



2024

# CGPSC FOREST RANGE OFFICER TOOLKIT

*The Ultimate Guide to Success*

**Module - 1**

General Forestry

State Forest

Silviculture

Mangroves

Tree Species

# Congratulations

To all our successful candidates in

## MADHYA PRADESH FOREST SERVICE 2020

### Assistant Conservator of Forest (ACF)



1

Ashish Vijaywar



2

Ankit  
Kumar Jain



3

Sachindra Singh  
Tomar



4

Shubham Soni



6

Rahul Chouhan

5 Out of 6 Selections in MPPSC  
Forest (ACF) 2020

### RANGE FOREST OFFICER (RFO)



1

Gourav Dubey



2

Saurabh Dubey



3

Pawan Sharma



4

Manish Sharma



5

Kuldeep Baghel



6

Sushil Parmar



7

Lantav Jain



9

Shubham  
Raghuvanshi



10

Manisha Mukati



12

Vedant Goutam



13

Parag Jain



16

Shri Ram Dwivedi



19

Anil Kumar



20

Shashi Prakash  
Pandey



21

Anubhav Jain



22

Ravindran Gupta



24

Kuldeep Bohare



25

Shubham Tiwari



26

Yogesh Dhote



27

Piyush Shukla



28

Yogendra Singh  
Baghel



30

Abhilash Pathak



31

Manav Patidar



33

Omkar Nath Mishra



34

Amit Singh  
Chandel

# GENERAL FORESTRY

MODULE – 1



**EDITION : 2024**

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## Module - 1

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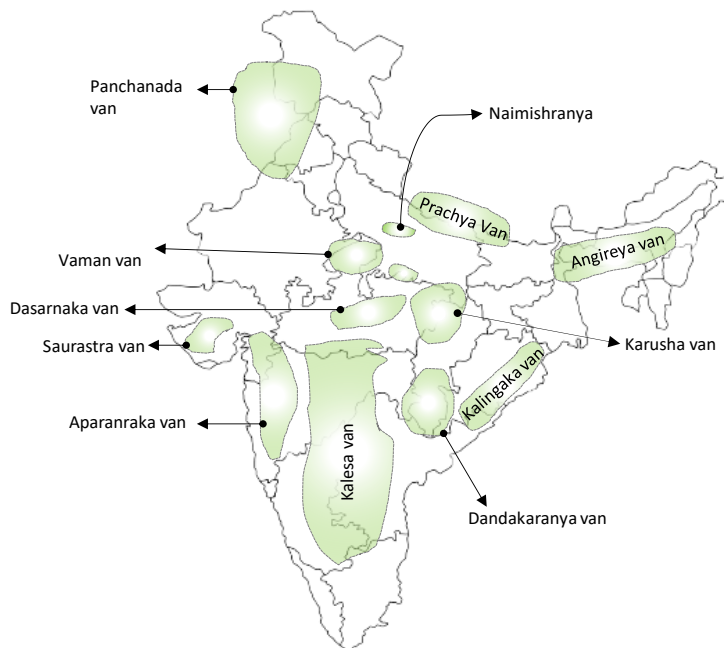
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# GENERAL FORESTRY

## 1.1 HISTORICAL BACKGROUND

Our religious texts such as Vedas, Aranyakas (*Aranya* in *Sanskrit* means Forest), Upanishad, and Smritis contain many descriptions of the uses and management of forests and highlight sustainability as an implicit theme. According to Vedic traditions, every village would be complete only when certain categories of forest vegetation or trees (*i.e.*, *Mahavan*, *Shrivana*, and *Tapovan*) are preserved in and around its territory.



- In *Vishnu Puran* (one of the eighteen Maharanas), there is a description of 13 types of forest occurring in different parts of the country, few of them are - *Angireya Vana* (Bengal and Assam), *Prachya Vana* (Bihar, UP, Nepal), *Naimisharanya* (central UP), *Panchanada vana* (Punjab + J & K), *Aparantaka Vana* (MH), *Dandkarandya van*, *Kalinga Van*, *Saurashtra Vana*, *Kalesha van* (south of river Narmada), *Vaman vana* (near Gwalior), *Dasarnaka vana* (around Bhopal, Sagar,

## Chapter Outline

- 1.1 Historical background
- 1.2 Forestry & Wildlife after independence
- 1.3 MoEFCC & Its Sub-ordinated bodies
- 1.4 Forestry Education system
- 1.5 Forest Survey of India
- 1.6 FAO & Its State of the world forest report
- 1.7 Forest types in India
- 1.8 Forest & wildlife related acts, policies & missions
- 1.9 Wildlife projects
- 1.10 National & International days & years
- 1.11 International Organizations
- 1.12 Superlatives in Forestry
- 1.13 Remarks

**Mahavan** : Great natural forest; Equivalent of modern-day 'Protected forest'

**Shrivana** : Forest of prosperity; Production forest / Planted forest for the production of fuel, fodder, Timber, etc.

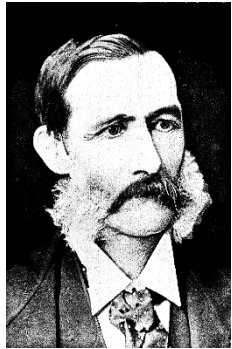
**Tapovan** : Home of sages; Being sacred, no animal or tree could be harmed in these forests

Damoh), *Mahakantara* van and *Karush* van (Baghel & Bundelkhand). These forests were further divided into two main classes –

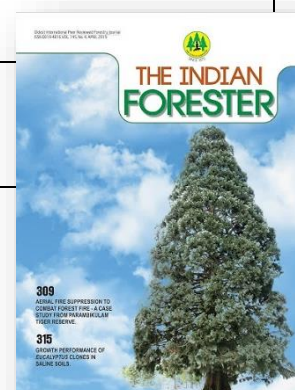
- (a) *Kunjar Van*\*\*\* or *Elephant forest* : Dense forest, as they provide comfortable shelter to wild elephants
- (b) *Kantak Van*\*\*\* (thorny scrub forest).

