** Total Selections in

Assistant Conservator of Forest (ACF)

108 Out of **126** Total Selections in

Range Forest Officer (RFO) 2023



Rank - 1

Arvind Ahirwar

Comprehensive Interview Guidance Programme + Test Series



Rank - 2

Pushpendra Singh Ahirwar

Comprehensive Forestry Course + CIGP



Rank - 3

Narendra Gunare

Comprehensive Interview Guidance Programme + Test Series



Rank - 4

Jitendra Kumar Verma

Comprehensive Forestry Course + CIGP



Rank - 5

Jaishrish Barethiya

Comprehensive Forestry Course + CIGP



Rank - 6

Bhavna Sehariya

Comprehensive Forestry Course + CIGP



Rank - 7

Pradeep Ahirwar

Comprehensive Forestry Course + CIGP



Rank - 8

Anil Kumar Gour

Comprehensive Forestry Course + CIGP



Rank - 9

Aakash Kumar Malviya

Comprehensive Forestry Course + CIGP



Rank - 11

Rajesh Kumar Jatav

Comprehensive Forestry Course + CIGP



Rank - 12

Veerendra Prajapati

Comprehensive Interview Guidance Programme + Test Series



Rank - 13

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Test Series



Rank - 14

Niranjan Dehariya

Comprehensive Forestry Course + CIGP



Rank - 15

Abhinay Chouhan

Test Series



Rank - 18

Sher Singh Ahirwar

Comprehensive Forestry Course + CIGP



Rank - 19

Pradeep Jatav

Comprehensive Forestry Course + CIGP



Rank - 21

Amit Sisodiya

Comprehensive Interview Guidance Programme



Rank - 22

Abhishek Barodiya

Comprehensive Interview Guidance Programme



Rank - 24

Golu Goyal

Comprehensive Interview Guidance Programme + Test Series



Rank - 25

Pawan Raj

Comprehensive Interview Guidance Programme + Test Series

Forestry

Module - 2



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Gole ka mandir, Morar, Gwalior (MP) 474005

Module - 2

Syllabus



<p>Indian Forest Service (IFoS) [Paper 1]</p> <p>or</p> <p>Uttar Pradesh PSC State Forest Service [Paper 1]</p>	<p>Mangrove : ♦ Habitat and characteristics of mangrove ♦ Plantation – establishment, and rehabilitation of degraded mangrove formations. ♦ Silvicultural systems for mangrove; ♦ Protection of habitats against natural disasters. Cold Desert – Characteristics, identification and management of species.</p> <p>Silviculture Systems : ♦ Clear feeling, Uniform shelter wood, Selection, Coppice and Conversion systems. ♦ Management of silviculture systems of temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding, and thinning.</p> <p>Silviculture of Trees : ♦ Traditional and recent advances in <u>tropical silvicultural research and practices</u>. ♦ Silviculture of some of the economically important species in India such as <i>Acacia catechu</i>, <i>Acacia nilotica</i>, <i>Acacia auriculiformis</i>, <i>Albizia lebbek</i>, <i>Albizia procera</i>, <i>Anthocephalus Cadamba</i>, <i>Anogeissus latifolia</i>, <i>Azadirachta indica</i>, <i>Bamboo spp.</i>, <i>Butea monosperma</i>, <i>Cassia siamea</i>, <i>Casuarina equisetifolia</i>, <i>Cedrus deodara</i>, <i>Chukrasia tabularis</i>, <i>Dalbergia sissoo</i>, <i>Dipterocarpus spp.</i>, <i>Emblica officinalis</i>, <i>Eucalyptus spp.</i>, <i>Gmelina Arborea</i>, <i>Hardwickia binata</i>, <i>Lagerstroemia Lanceolata</i>, <i>Pinus roxburghii</i>, <i>Populus spp.</i>, <i>Pterocarpus marsupium</i>, <i>Prosopis juliflora</i>, <i>Santalum album</i>, <i>Semecarpus anacardium</i>, <i>Shorea robusta</i>, <i>Salmalia malabaricum</i>, <i>Tectona grandis</i>, <i>Terminalia tomemtoza</i>, <i>Tamarindus indica</i>.</p> <p>Agroforestry : ♦ Scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) nutrient availability to crops; (iv) nature and eco-system preservation including ecological balances through pest-predator relationships and (v) Providing opportunities for enhancing biodiversity, medicinal and other flora and fauna. ♦ Agroforestry systems under different Agro-ecological zones; Selection of species and role of multipurpose trees and Non-Timber Forest Products (NTFPs), techniques, food, fodder and fuel security. ♦ Research and Extension needs. Social / Urban Forestry - Objectives, scope and necessity; People's participation.</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], Maharashtra PSC State Forest Service Examination [Unit – 1],</p>
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Module - 2

CONTENTS



PART – I : Mangroves & Cold Desert		
1.	Mangrove forest	5 – 20
2.	Cold desert	21 – 28
PART – II : Silviculture System		
1.	Introduction	33 – 34
2.	Clear felling system	35 – 38
3.	Shelterwood system	39 – 50
4.	Selection system	51 – 53
5.	Accessory system	54 – 55
6.	Coppice system	56 – 63
7.	Conversion	64 – 65
8.	Choice of silviculture system	66
9.	Management of bamboo forest	67 – 68

PART – III : Silviculture of Important Indian Tree Species		
1.	Introduction	73 – 75
2.	Peninsular tree species	76 – 90
3.	Tree species growing in North Indian plains	91 – 101
4.	Species of semi-arid tropics	102 – 105
5.	Exotic tree species	106 – 111
6.	Conifers	112 – 114
7.	Bamboo	115 – 117
PART – IV : Agroforestry & Social Forestry		
1.	Agroforestry : Introduction	127 – 133
2.	Classification of Agroforestry	134 – 144
3.	Role of trees in Agroforestry	145 – 149
4.	Choice of Agroforestry system	150 – 153
5.	Multi-purpose trees in Agroforestry	154 – 156
6.	N-fixing trees in Agroforestry	157 – 158
7.	Diagnosis & Design (D & D)	159 – 161
8.	Agroforestry policy 2014	162 – 163
9.	Social forestry	164 – 174
10.	Social forestry plantation	165 – 166

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UPPSC STATE FOREST SERVICE (ACF/RFO) PYQs | 2017 – 2021
Mangroves & Cold desert

Year	Questions
2021	निम्नलिखित पर संक्षिप्त टिप्पणी लिखिए / Write a short note on the following — मैंग्रोव वनों का सतत प्रबंधन / Sustainable management of mangrove forests [P1/1(e) 8 M]
2020	निम्नलिखित पर संक्षिप्त टिप्पणी लिखिए / Write a short note on the following — मैंग्रोव की वन-वर्धनिक प्रणालियाँ / Silvicultural systems of Mangroves [P1/1(b) 8 M]
2019	निम्नलिखित के बीच अंतर करें / Differentiate between the following — कच्छ वनस्पति एवं शीत मरुस्थल वनस्पति / Mangroves and cold desert plants [P1/4(b) 10 M]
2018	निम्नलिखित पर संक्षिप्त नोट लिखें / Write brief notes on the following — निम्नीकृत कच्छ वनस्पति वनों का पुनर्वास / Rehabilitation of degraded mangrove forests [P1/3(a) 4 M] — कच्छ वनस्पति के वन-संवर्धन गुण / Silvicultural properties of mangrove [P1/3(b) 4 M] — शीत मरुस्थल की विशेषताएँ / Characteristics of cold desert [P1/3(d) 4 M] निम्नलिखित के बीच अंतर करें / Differentiate between the following — कच्छ वनस्पति का गठन और गिरावट / Formation and degradation of mangrove [P1/4(d) 4 M]
2017	निम्न के तकनीकी व्योमों एवं लाभों का वर्णन कीजिए / Describe the technical details and benefits of the following — कच्छ वनस्पति वासों का संरक्षण / Protection of mangrove habitats [P1/3(d) 4 M] निम्न में अन्तर बताइए / Differentiate between the following — कच्छ वनस्पति एवं शीत मरुस्थल वनस्पति / Mangrove and cold desert vegetation [P1/4(d) 4 M]

Silviculture Systems

Year	Questions
2021	निम्नलिखित पर संक्षिप्त टिप्पणी लिखिए / Write a short note on the following — अवधि खण्ड में पुनर्जनन की लंबाई के लिए जिम्मेदार कारक। Factors responsible for length of regeneration in a periodic block. [P1/1(a) 10 M] — विषम आयु वनों के प्रबंधन पर चर्चा करें। / Discuss the management of uneven-aged forests [P1/1(c) 8 M] निम्नलिखित के मध्य अन्तर कीजिए / Differentiate between the following — कॉपिस और रक्षि वितान पद्धति। / Coppice and shelterwood system [P1/4(a) 10 M] — भारतीय विषम रक्षि वितान पद्धति और समान आयु पद्धति। / Indian irregular shelterwood system and uniform system [P1/4(c) 10 M]. निम्न वन प्रबन्ध पद्धतियों को स्पष्ट करो : (i) सामान्य कॉपिस पद्धति / Simple Coppice System. (ii) कॉपिस विथ रिजर्व पद्धति / Coppice with Reserve System. (iii) कॉपिस विथ स्टैंडर्ड पद्धति / Coppice with Standard System [P2/3(a) 20 M]
2020	निम्नलिखित पर संक्षिप्त टिप्पणी लिखिए / Write short notes on the following — सम्पूर्ण कटाई पद्धति। / Clear felling system [P1/1(e) 8 M] निम्नलिखित के मध्य अन्तर कीजिए / Differentiate between the following — चयन पद्धति एवं कोपिस पद्धति। / Selection system and coppice system [P1/4(d) 10 M]

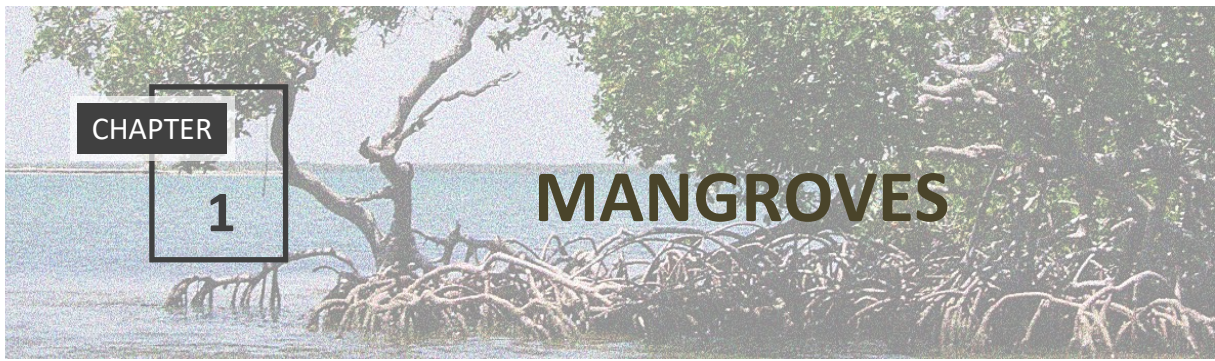
2019	निम्नलिखित के बीच अंतर करें / Differentiate between the following: गुल्म-वन एवं समरूप छाया काष्ठ चयन वनवर्धन प्रणाली / Coppice and uniform shelter wood selection silviculture systems [P1/4(c) 10 M]
2018	निम्नलिखित पर संक्षिप्त नोट लिखें / Write brief notes on the following — गुल्मन / Coppice [P1/1(c) 5 M]
2017	निम्न में अन्तर बताइए / Differentiate between the following — शीतोष्ण एवं शुष्क उष्णकटिबन्धी वनों की वनवर्धन पद्धति / Silviculture system of temperate and dry tropical forests [P1/4(a) 4 M] — गुल्मवन एवं रूपान्तरण वनवर्धन पद्धतियाँ / Coppice and conversion silvicultural systems [P1/4(c) 4 M]