- ▶ **MAURYA PERIOD** : when *Chandra Gupta Maurya*\*\*\* came to power around 300 BC, he realised the importance of forests. He appointed a *Kupyadhyaksha*\* (head of the forest department) to look after the forests with the help of several *van-pals* (forest guards). As per *Kautilya's Arthashastra*. During this period, usually, a king divides their forest into 4 Bhag (parts) - (a) one part reserved for themselves for hunting and personal use purposes, (b) the 2<sup>nd</sup> part reserved for the state (*i.e.*, Magadh), (c) the 3<sup>rd</sup> part for donation purpose (to the Brahmins and others), and (d) the fourth part for public use.
- ▶ **GUPTA PERIOD** : A large part of the central peninsular region was donated by the Gupta rulers in the form of *brahmadeya*, which was converted into agricultural land with the help of forest dwellers.
- ▶ **DURING COLONIAL RULE**

1806	<p><i>Captain Watson</i>*** was appointed as the <i>first Conservator of forests</i>*** by Govt. of Madras. His duties were to preserve and improve the production of teak and other timber suitable for shipbuilding. Watson's appointment and his works in this region (Malabar and Travancore) almost monopolized the production of wood, which enabled the Government to extract cheap timber in large quantities up to 1823, when this <i>conservatorship was abolished</i> after the recommendation of <i>Thomas Munro</i>.</p> <ul style="list-style-type: none"> <li>▪ Watson was thus the first person in India to be named a '<b>Conservator of Forests</b>'</li> </ul>
1842	<p>After the directions of the Court of Directors, Madras Govt. initiated the <i>Nilambur Teak plantation</i>* work through <i>Conolly</i>, the then Collector of Malabar. Conolly was authorized to appoint a sub-conservator of the forest to work under his own supervision with a salary of ₹ 150 per month. This was the first step towards re-establishing the conservatorship, which had been abolished some years back. <i>Chatbu Menon</i> was appointed as the sub-conservator in 1844 who devised the method of pre-sowing seed treatments and planting of saplings, which is largely followed with slight modifications even today.</p> <ul style="list-style-type: none"> <li>▪ <i>Oldest teak plantation of the world</i> = Nilambur [ Recently received GI-Tag]</li> <li>▪ To pay tribute, the plantation area is known as <i>Connolly's Plot</i>.</li> <li>▪ This marked the <i>start of plantation forestry in India</i>.</li> </ul>
1843	<p><i>Campbell</i> introduced the <i>Eucalyptus pinata</i> at Wellington (Madras).</p> <p>[The first plantation of Eucalyptus in India was of <i>Eucalyptus pyrenantha</i>, started in 1858 near Wellington by Cambell – Book : <i>One Hundred Years of Indian Forestry, Vol. II</i>]</p>
1847	<p><i>Gibson's</i> appointment as the <i>Conservator of Forests</i> by the Bombay Presidency laid the foundation for forest services in India.</p>

1854	First Zoo in India (Calcutta Zoo, West Bengal) was established.
1856	<p><i>Cleghorn</i> was appointed as the <i>first regular Conservator of Forests</i>. Initiate <i>Udhagamandalam</i> or <i>Otacamund Eucalyptus plantation</i>.</p> <ul style="list-style-type: none"> <li>▪ <i>Dietrich Brandis</i> was selected and appointed as Superintendent of Pegu (Burma) Forest by <i>Dalhousie</i> [In which country did Brandis work before coming to India = Burma/Pegu]</li> <li>▪ 1<sup>st</sup> "Regular" conservator of forests : 1<sup>st</sup> choice <b>Cleghorn</b>*** (1856), 2<sup>nd</sup> Choice Gibson (1847).</li> <li>▪ Cleghorn published a book : <b>Forest and Gardens of South India</b></li> </ul> <p>note : In 1847, <i>Gibson</i> was appointed, in addition to his duties as the superintendent of the Botanical Garden, as their <i>Conservator of Forests</i> by the Bombay Government. In 1856, <i>Cleghorn</i> was appointed as the <i>first regular Conservator of Forests</i> (Regular = have no other side works) in the Madras Presidency. With these appointments, regular steps at forest conservancy began to be undertaken in the Bombay and Madras Presidency. At that time, the vast forest tracts in Central Provinces, Bengal, and Assam had not even been explored to any extent with regard to the forests. Stewart was Punjab's first regular Conservator of Forests (1864),</p> <p>Source : <i>One Hundred Years of Indian Forestry, Vol. I, Forest Research Institute, Dehradun 1961, p.73, 77</i></p>
1864	<p>The then <i>governor-general John Lawrence</i> created the <i>Indian Forest Department</i> and appointed <i>Dietrich Brandis</i> as its <i>Inspector General for Forests</i> (IGF). This <i>marks the beginning of scientific forestry in India</i>.</p> <ul style="list-style-type: none"> <li>▪ First IGF of India = Brandis</li> <li>▪ Forest department set up = 1864</li> <li>▪ Scientific forestry started in India = in 1864</li> </ul> <p><b>DIETRICH BRANDIS</b></p> <ul style="list-style-type: none"> <li>• German</li> <li>• Also known as <i>Father of Tropical forestry</i> and <i>Father of Indian Forestry</i>.</li> <li>• Appointed as Superintendent of Forest in Pegu province, Burma, by Lord Dalhousie (Joining date 16.1.1856).</li> <li>• Inspector General for Forests (IGF) : 1st April 1864, remaining unto 1881</li> <li>• Famous books : The forest flora of North-west and Central India (1874), Forest Entomology (1882), Indian trees (1906).</li> </ul> 
1865	<p>Indian Forest Act [ Passed by Governor-general of India in council]</p> <ul style="list-style-type: none"> <li>• Define Forest ? = Any such land covered with trees, brushwood or jungle</li> <li>• Come into operation : 1<sup>st</sup> May 1865</li> </ul>