Important Tree Species

Year	Questions
2021	निम्नलिखित की वन-वर्धन विशेषताओं की चर्चा करें / Discuss the silvicultural characteristics of the following — एजाडिरेक्टा इंडिका / Azadirachta indica [P1/3(a) 10 M] — एल्बिज़िया प्रोसेरा / Albizzia procera [P1/3(b) 10 M] — ब्यूटिया मोनोस्पेर्मा / Butea monosperma [P1/3(c) 10 M] — प्रोसोपिस ज्यूलीफ्लोरा / Prosopis juliflora [P1/3(d) 10 M]
2020	निम्नलिखित की वन-संवर्धन विशेषतायें बताइये / Describe the silvicultural characteristics of the following — कैज़ूरिना इक्विसिटिफोलिया / Casuarina equisetifolia [P1/3(a) 10 M] — डलबर्जिया सिस्सू / Dalbergia sissoo [P1/3(b) 10 M] — चीड़ पाइन / Pinus roxburghii [P1/3(c) 10 M] — सफेदा (यूकलिप्टस) स्पी / Eucalyptus spp [P1/3(d) 10 M]
2019	कैसुरीना इक्विसिटिफोलिया के आर्थिक उपयोग / Economic uses of Casuarina equisetifolia [P1/1(d) 8 M] निम्नलिखित की वन-संवर्धन विशेषताओं को बताइये / Describe the silvicultural characteristics of the following — सागोन (टेक्टोना ग्रैन्डिस) / Tectona grandis [P1/3(a) 10 M] — खैर / कत्था (ऐकेशिया कैटेचू) / Acacia catechu [P1/3(b) 10 M] — बांस प्रजाति / Bamboo species [P1/3(c) 10 M] — नीम (एजाडिरेक्टा इण्डिका) / Azadirachta indica [P1/3(d) 10 M]
2018	निम्नलिखित की वन-संवर्धन विशेषताओं पर टिप्पणी लिखें / Write a note on silvicultural attributes of the following — एनोगेयस लैटिफोलिया / Anogeissus latifolia [P1/2(a) 4 M] — गमेलिना आर्बोरिया / Gmelina arborea [P1/2(b) 4 M] — लेगरोस्ट्रिमिया लांसोलाटा / Lagerstroemia lanceolata [P1/2(c) 4 M] — प्रोसोपिस ज्यूलीफ्लोरा / Prosopis juliflora [P1/2(d) 4 M] उत्तर प्रदेश में पायी जाने वाली विभिन्न बांस संसाधनों का विस्तार, विविधता एवं उनकी उपयोगिता का वर्णन करें। Describe the distribution, diversity and utilization of important bamboo resources of Uttar Pradesh [P2/6(b) 20 M]
2017	निम्न के वनवर्धन लक्षणों का वर्णन कीजिए / Describe silviculture characteristics of the following — ऐकेशिया कैटेचू (खैर) / Acacia catechu [P1/2(a) 4 M] — कैसिया साइमा / Cassia siamea [P1/2(c) 4 M] — एजाडिरेक्टा इण्डिका (नीम) / Azadirachta indica [P1/2(b) 4 M] — टेक्टोना ग्रैन्डिस (सागवान) / Tectona grandis [P1/2(d) 4 M]

Agroforestry & Social forestry

Year	Questions
2021	<p>निम्नलिखित पर संक्षिप्त टिप्पणी लिखिए / Write a short note on the following</p> <ul style="list-style-type: none"> — लोगों के लाभ के लिए कृषि वानिकी की आवश्यकता और विस्तार Need and scope of agroforestry for the benefit of people [P1/5(b) 8 M] — पोषक तत्व चक्रण और मृदा संरक्षण में कृषि वानिकी की भूमिका। Role of agroforestry in nutrient cycling and soil conservation [P1/5(c) 8 M]
2020	<ul style="list-style-type: none"> • कृषि वानिकी की जैवविविधता बढ़ाने में भूमिका। Role of agroforestry in enhancing biodiversity [P1/5(a) 8 M] • कृषि वानिकी पद्धति में बहु-उपयोगी पौधों की भूमिका। Role of multipurpose tree in Agroforestry systems [P1/5(c) 8 M] • विभिन्न कृषि-पारिस्थितिकी क्षेत्रों में कृषि वानिकी पद्धति। Agroforestry systems under different agro-ecological zones [P1/5(d) 8 M]
2019	<ul style="list-style-type: none"> • वातरोधक (विन्ड ब्रेक) बनाम आश्रय कटिबन्ध (शेल्टर बेल्ट्स) Wind breaks vs shelter belts [P1/5(b) 8 M] • कृषि वानिकी का पारिस्थितिकी तंत्र के संरक्षण में भूमिका Role of Agroforestry in ecosystem preservation [P1/7(d) 8 M] • कृषि वानिकी के लिए प्रजाति चयन का मानदंड Selection criteria of species for Agroforestry [P1/7(e) 8 M]
2018	<p>निम्नलिखित के बीच अंतर करें (अधिकतम 5 बिन्दु अथवा 5 पंक्तियाँ)। Differentiate between the following (maximum 5 points or 5 lines).</p> <ul style="list-style-type: none"> — वनस्पति और प्राणी समूह / Flora and fauna [P1/5(f) 5 M] — बहुउद्देशीय वृक्ष प्रजातियाँ तथा अ-काष्ठ वन उत्पाद / Multipurpose tree species and NTFPs [P1/5(g) 5 M] — कृषि-वानिकी और सामाजिक वानिकी। / Agroforestry and social forestry [P1/5(h) 5 M] <p>निम्नलिखित पर कृषि-वानिकी की भूमिका का वर्णन करें / Describe the role of agroforestry on the following.</p> <ul style="list-style-type: none"> — मृदा और जल संरक्षण / Soil and water conservation [P1/8(b) 8 M] — फसलों के लिए पोषक उपलब्धता / Nutrient availability to crops [P1/8(c) 8 M] — सामाजिक आजीविका / Social livelihood [P1/8(e) 8 M] <p>कृषि-वानिकी को परिभाषित कीजिए। कृषि-वानिकी की फसलों में पोषण उपलब्धता तथा मृदा एवं जल संरक्षण में भूमिका का वर्णन कीजिए / Define agroforestry. Describe the role of agroforestry in relation to nutrient availability and soil-water conservation. [P1/6 40 M]</p>



Mangroves form the coastal and estuarine wetland ecosystems in the tropical and subtropical regions of the world. This unique intertidal ecosystem acts as a safeguard to the coastlines from the disastrous effects of storm surges, erosion, and floods. Some mangroves occur along open coasts, subject to moderate wave processes, while most of them grow in sheltered, muddy tracts that are either regularly or occasionally immersed by tides

Definition : Mangroves are a diverse group of *salt-tolerant plant communities* found in the *tropical and subtropical coastal* and *intertidal zone* of the world, occurring mainly between *latitudes 24° N and 38° S*.

1.1 HABITAT

- The intertidal zone of coastal and estuarine mudflats.
- Diurnal tidal inundation of marine water, making the soil loose, very wet, salty, and low in oxygen.
- The soil lacks minerals like nitrogen (N), phosphorus (P), potassium (K), iron (Fe), and sulfur (S).
- Area experiences strong winds from cyclones and tsunamis.
- The temperature ranges from 25-35°C, and there is 100 to 300 cm of rainfall annually
- Rich biodiversity because of the edge effect.



Figure 1.1 : Mangroves habitat

1.2 DISTRIBUTION

- ▶ **INDIA** : 4992 km², which is 0.15% of the country's total geographical area. *Very Dense mangrove* comprises 1476 sq. km (≈ 29.5%) of the mangrove cover, *Moderately Dense mangrove* is 1481 km² (29.7%), while *Open mangroves* constitute an area of 2036 km² (≈ 40%). There has been a net increase of 17 km² (1.1 %) in the country's mangrove cover compared to the 2019 assessment [*Data as per Indian state of forest report 2021*].

STATE/UTS-WISE : West Bengal = 2114 km² (42.5 % of total mangroves in India) > Gujarat = 1175 km² (23.66 %) > A & N = 616 km² (12.5 %). *South 24 Parganas* district of *West Bengal* alone accounts for *41.75 % Mangrove cover* of the country.

IFoS 2017 : Enlist 6 genera of mangroves. Name 2 state and 1 UT with the large area under mangrove forest [8m]. [OPSC Civil (Main) 2018, 2019].

is referred to as "viviparity." The propagules either take root in the sediments near the parent tree or are dispersed with the tides and currents to other shorelines.

PLANT VIVIPARY

Vivipary means germination of the seed within the fruit (in situ) while still attached to the plant, *i.e.*, *Rhizophora*, *Sonneratia*, etc. This type of germination is essential due to the greater salt concentration in the mudflat with reducing oxygen conditions. The seeds fail to germinate if dispersed directly onto the soil. In such plants, seed dormancy is absent. The seed's embryo continues to grow while present inside the seeds, which are still present inside the fruits attached to the parent plant. The hypocotyl elongates and pushes the radicle out of seed and fruit and makes the seedling heavy. This increasing weight leads to falls propagules vertically in the salt-rich marshy habitat in such a way that the plumule remains outside the salty water. The radicle then produces roots quickly and fixes the seedling.

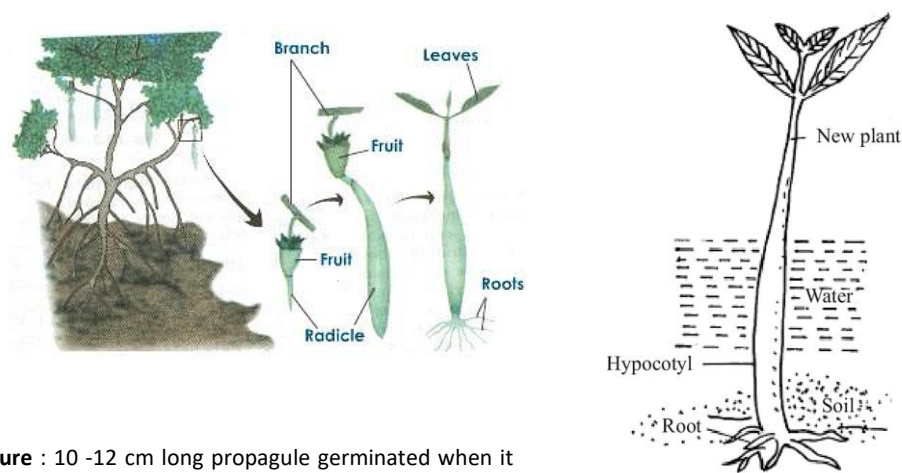


Figure : 10 -12 cm long propagule germinated when it still attached to its mother tree.

IFoS 2010 : Comment on - Mangrove ecosystems have physiologically dry soil (5m)

Hints : *Physiologically dry* soil means that water is present in the soil, but due to high levels of salt, waterlogging, low temperature, and/or any other extreme local condition. The plants cannot easily absorb the water present in the soil.

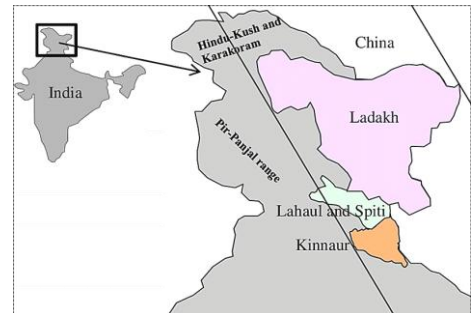
In the mangrove ecosystem, Although the soil contains adequate water, yet plants cannot avail this water because of its high salt concentration (mostly sodium & magnesium chloride and magnesium sulphate), and waterlogging. This is a *physically wet* but *physiologically dry* type of soil. Most of the plants unable to sustain or grow their seedlings in those areas, and only the halophytes that have moulded themselves according to this situation only remain to thrive.

The cold desert is an area that experiences extreme cold weather and denuded terrain. It is also known as a 'temperate desert'. Cold deserts in India have been formed primarily due to the rain-shadow effects of the towering main Himalayan mountains wall, and its offshoot ranges run in an arcuate shape from the Indus gap to the Brahmaputra gap. Here, climate and soil are not suitable for plant growth. Hence land is barren of vegetation except for isolated, scattered, and overgrazed herbaceous shrubs.