1866	<i>Changa-manga fuelwood plantation</i> was established to gather fuel and resources for the engines employed in the North-Western railway networks [Now in Punjab, Pakistan].
1867	<i>Imperial Forest Service (IFoS)</i> started.
1875	1 <sup>st</sup> copy of <i>Indian forester</i> journal issued by <i>Baden Powell</i> and <i>Dr. Schlich</i>
1878	<ul style="list-style-type: none"> <li><i>Forest school at Dehradun</i> started [ 1<sup>st</sup> Director = <i>F. Bailey</i>]</li> <li>Indian Forest Act, 1878 : 1<sup>st</sup> time classified Indian forests into – <i>Reserve Forests</i> (Chapter 2), <i>Village Forests</i> (chapter 3), and <i>Protected forest</i> (Chapter 4),</li> </ul>
1879	Elephant Preservation Act passed.
1881	Brandis retired from the service and <b>William Schlich</b> became the 2 <sup>nd</sup> Inspector General of the Forest [In some books, it is given as 1883].
1883	<i>Bombay Natural History Society</i> (BNHS) <sup>***</sup> started, <b>Mumbai</b> * [Its logo = <i>Hornbill</i> *]
1888	1 <sup>st</sup> All India Forestry Conference, Allahabad
1890	<p><i>Dr. John Augustus Voelker</i><sup>***</sup> (German) was a consulting chemist of the Royal Agricultural Society of England. At the request of the Government of India starts a study on the problems of Indian agriculture. In 1893, he presented his report "<i>Improvement of Indian Agriculture</i>" with a dedicated chapter on forests (Chapter 8, titled "Wood"), which laid down the foundation of the <i>forest policy of 1894</i>.</p> <ul style="list-style-type: none"> <li>The First Forest policy of India came in = <b>1894</b></li> </ul>
1894	<p>The first working plan for the Nilambur division (1896 – 1905) was prepared in 1894.</p> <p>[<b>First working plan of India</b> ? The man who initiated this exercise was <i>Mr. Munro</i>, the then Superintendent of Forests in Travancore, in 1837. He estimated that about 1 lakh teak trees would be required to be felled in the forest of Travancore. The <i>credit of having been the first to introduce a simple form of forest working plan in India</i> ascribed to <i>Mr. Munro</i>". It was Brandish who further improved it and made its current format]</p>
1898	<i>Vedanthangal</i> * declared as the first wildlife sanctuary in India
1906	<p>The <i>Imperial Forest Research Institute</i>, also known as the <i>Forest Research Institute</i> (FRI), was established in 1906 (Dehradun). It initially started functioning from the Imperial Forest School building and then from 1914 to 1929 from a building at Chandbagh (now known as Doon Public School). In 1929 its own commenced building was inaugurated by <i>Irwin</i> (Governor Gen of India).</p> <ul style="list-style-type: none"> <li>1<sup>st</sup> President : <i>E. Wilmont</i></li> <li>FRI became deemed university : 1991</li> </ul>



	<ul style="list-style-type: none"> <li>• Review and assess the existing policy and legal framework and their impact in a holistic manner from the ecological, scientific, economic, social and cultural viewpoints.</li> <li>• Examine the current status of forest administration and forestry institutions both at all-India and state levels to meet the emerging needs of the civil society.</li> <li>• Make recommendations indicating policy options for achieving sustainable forest and wildlife management and development, biodiversity conservation and ecological security.</li> </ul>
2003	<p>– <b>National Board of Wildlife</b> : Indian Board of Wildlife (IBWL) was <i>1<sup>st</sup> time constituted in 1952</i> as an apex advisory body headed by the Forest minister. In 2002, the Atal Ji government gave it legal back-up through the <i>Wildlife (Protection) Amendment Act 2002</i> and renamed it from the Indian Board of Wildlife (IBWL) to <i>National Board for Wildlife (NBWL)</i>.</p> <ul style="list-style-type: none"> <li>* It is a <i>Statutory Body</i>*** constituted by the Central Government under <i>Section 5 A</i>** of the <i>Wild Life (Protection) Act, 1972</i>***.</li> <li>* Chaired by the <i>Prime Minister</i>***, with 46 other members [<i>Total 47 members</i>].</li> <li>* An <i>apex body</i> for the review of all wildlife-related matters and for the approval of projects in and around national parks and sanctuaries.</li> <li>* The board is '<i>advisory in nature</i>'*** and can only advise the Government on policymaking for the conservation of wildlife.</li> <li>* The WLPA mandates that without the approval/recommendation of the NBWL, construction of tourist lodges, alteration of the boundaries of PAs, destruction or diversion of wildlife habitat, and de-notification of Tiger Reserves cannot be done</li> <li>* The National Board may, at its discretion, constitute a <i>Standing Committee</i> under sub-section (1) of Section 5B. The Standing Committee shall consist of the Vice-Chairperson (Union Minister in charge of Forests and Wildlife), the Member Secretary, and not more than ten members to be nominated by the Vice-Chairperson from amongst the members of the National Board.</li> </ul>
2005	<p><b>TIGER TASK FORCE</b> : In <b>2005</b>, After the exposure by the media on the sudden disappearance of the tigers from the <i>Sariska Wildlife Reserve</i>, The Prime Minister of India set up the Tiger Task Force to strengthen the conservation of Tigers in the country.</p> <p><b>NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)</b> was <i>established in December 2005</i> after the recommendation of the Tiger Task Force and became a <i>statutory body in 2006</i> (Under <i>Wildlife (Protection) Amendment Act 2006</i>).</p>
2006	<ul style="list-style-type: none"> <li>– National Bamboo Mission***</li> <li>– Forest Rights Act passed</li> </ul>
2008	<p>The <i>National Action Plan on Climate Change</i> (NAPCC) was released on <b>30th June 2008</b></p> <ul style="list-style-type: none"> <li>* National Solar Mission</li> <li>* National Mission for Enhanced Energy Efficiency</li> <li>* National Mission on Sustainable Habitat</li> <li>* <b>National Water Mission</b> : The plan sets a goal of a 20% improvement in water use efficiency</li> </ul>

	<p>through pricing and other measures.</p> <ul style="list-style-type: none"> <li>* National Mission for Sustaining the Himalayan Ecosystem.</li> <li>* National Mission for a "Green India"</li> <li>* National Mission for Sustainable Agriculture.</li> <li>* National Mission on Strategic Knowledge for Climate Change.</li> </ul>																								
2010	<ul style="list-style-type: none"> <li>- National Green Tribunal Act (NGT)*** passed</li> <li>- <b>NATIONAL MISSION FOR A GREEN INDIA or GREEN INDIA MISSION (GIM)</b> was launched on <b>24th February 2010</b>***. The Draft Green India Mission document was put on the website for public comments in May 2010. The year 2011-12 was declared as the preparatory year. [Green India Mission (GIM) is an unusual Mission which has a preparatory phase of one year]. GIM was finally approved by the <i>Cabinet Committee on Economic Affairs (CCEA)</i> in February 2014 with a projected cost of Rs.13,000 crores. So, in govt documents, the <i>Green India mission was launched in February 2014</i>***</li> </ul>																								
2014	<ul style="list-style-type: none"> <li>- 3<sup>rd</sup> meeting held at <i>World Congress on Agroforestry</i>, New Delhi. Organizer <b>ICRAF, Nairobi</b>, Kenya, with local govt. bodies</li> </ul> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #4a86e8; color: white;"> <th>World Congress on Agroforestry</th> <th>Year</th> <th>Place</th> <th>Remarks/Theme</th> </tr> </thead> <tbody> <tr> <td>1<sup>st</sup></td> <td>2004</td> <td>Orlando, USA</td> <td></td> </tr> <tr> <td>2<sup>nd</sup></td> <td>2009</td> <td>Nairobi, Kenya</td> <td>-</td> </tr> <tr> <td>3<sup>rd</sup></td> <td>2014</td> <td>New Delhi</td> <td>10-14 February 2014</td> </tr> <tr> <td>4<sup>th</sup></td> <td>2019</td> <td>Montpellier, France</td> <td></td> </tr> <tr> <td>5<sup>th</sup></td> <td>2022</td> <td>Québec, Canada</td> <td>Transitioning to a Viable World</td> </tr> </tbody> </table>	World Congress on Agroforestry	Year	Place	Remarks/Theme	1 <sup>st</sup>	2004	Orlando, USA		2 <sup>nd</sup>	2009	Nairobi, Kenya	-	3 <sup>rd</sup>	2014	New Delhi	10-14 February 2014	4 <sup>th</sup>	2019	Montpellier, France		5 <sup>th</sup>	2022	Québec, Canada	Transitioning to a Viable World
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2016	<ul style="list-style-type: none"> <li>- CAMPA Notification</li> </ul>																								
2017	<ul style="list-style-type: none"> <li>- By <i>Indian Forest (Amendment) Act 2017</i>, the word "<i>Bamboo</i>" has been omitted from the "Tree" list of Indian Forest Act 1927 [Remember Palms, Stums, Brush-wood, and Canes (Ratan) still under this "Tree" list].</li> <li>Come into force : 23<sup>rd</sup> November 2017 (<i>Ordinance</i>)   Notify : 5<sup>th</sup> January 2018</li> </ul>																								
2022	<ul style="list-style-type: none"> <li>- Forest (Conservation) Rules, 2022</li> <li>- Wildlife (Protection) Amendment Act 2022</li> </ul>																								
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### 1.3 MoEFCC & ITS SUBORDINATE BODIES

► About Ministry

- Earlier, a department under the Ministry of Agriculture
- 2/3 December 1984 = Bhopal gas leak case = *Methyl isocyanate* (MIC)
- 1985 : The Ministry of Environment and Forestry was created.



- Sub-ordinated bodies – BSI, ZSI, NGT, FSI, ICFRE, IGNFA, National Zoological Park (Delhi), National Museum of Natural History, etc.

## ▶ BOTANICAL SURVEY OF INDIA

- HQ : Kolkata
- Established in : 1890 under the direction of Sir **George King**.
- LOGO : Banyan tree (*Ficus benghalensis*)
- Works : Phyto-diversity, Ethnobotany, Ex-situ conservation, **National database of Indian plants** including herbarium.
- The nodal agency for – *IUCN - Red data book*.
- Gardens : AJC Bose Indian Botanical garden, Howrah  
The botanical garden of Indian republic, Noida

Deccan Regional Centre  
**Hyderabad**, Telangana  
Western Regional Centre, **Pune**

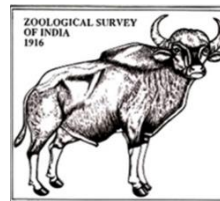


भारतीय वनस्पति सर्वेक्षण  
BOTANICAL SURVEY OF INDIA

World's Largest and Most Famous botanical Garden –  
*Royal Botanical Garden, Kew, England*

## ▶ ZOOLOGICAL SURVEY OF INDIA

- HQ : Kolkata
- 1916 (during WWI, and not in 1890) -
- LOGO : Indian Bison (*Bos gaurus*)
- ~~16~~ regional centres.
- Works : survey and monitoring of *Faunal Diversity*. Status of



- **Estuarine Biology** Regional Centre, **GOPALPUR**, Orissa
- **Freshwater Biology** Regional Centre, **Hyderabad**
- **Central Zone** Regional Centre, **Jabalpur**

Threatened and Endemic species + Bio-ecological studies. *Red Data Book*, Fauna of India, Fauna of States and Status of Coral Resources of India.

## ▶ NATIONAL GREEN TRIBUNAL

- In 1995, the Central Government established the *National Environment Tribunal* (under the National Environment Tribunal Act 1995) and
- *National Environment Appellate Authority* (under National Environment Appellate Authority Act 1997).
- *National Green Tribunal* (NGT) : a *quasi-judicial body*, established in 2010 through *National Green Tribunal Act, 2010* under MoEFCC  
Main Office : New Delhi | Regional benches - **Bhopal**, Pune, Kolkata, and Chennai.
- Cases relating with environmental protection and conservation of forests and other natural resources, including enforcement of any legal right relating to the environment and giving relief and compensation for damages to persons and property
- *Guided by principles of natural justice*

▶ Indian Institute of Forest Management (IIFM), Bhopal (1982).

▶ Wildlife Crime Control Bureau (WCCB), New Delhi : in 2006, by Amendment in Wildlife Protection Act in 2006.

▶ National Museum of Natural History : New Delhi - in 1972, on the occasion of the 25th anniversary of India's Independence, decided that the country needed a Museum of Natural History to depict its flora,

fauna, and mineral wealth to provide an out of school facility for the education of children and to promote environmental awareness among the masses. Udghatan – 1978.