2.1 DISTRIBUTION

There are two physiographic divisions of cold deserts in India –

- ▶ **The Trans-Himalayan zone** : about 2 % of the Geographical area forms a part of the Tibetan plateau, *i.e.*, Leh-Ladakh region, Lahul-Spiti Valley, and Pin Valley region of Himachal Pradesh.
- ▶ **Inner dry valleys** : smaller valleys within the main Himalayan range that lie in the rain shadow zone, *i.e.*, Kinnaur, Chamba (H.P.), Uttarkashi, Chamoli, Munsiri, Pithoragarh (U.K.), and Northern Sikkim.



IFoS 2017 : Where are cold deserts found in India? Explain site characteristics encountered in a cold desert and steps suggested to overcome problems in their afforestation (10).

2.2 HABITAT CHARACTERISTICS

- ▶ **HARSH CLIMATE** : Unlike other parts of the country, the cold deserts experience *two pronounced seasons, viz., summer and winter*. The summer usually begins around May and continues till September. Winter commences from November to early May.
 - Being a rain shadow area for both the monsoon and the monsoon depression, rainfall is very low (below 60 cm). The melting of snow is the only primary source of moisture.
 - The temperature is usually below 0°C.
 - Short growing season = 3 to 5 Months, mostly during summer season.
 - High insolation due to low thickness of the atmosphere.

IFoS 2019 : What are the characteristic features of cold deserts of the Himalayas? _____ (10 m).

IFoS 2017 : Where are cold deserts found in India? Explain site characteristics encountered in a cold desert and steps suggested to overcome problems in their afforestation (10 m).

IFoS 2016 : Write the characteristics of a cold desert. Discuss soil working and planting techniques for cold desert (8 m).

IFoS 2008 : Discuss the characteristics of cold desert in India. _____ (20 m).

SILVICULTURE SYSTEM

INTRODUCTION

Silviculture is the art and science of cultivating forest crops. It encompasses the natural laws governing tree and forest growth, the influence of environmental factors, and the techniques for both natural and artificial regeneration, as well as ongoing forest management.

Due to the diverse nature of forest types and their specific environmental conditions, a variety of silvicultural methods are required to effectively regenerate and manage different forest sub-types in varying locations. These specific methods or techniques are known as **Silvicultural Systems**.

- **SILVICULTURAL SYSTEM** : a method of the silvicultural procedure worked out in accordance with accepted sets of silvicultural principles, by which crops constituting forests are tended, harvested and replaced by new crops of distinctive forms.

OR

Silviculture system is a planned silvicultural treatment which is applied to a forest crop, throughout its life, so that it assumes a distinctive form. It begins with regeneration felling, tending the crop to its final felling.

✎ Silviculture system deals with the removal of a forest crop.

1.1 CLASSIFICATION

In India, silvicultural Systems have been classified primarily based on the ① mode of regeneration and then the ② pattern of felling.

HIGH FOREST SYSTEMS : All those silvicultural systems in which the regeneration is usually of seedling origin, either natural or artificial^{***} (or a combination of both). So, rotation is generally long. These are further classified based on the pattern of felling, which in turn, affects the concentration or diffusion of regeneration and characteristics of the new crop [Figure 1.1].

COPPICE SYSTEMS : In these silvicultural systems, the crop originates from coppice growth^{***}, leading to a shorter rotation period compared to high forest systems. Coppice systems are further categorized based on the pattern of felling into the

IFoS 2018 : Enlist the classification of silvicultural systems on the basis of mode of regeneration and pattern of felling (15 m).

Hints : For questions like this, we can start answer writing by defining the silviculture system as its introduction part (the most straightforward way), then classified it into two major groups based on regeneration (as per given 1st basis); The 1st one is High forest system, and another one is coppice system, then further divide them according to the mode of felling.

SHELTARWOOD SYSTEM

As described in the previous chapter, the entire cropped area is clear-felled in one operation and restocked, either artificially or naturally (occasionally), in the Clear-felling System. However, this creates some issues, such as :

- Artificial regeneration requires a lump sum investment and a one-time, high labour demand.
- Its success depends on the correct choice of species, the use of proper techniques, favourable climatic conditions (such as adequate rainfall), and freedom from adverse biotic factors.
- Soil erosion is an issue due to the opening up of the tree cover.

Therefore, when large sums of money are not available for artificial regeneration, or when natural regeneration of the species is not possible on a clear-felled site due to inadequate seed supply or adverse climatic and soil conditions, **alternative methods must be considered**.

The alternative is to emulate nature and remove the over-wood gradually, in two or more successive fellings, depending on the progress of regeneration. Since regeneration occurs under the shelter of the over-wood, such systems are called **Shelterwood Systems**. As the over-wood is removed in multiple operations, they are also known as **Systems of Successive Regeneration Fellings**.

In other words, Shelterwood Systems involve the gradual removal of the entire stand in two or more successive fellings that extend over a portion of the rotation. The process begins with the opening of the canopy to allow natural regeneration under the shelter of the remaining over-wood. As the natural regeneration progresses, the over-wood is gradually removed. When the regeneration no longer requires protection, the shelterwood is removed completely, allowing the newly established crop to utilize the growing space effectively.

The varying patterns of regeneration fellings, and their distribution in space and time, result in a variety of shelterwood systems.

- ⇒ Uniform shelterwood system or simply called 'Uniform system'.
- ⇒ Group system
- ⇒ Shelterwood strip system
- ⇒ Strip and group system
- ⇒ Wagners blender saumschlag system
- ⇒ Eberhard's **Wedge** system
- ⇒ Irregular shelterwood system
- ⇒ Indian irregular shelterwood system

✿ Define and classify silvicultural system. What is shelterwood system? Write, in detail, about different shelterwood systems [OPSC Forest Service 2015-16].

ACCESSORY SYSTEM

Accessory Systems refer to those *high forest systems* that *originate from other even-aged systems* by *modifying technique*, resulting in an irregular or two-storeyed high forest. These are –

5.1 TWO-STOREYED HIGH FOREST SYSTEM

Under this system, the formation of a two-storeyed forest. The canopy can be differentiated into two strata, and *each story is approximately even-aged* and usually *seedling in origin*.