## 1.4 FORESTRY EDUCATION SYSTEM

### Background

- In 1878, the Establishment of a *forest school in Dehradun*. Which was later renamed *Imperial Forest School* in 1884.
- *Imperial Forest Research Institute* was established in 1906.
- *Directorate of forest education* (1953) : ACF/RFO training
- **1985** : MoEF established.
- **1986** : Indian Council of Forest Research and Education (ICFRE), Dehradun, established. Become Autonomous in 1991\*\*\*
- **1987** : Indira Gandhi National Forest Academy (IGNFA) Dehradun, established.



### Sub-ordinated institutes of ICFRE

- FRI, Dehradun (1906)
- *Tropical* FRI, **Jabalpur** (1988)
- *Arid* FRI, Jodhpur
- *Rain* FRI, Jorhat
- Institute of *forest genetics and tree breeding*, Coimbatore
- Institute of *wood science & tech*, Bengaluru
- *Himalayan* FRI, Shimla
- Institute of *forest productivity*, Ranchi, **Jharkhand**.
- Institute of forest *biodiversity*, **Hyderabad**

### Forest research centers

- ICFRE - Coastal Ecosystem Centre **Visakhapatnam**

### Other Important Institutes under ICAR, CSIR, ISRO and other govt ministries

- The *Indian Institute of Natural Resins and Gums*, formerly known as the *Indian Lac Research Institute*, is an autonomous institute established under the umbrella of the *Indian Council of Agricultural Research* (ICAR) by the Ministry of Agriculture, Government of India, for advanced research on lac and other natural resins and gums. The Institute is located at **Namkum, Ranchi in Jharkhand**, India.
- *Central Sericultural Research & Training Institute* (CSRTI), Mysuru
- *The Centre for Environment Education* (CEE), is a national institute established in 1984 at Ahmedabad
- National Research Centre for Agroforestry (NRCAF) was established in the year **1988\*\*\*** at **Jhansi\*\*\***. In December 2014, NRCAF was upgraded to ICAR - *Central Agroforestry Research Institute* (ICAR-CAFRI). All India Coordinated Research Project on Agroforestry (AICRPAF) was initiated in **1983\*\*\*** | HQ – Jhansi\*\*\*

- The *Indian Grassland and Fodder Research Institute* (IGFRI), established in **1962**\*\*\*, at **Jhansi**\*\*\* (UP) under the ICAR framework. It fosters research, training, and extension programs on all aspects of forage production and utilization
- *Animal Welfare Board of India*, Chennai (1962) – Under section 4 of Prevention of Cruelty to the Animals Act, 1960.
- *G. B. Pant Institute of Himalayan Environment & Development*, Almora (UK)
- National Environmental Engineering Research Institute (NEERI), Nagpur
- National Zoological Park (Delhi zoo) : New Delhi
- National Bureau of Plant Genetic Resources (NBPGR), Pusa, New Delhi
- *Salim Ali Centre for Ornithology and Natural History* (SACON), Coimbatore

## 1.5 FOREST SURVEY OF INDIA

### About it

- In 1965, a center, *Pre-investment Survey of Forest Resources* (PISFR), was established under a joint project of FAO with Gol & UNDP. Later on the recommendation of the National Commission on Agriculture (NCA) 1976 report, this centre became the *Forest Survey of India* in **1981**
- HQ : Dehradun\*\*\*
- Report : *Indian state of Forest report*, Biennial report, **1<sup>st</sup> time published in 1987**. Currently, the 17<sup>th</sup> report published in 2022.
- Sensor : **IRS-Resourcesat 2 – LISS III\*** [Resolution – **23.5 m\***, Scale – **1:50,000\***,
- Minimum mappable area = 1 Hec.



### INDIAN STATE OF FOREST REPORT 2021

- ▶ **FOREST AREA** : all such lands which have been notified as forest under any Government Act or Rules or recorded as 'forest' in the Government records. The recorded forest area may or may not have forest cover.

Forest area : Area-wise

**MP > MH > Orissa > CG >>>> Punjab > Haryana > Goa**

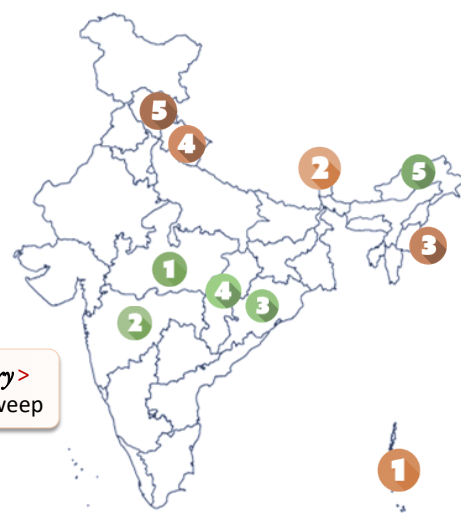
Highest

Lowest

Forest area : Percentage-wise

**A&N > Sikkim > Manipur > UK >>>> Punjab > Puducherry > Lakshadweep**

(87%) (82%) (78%) (71%) (6%) (2.6%) (0%)



- Total = **77.5 m hectares**\*\*\* (**23.58%**\*\*\* of Geographical area),

**CHHATISHGARH**

- Recorded forest area = **59,816<sup>\*\*\*</sup>** sq. km [**5.9 million** hectares] which is **44.25 %** of the state's geographical area.
- of which, *Reserve* forest (43%) > *Protected* forest (40%) > *Unclassed* forest (16%).

► **FOREST COVER** : all tree patches with a canopy density of more than 10% and an area of 1 ha or more in size, irrespective of their legal status, use, and species composition.