▷ Advantages / Aim

- The lower story crop can be used to protect the soil when the upper story of strong light-demanding species like teak is unable to do so.
- Increasing the proportion of valuable species in the moist deciduous and semi-evergreen forests.
- To propagate shade-bearing or frost tender species which cannot be grown without protection.
- by growing two crops in the same area = Increase production = Income
- To change the species gradually
- To creates a vertical mixture in species composition



▷ Disadvantages

- Very difficult in operation + require a very high level of skill + labour-intensive = likely to fail
- Often under-story is damaged during thinning or fellings of upper-storey
- Under-story crop may affect the growth of the upper story crop.

▷ **Application** : Examples of two-storeyed natural forests are not uncommon in India. For example, **Chir pine** and **Sal** are sometimes found growing together in certain localities in Tehri and Garhwal (UK). Deodar has come-up naturally under the pure crop of Chir. Oak growing under Deodar and Chir crop.

In Haldwani, Ramnagar, and some other divisions of Uttar Pradesh, *Teak* is being introduced in those *Sal* areas where all attempts to obtain natural *Sal* regeneration have failed. While the long-term goal is the gradual replacement of the current crop with an even-aged *Teak* Forest, *Teak* is currently being introduced under a canopy density of about 0.4 in the overwood, which translates to roughly 120 to 150 trees per hectare.

Since *Teak* is managed on a 50-year rotation and *Sal*, which is to be removed gradually, has a rotation of

CHOICE OF SILVICULTURE SYSTEM

The choice of silviculture system that we adapted to a particular area and species usually based on –

- Suitability of system to that species
- Soil & Topography
- The resistance offered to external dangers
- Objective of management
- Economic consideration
- Road and water transportation /communication
- Availability of skill workforce
- Existence of forest right
- Aesthetic consideration

DAUERWALD CONCEPT ?

Dauerwald is a German term (meaning in English continuous forest), we used this term to refer to any silvicultural system, which does not involve clear-felling and exposure of soil.

Definition : A treatment of forest in such a way that a continuous and unbroken forest cover is maintained over the entire area.

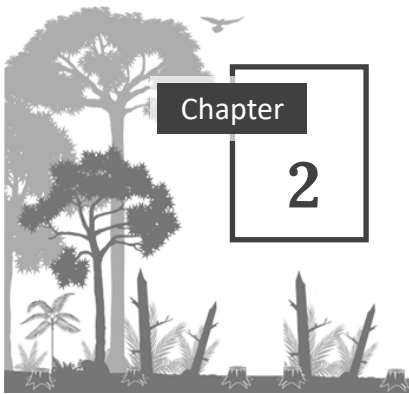
On the basis of this concept, we Classified silvicultural systems broadly into two categories :-

- (i) Dauerwald systems and
- (ii) Clear-felling systems

IFoS 2021 : What are the conditions on which the *choice of a particular silvicultural system* to be adopted for specific species in any locality depends? (15 m).

IFoS 2021 : 'An appropriate silviculture system promotes better regeneration of forest stand' Comment (8m).

- 🌿 What are the criteria for choice of species to be raised in shelterbelt? [OPSC Civil (Main) 2021]
- 🌿 Successful regeneration is a forest stand depends upon judicious choice of silvicultural system comment [OPSC Civil (Main) 2011].
- 🌿 How does high forest system differ from coppice system? Discuss the various factors which affect the choice of silvicultural systems by giving suitable example [Himachal PSC Civil (Main) 2012].
- 🌿 Explain in brief the factors that decide the choice of a silvicultural system [Arunachal PSC Civil (mains) 2015-16].



PENINSULAR TREE SPECIES



There is no any such classification that divides our trees into North Indian, South Indian, Himalayan Indian, etc. We are here creating this arbitrary to make the species easier to understand, remember, and reproduce in the main exam. Species that primarily grow in the peninsular region are :

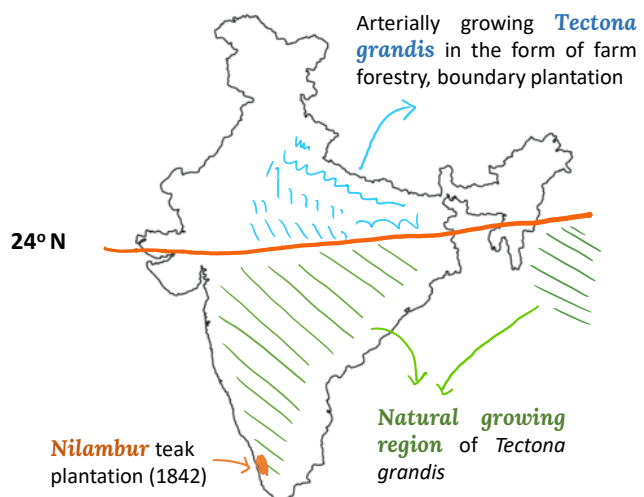
- ▶ *Tectona grandis* (Teak) & *Gmelina arborea* (Gamhari, Safed teak)
- ▶ *Albizia lebbek* (Kala Siris) & *Albizia procera* (Safed siris)
- ▶ *Santalum album*
- ▶ *Lagerstroemia Lanceolata*
- ▶ *Bombax Ceiba Syn. Salmalia malabaricum*
- ▶ *Butea monosperma*
- ▶ *Semecarpus anacardium*
- ▶ *Pterocarpus marsupium*

2.1 *Tectona grandis* (Teak)

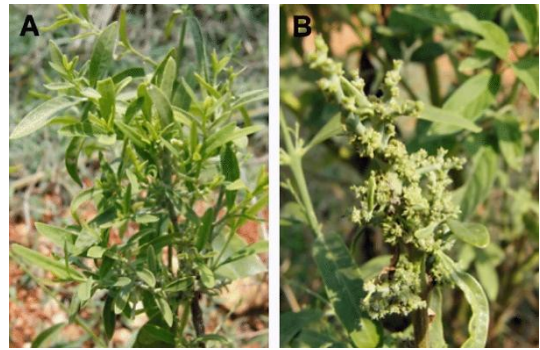
- ▶ **Vernacular / Local Name** : Sagwan (Hindi), Sagaun (Kannada), Singuru (Oriya), Tekkumaram (Tamil)
- ▶ **Family** : Verbenaceae.
- ▶ **DISTRIBUTION** : Teak is a *Large, deciduous, and light-demanding* tree that naturally grows *below 24° North latitude* on the Indian peninsula and in Myanmar, where a warm tropical climate with *100–500 cm of rainfall* and temperatures ranging from *10°C to 40°C* provides the perfect growing conditions. Therefore, most of our teak forests are located in *Madhya Pradesh, Maharashtra, Karnataka, etc.*, where the tropical conditions are suitable for their strong light-demanding nature.