\* Total = **71.3 m hectares<sup>\*\*\*\*</sup>** (**21.71 %<sup>\*\*\*\*</sup>** of Geographical area)

\* Forest cover classification based on canopy density -

SN	Forest type	Canopy density	Area (in m hac.)	% of total cover
1.	Very dense forest	All lands with tree canopy density of 70 % and above.	9.9	<b>3 %</b>
2.	Moderately dense forest	All lands with tree canopy have a density b/w 40 to 70 % (up to 69.9%).	30.6	<b>9.33 %</b>
3.	Open forest	All lands with tree canopy density of 10 percent and more but less than 40 %.	30.7	<b>9.34 %</b>
<b>Total forest cover</b>			<b>71.3</b>	<b>21.71 %*</b>
	Scrubland	Below 10 %		1.4 %
	Non-Forest	Lands are not included in any of the above classes (Including water)		76.87 %

**STATE-WISE FOREST COVER**

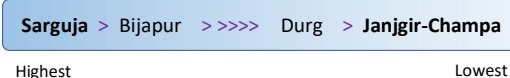
% Based	Area Based
<b>1<sup>st</sup> : Lakshadweep*</b> (90 %)	<b>1<sup>st</sup> : MP<sup>***</sup></b> (7.7 m hac.)
<b>2<sup>nd</sup> : Mizoram**</b> (84.5 %)	<b>2<sup>nd</sup> : Arunachal<sup>***</sup></b> (6.6 m hac.)
<b>3<sup>rd</sup> : A &amp; N</b> (81.7 %)	<b>3<sup>rd</sup> : CG (5.5 m hac.)</b>
4 <sup>th</sup> : Arunachal (79 %)	4 <sup>th</sup> : Odisha (5.1 m hac.)
5 <sup>th</sup> : Meghalaya (76 %)	5 <sup>th</sup> : MH (5 m hac.)

**GREEN WASH AREA ?**  
 In the *Survey of India* (SOI) *topographic sheets*, the forest areas are showed by green colour, which is commonly known as green wash area.

**FOREST COVER IN CHHATISHGARH = 55,716 km<sup>2</sup> [ 41.21 % of state GA].**

- Forest cover (District wise)

Area-wise



Percentage-wise



► Total geographical area of India : **328.7 m hac<sup>\*\*\*</sup>**

India	Forest area	Forest Cover
1950	40 m hac. ( <b>21.8 %<sup>***</sup></b> of GA)	82.5 m hac. ( <b>25.8 %</b> of GA)
2021	<b>77.5 m hac.</b> (23.58 % of GA)	<b>71.3 m hac.</b> (21.71 % of GA)

► **TREE COVER** : Tree cover is defined as *all tree patches (including scattered trees) of size less than 1 hec. occurring outside the recorded forest area.*

- **Trees Outside Forest (TOF)** refers to all trees growing outside of the reserve forest area, irrespective of patch size, which could also be larger than 1 ha.
- Total tree cover = **9.5 m hac. (2.91 % of GA).**
- Forest cover + TOF = 71.3 m hac + 9.5 m hac = **24.62 % of GA\*\*\***
- Most prevalent species in TOF : 1<sup>st</sup> *Mangifera indica*, 2<sup>nd</sup> *Azadirachta indica*.
- State wise : **MH** > Rajasthan > MP

**Table 13.5.2 Forest Cover of Chhattisgarh** (in sq km)

Class	Area	% of GA
VDF	7,068.21	5.23
MDF	32,278.59	23.87
OF	16,369.80	12.11
<b>Total</b>	<b>55,716.60</b>	<b>41.21</b>
Scrub	615.26	0.45

► **FOREST FIRE MONITORING** : The Ministry of Environment, Forest and Climate Change (MoEF&CC), has come up with the *National Action Plan on Forest Fires in 2018*. One of the main objectives of the action plan is to *reduce the incidences of fires by informing, enabling, and empowering forest fringe communities*, and MoEFCC makes the Forest Survey of India (FSI) its nodal agency.

- In 2019, FSI released an updated version of the *Forest Fire Alarm System (FAST) 3.0* with complete automation of the processes.
- Sensor used : **MODIS (Moderate Resolution Imaging Spectro-radiometer)** Sensor on-board aqua and terra satellite of NASA.

► **GROWING STOCK (GS)**

- **GS (Total) = 6167 mm<sup>3</sup>** [ GS of Forest = 4388 mm<sup>3</sup> + GS of TOF = 1780 mm<sup>3</sup>].
- GS per hectare basis : Forest = **56.6 m<sup>3</sup>/hec\*\*\*** | TOF = **8.4 m<sup>3</sup>/hec**
- Most prevalent species in the forest (That makes the highest growing stock too) :
- Growing Stock of top 10 species in Forest & TOF  
 Forest : *Shorea robusta* (10.8 % of total forest GS), *Tectona grandis* (4.3%), *Pinus roxburghii* (4.1%)  
 TOF : *Mangifera indica* (13% of total TOF GS), *Azadirachta indica* (6.8%), *Madhuca latifolia* (4.6 %), *Cocus nucifera* (4.5 %)

► **CARBON STOCK** : Total : **7.2 Billion tonnes\*\*\***.

Component	Carbon stock in Forest in 2021	% of total	Carbon stock in Forest in 2021	Annual changes in carbon stock
Above Ground Biomass	2320	32.2 %	2256	31.7
Below ground Biomass	≈ 719	10 %	700	9.1
Dead wood	47.7	0.66 %	35.8	6
Litter	107.3	1.5 %	128	-10.3
Soil organic carbon %	4010	55.6 %	4003	3.3
<b>Total</b>	<b>7204***</b>	<b>100 %</b>	<b>7124</b>	<b>39.7</b>

(In million tonnes)

- State wise : Arunachal (1 Billion tonnes) > MP (0.6 B tonnes) > CG (0.49 B tonnes).
- An important indicator of ecosystem services from forests.

**2.1 BACKGROUND**

- Carved out from Madhya Pradesh : **1<sup>st</sup> November 2000**
- Dr. **R.C. Sharma**, IFS, was appointed as the first Principal Chief Conservator of Forests (PCCF).

**▶ STATE SYMBOLS**

Symbol	English Name	Scientific name	Family
State Tree	Sal	<i>Shorea robusta</i>	Dipterocarpaceae
State animal	Wild Buffalo (Van Bhainsa)	<i>Bubalus arnee</i>	Bovidae
State Bird	Bastar hill mynah	<i>Gracula religiosa peninsularis</i>	
State Flower	Karachia karantha (Foxtail orchid)	<i>Rhynchosstylis gigantea</i>	

The emblem is a circular seal depicting the *Lion Capital of Ashoka* encircled by *Ears of Rice*. The Lion Capital of Ashoka is a symbol of India's rich heritage and strength. The ears of rice represent the importance of agriculture in the state's economy.