As market demand and popularity have increased, *block and boundary plantations* have become common in the North Indian plains. Teak trees can attain a *height of 40 meters* and a *girth of more than 1.5 meters*.

- **Climate** : Thrives best in a *fairly moist, warm tropical climate*.
- **Altitude** : Generally grows *below 800 meters*, but it may perform well up to 1200 meters in the Western Ghats.
- **Geology & soil** : Teak grows on a wide



- Presently, there is no option but to cut down and remove the infected tree to prevent the spread of the disease, caused by **phytoplasma** (MLO)—which are **transmitted by insect vectors** involving plants to plant transmission.
- Very difficult to identify the symptoms of SSD. It can be noticed only when the tree gets completely affected.
- Heartwood production has decreased from 4,000 tonnes in the 1930s to just 300 tonnes now, while prices have increased from ₹12,000 to ₹29,500 per kg.



EXERCISE

IFoS 2019 : Give a brief account of the origin & natural distribution of the following - (c) *Santalum album* [5 M].

IFoS 2016 : Describe in brief the *distribution, phenology, silvicultural characteristics, artificial regeneration and uses* of the following species [20 M]. (1) ___ (2) *Santalum albus*. [OPSC Civil (Main) 2019].

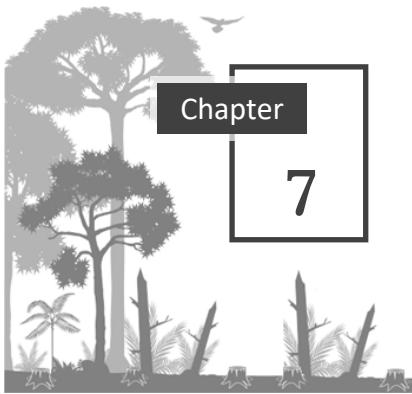
IFoS 2010 : “Indian Sandalwood (*Santalum album*) is the most valuable wood in India. However, silvicultural production of this species is not satisfactory.” Discuss the above in relation to the phenology of *Santalum album* and the forest laws governing its cultivation and trade.

IFoS 2009 : Narrate the silviculture practices followed in any of the following – (a) *Santalum album*.

2.6 Lagerstroemia Lanceolata (Nana)

- ▶ **FAMILY** : Lythraceae
- ▶ **DISTRIBUTION** : well distributed along the west coast of India, it grows in almost every state from Madhya Pradesh to Tamil Nadu with the association of Teak and other trees, except the *lateritic* soil zone.
 - **Climate** : Tropical (20° C to 45°C)
 - **Rainfall** : 1000 to 3500 mm
- ▶ **PHENOLOGY** : it is a large-sized deciduous tree with a relatively well-developed crown. In favourable conditions, the tree may attain up to 30 m in height with a clear bole of 10 to 15 m. In dry localities, it grows to moderate size.
 - **Leaf fall** : March – April and remain leafless during the entire summer
 - New leaves appear in June/July
 - **Flowering** : April to June
 - **Fruiting** : November to January (During the cold season)
- ▶ **SILVICULTURAL CHARACTERISTICS** : Nana tree is a *strong light-demander*. The mature tree is resistant to frost, but young seedlings are very frost-tender.
 - Strong light demander
 - It was resistant to grazing and fire
 - Wind firm - have a long taproot system.
 - Good coppicer
- ▶ **NATURAL REGENERATION** : By seed and Coppice

✿ Write a note on silvicultural attributes of - (c) *Lagerstroemia lanceolata* [UPPSC (ACF/RFO) 2018].



BAMBOO



- ▶ **FAMILY** : Gramineae (old name Poaceae)
- ▶ **DISTRIBUTION** : The most commonly distributed bamboo of the Indian peninsula is **Dendrocalamus strictus** or **male bamboo** which is easily growing in the tropical dry deciduous locality. The culms in this bamboo are solid = and have high commercial value. The other common bamboo of the Indian peninsula is **B. Arundinaria (B. bamboo)** which is often grown in moist soil, along the river beds.

Some of the important bamboo in its growing region

SN	Scientific name	Common name	Distribution
1.	<i>Arundinaria falcata</i>	Ringal	The low-level bamboo of the western Himalayas, at elevations between 1000-2200 m. It grows gregariously, forming an undergrowth in the forests of deodar, oak, etc., usually in moist shady locations.
2.	<i>Arundinaria spathiflora</i>		
3.	<i>Arundinaria Wightiana</i>	Chevani	Nilgiri region
4.	<i>Bamboosa bamboo</i> (Syn. <i>B. Arundinaria</i>)	Thorny bamboo	Pan India particularly along the river valley and in moist locality <i>i.e.</i> Indo-Gangetic plains. Useful in paper manufacturing.
5.	<i>Bambusa vulgaris</i>	Yellow bamboo	
6.	<i>Bambusa tulda</i>		Common in alluvial flats along the stream <i>i.e.</i> Assam valley.
7.	<i>Bambusa Polymorpha</i>	Betua (Assame)	NE India. Uses - for paper, Agarbatti sticks, fiberboards, etc. tender shoots are of best quality for edible purposes.
8.	<i>Ochlandra travancorica</i>		This shrubby bamboo with culm up to 5 m height. Commonly growing in the Malabar region and Tamil Nadu.
9.	<i>Dendrocalamus giganteus</i>		Largest bamboo. Indigenous to Myanmar (Burma), in India, grows primarily in the NE region.
10.	<i>Dendrocalamus hamiltonii</i> .	Kaghzi Bans	found mainly in the northeastern Himalayas mostly between an altitude of 600-1200 m. The most important use is for paper manufacture.