Below the capital are *three wavy lines in the colours of the Indian national flag* (saffron, white and green), which represent the three major rivers of the state - the *Mahanadi*, the *Sheonath*, and the *Kanhar*.

The emblem is flanked by *two lightning bolts* which represent Chhattisgarh's status as an Energy Surplus State. The whole emblem is surrounded by *36 fortifications* representing the 36 fortresses after which the state is named ("Chhattisgarh" literally translates to "36 Garhs")

**2.2 FOREST DEPARTMENT**

**Territorial Circles = 6** : Durg, Jagdalpur, Bilaspur, Kanker, Sarguja, and Raipur Circle.

*Chapter Outline*

- 2.1 Background
- 2.2 Forest Department
- 2.4 Forest Resources





# CLIMATIC FACTORS

Climate is the average weather prevalent in any locality that influences our forest vegetation, *i.e.*, light, atmospheric temperature, pressure & humidity, wind, etc.

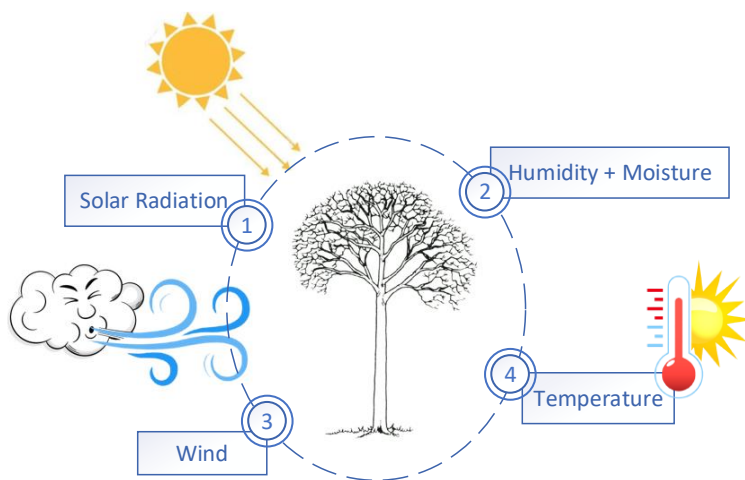


Figure 5.1 : Climatic factors

## 5.1 SOLAR RADIATION

Solar radiation is the primary source of energy for photosynthesis. Factors such as quality, intensity, and duration of light affect the vegetation or indirectly the entire forest ecosystem.

### Related Terminology

- **Solar constant** – Energy falling in one minute on a surface area of 1 cm<sup>2</sup> at the outer boundary of the atmosphere. Value = *2 Cal/cm<sup>2</sup>/minute*
- **Photosynthetic active radiation (PAR)** : the portion of the light spectrum utilized by plants for photosynthesis, *400 nm to 700 nm*.
- **Radiation's interaction with the atmosphere** : (a) Absorption, (b) Reflection, (c) Scattering, etc.
- **Insolation** – the solar energy flow per unit area at the Earth's surface is called insolation

## Chapter Outline

### 5.1 Solar radiation

- ✿ Related terminology
- ✿ Importance
- ✿ Species behaviour toward light

### 5.2 Temperature

- ✿ Temperature zones
- ✿ Importance of Temperature
- ✿ Effects of temperature
- ✿ Types of Frost; Frost resistance & Species behaviour
- ✿ Snow, its beneficial & harmful effects

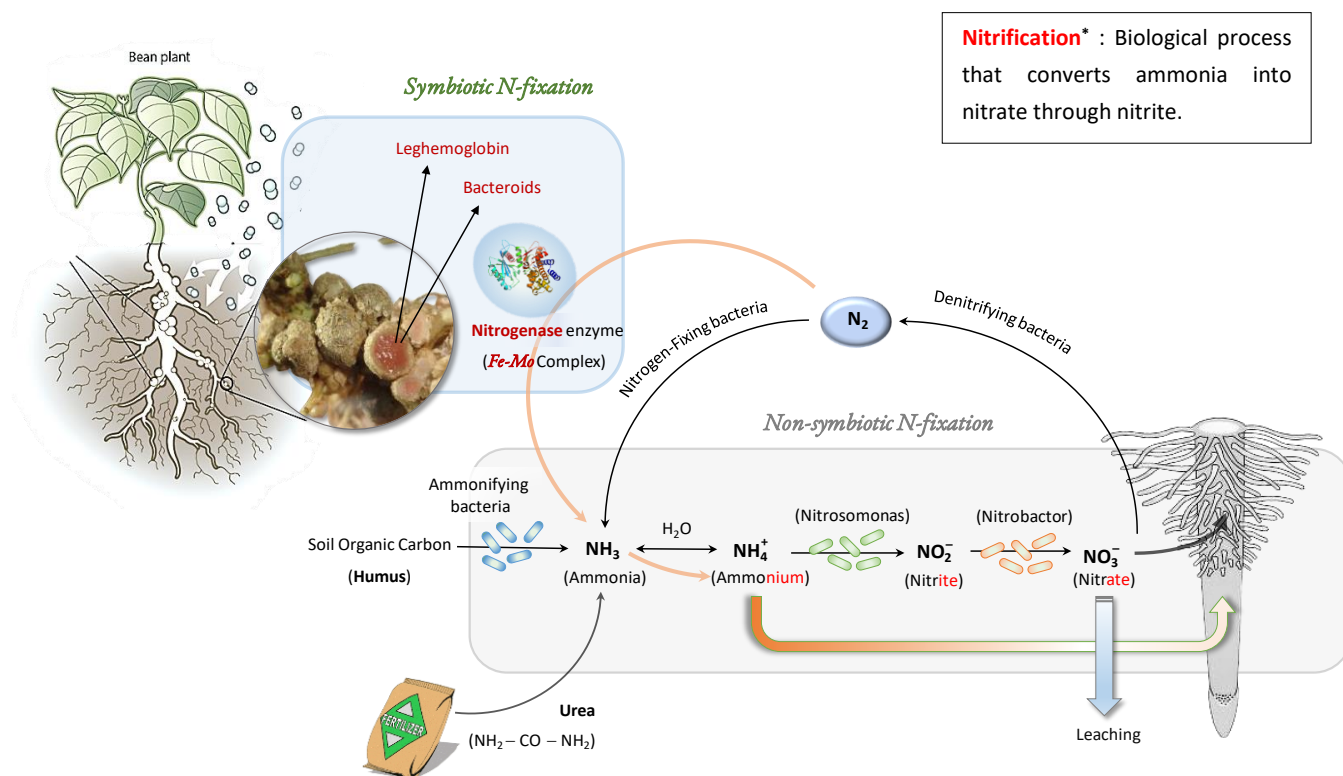
### 5.3 Wind

- ✿ Beneficial & harmful effects

### 5.4 Moisture

- ✿ Types of precipitation
- ✿ Source of Moisture
- ✿ Importance of water
- ✿ Water-logging / Flood
- ✿ Drought
- ✿ Water tapper, Saver and Storer plants