Agroforestry is a collective name for sustainable land-use systems involving trees combined with crops and/or animals on the same unit of land. It combines the -

- The production system of food crops with protection covers of trees especially in fragile ecosystems.
- Emphasis on the use of indigenous trees has multi-purpose uses (MPFTs) and High yield short rotation (HYSR) tree varieties.
- It is structurally and functionally more complex than monoculture.
- It also provides alternative investment opportunities with insurance coverage that if our main agricultural crops fail, we still have the trees covered to sell them and sustain their house economy.
- This concept is based on our ancient tradition and Socio-cultural values, to grow trees on the boundaries of the farm, protect them and harvest them at a necessary point in time to reduce village dependency on the Forest.

► **DEFINITION** : Agroforestry is a sustainable land-use system that maintains or increases total yields by combining food crops (annuals) with tree crops (perennials) and/or livestock on the same unit of land, either alternately or at the same time while using management practices that suit the local social-cultural characteristics of society and Economic and ecological conditions of the area.

Remember “Crop + Tree ± Domestic animals”. 1st two are the essential requirement, 3rd component is optional it may be present or absent.

Nair (1979) defines agroforestry as a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers

Land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers [**Bene, et.al.**]

► **ATTRIBUTES OF AGROFORESTRY**

Productivity : maintain or increase the production of preferred crops & productivity of the soil.

Sustainability : By conserving the production potential of the resource base, mainly through the beneficial effects of woody perennials on soils; **Cornerstone of agroforestry**]

Adaptability : The word “adopt” here means “accept” (not “modify” or “change”). The implication here is that improved or new agroforestry technologies that are introduced into new areas should also conform to local farming practices.

► **SCOPE/NECESSITY** : Agroforestry has an excellent scope in the context of Indian Agriculture due to its intrinsic relation with traditional agricultural practices. Agroforestry practices are beneficial in –



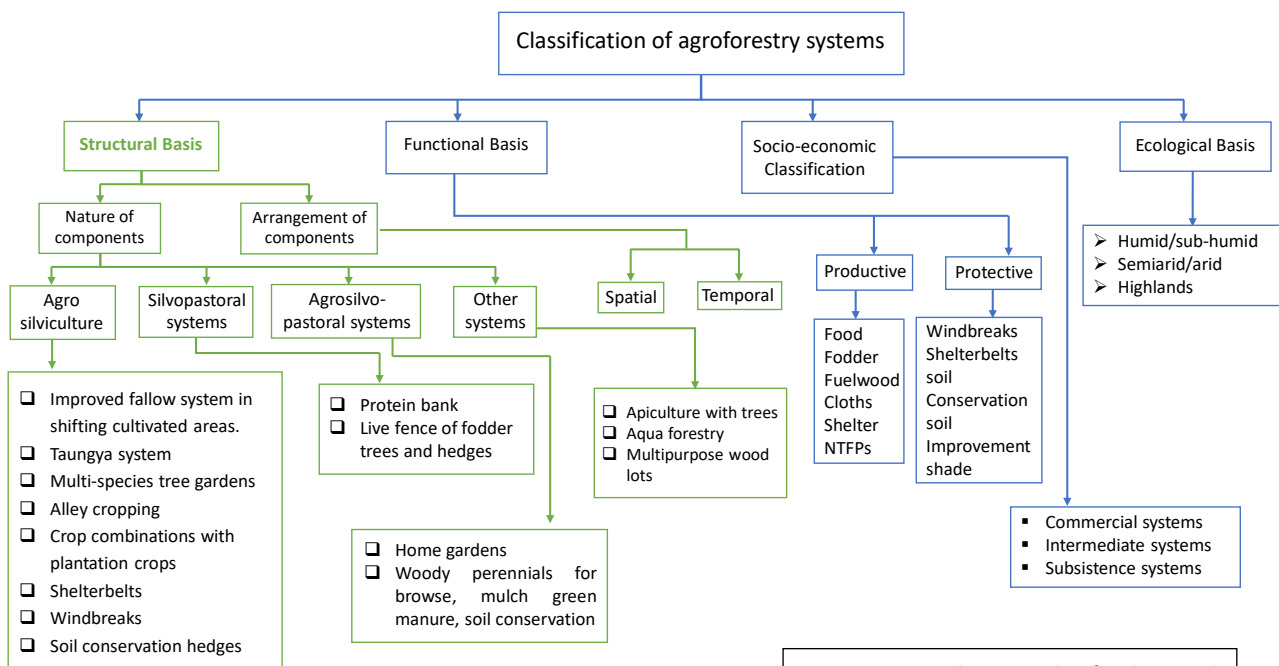
CHAPTER
2

CLASSIFICATION OF AGROFORESTRY

According to **Nair** (1987), the Agroforestry system can be classified according to the following four bases -

- ▶ Structural Basis
- ▶ Functional basis
- ▶ Socio-economic Basis
- ▶ Ecological basis

Tejwani (1994) Classified Agroforestry systems into (1) Structural Basis, (2) Functional basis, (3) Socio-economic Basis, (4) Ecological basis, and (5) Physiognomic basis.



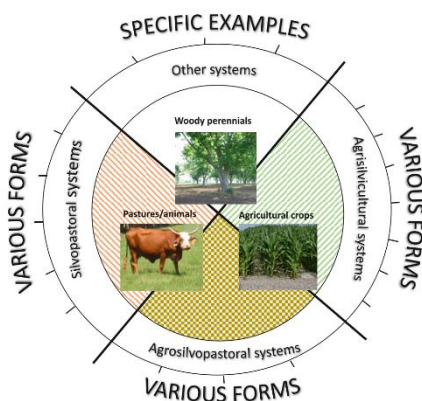
IFoS 2013 : What are the fundamental bases of the **classification** of agroforestry systems? (10 m).

2.1 | STRUCTURAL CLASSIFICATION

Based on the types of components and their arrangements, it is further divided into – (a) the nature of the component, and (b) the arrangement of components.

2.1.1 | NATURE OF COMPONENT

(1) Agri-silviculture system, (2) Silvi-pasture, (3) Agro-Silvi-pasture, and (4) other systems.



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