### 5.5 Add-on



**Nitrification\*** : Biological process that converts ammonia into nitrate through nitrite.

Figure 6.8 : Development of root nodules in sweet pea plant.

Some free-living bacteria like *Azotobacter*, *Azospirillum*, and Blue-green algae (BGA) also fix atmospheric nitrogen. Still, they freely move into the air (free-living) and are not associated with any particular plant species.

## 6.4 SOIL NUTRIENTS

The plant body contains about 30+ elements. However, all is not essential for the proper functioning of the plant's metabolic reactions, and their absence causes deficiency symptoms/diseases. A Plant requires **17\* elements** for its basic functioning, so-called *essential elements* or *essential Nutrients*

**CRITERIA OF ESSENTIALITY** : Proposed by *Arnon* (1954).

- The deficiency of the element makes it impossible for the plants to complete their life cycle's vegetative or reproductive stage.
- The deficiency is specific to the element in question and can be prevented or corrected only by supplying that particular nutrient element to the plant.
- The elements must directly influence the plant and be directly involved in the nutrition and metabolism of the plant.

In **Arnon's** time, they considered only 16 elements as essential. Presently 'Ni' (Nickel) is also considered essential. Hence total essential nutrients are **17**.

Out of these **17 Essential elements** : **C, H, O, N, P, K, Ca, Mg, and S** are called **Macro-elements** or **Macro-Nutrients**, and they generally present in plant tissues in large amounts (over 10 million moles per Kg of dry

**Critical Concentration** : concentration of vital nutrients and elements below which the growth of the plant gets hindered.

# TREE'S STRUCTURE & GROWTH FORMS

## 10.1 WHAT IS A TREE ?

Trees are woody plants having one erect *perennial stem or trunk* at least three inches (7.5 cm) in diameter at breast height, a more or less *defined formed crown* of foliage, and a *height of at least 12 ft* (4 m).

As in the above definition, our concept of a tree is highly angiosperm-centric in which a tree has only one trunk, but we will see that this is not necessarily a constant feature. This definition is used by those foresters for whom a tree is considered mainly as the source of merchandisable timber

### FORMS OF TREE CROWN

A crown is an upper branchy part of a tree above the bole. It is the result of branching behaviour in the bole. In some trees, *i.e.*, *Phoenix*, *Cocos*, *Borassas*, etc., there is no branching behaviour in the stem and the crown is formed by larger leaves which come out from the top of the unbranched stems. In other trees crown may be – (a) **Conical** as in the case of Pines, and Deodar, (b) **Cylindrical** as in silver fir, Eucalyptus, Ashoka, etc. (c) **Spherical** in mango, neem, Imli, Mahua, etc., (d) **Broad & Flat topped** in *Acacia planifrons*, (e) **Broom shape** as in *Acacia nilotica* (Babool), and (f) **Frondose crown** as in *Prosopis juliflora*.

*Phoenix, Coconut, Borassus*



Unbranched stem of Coconut



Conical shape

*Abies pindrow* (Silver Fir),  
Eucalyptus, Ashoka



Cylindrical shape

*Mango, Neem, Imli, Mahua, etc.*



Spherical shape

## Chapter Outline

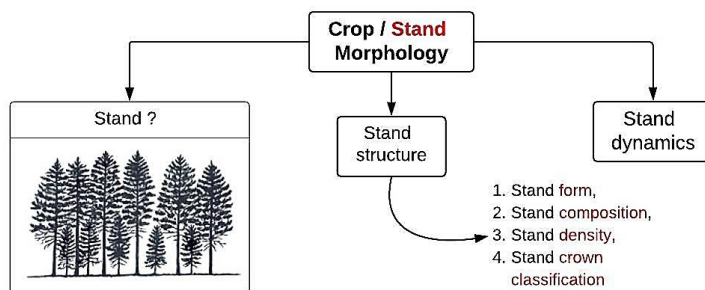
- 10.1 What is a tree?
- 10.2 Basic terminology
- 10.3 Tree's growth phases
- 10.4 Tree's growth stages
- 10.5 Reproduction



# TREE'S STRUCTURE & GROWTH FORMS

*Morphology* means the science of form, especially studying the outer form (structure), inner structure, and development of their parts.

*Crop morphology* means the study of the outer form of forest crops and their development.



## 11.1 STAND ?

The **stand** concept has long been central to the practice of Silviculture and has traditionally been defined as *a group of trees that are relatively homogenous in composition, age-class distribution, and structure growing on a site of uniform quality*. Stands, as defined in this context, have served as the primary unit of forest management around the globe with the stand-by-stand application of silvicultural treatments for achieving a sustainable yield of produce.

### Stand v/s Forest

A forest is a collection of stands. Remember that a stand is a unit of silvicultural interest. Forester's practice silvicultural operations on stands, but not on forests. It is not an ecological management unit.

## 11.2 STAND STRUCTURE

Stand Structure refers to the *overall look* of a forest stand. It is the *horizontal and vertical distribution of components* of a stand, including the height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags and down woody debris. Based on

## Chapter Outline

### 11.1 Stand?

### 11.2 Stand structure

✿ Stand Forms

✿ Stand composition

### 11.3 Stand density

### 11.4 Stand Crown classification

# FOREST SUCCESSION

Succession is the process of replacing one set of biotic communities by another set of more advanced and different nature biotic community.

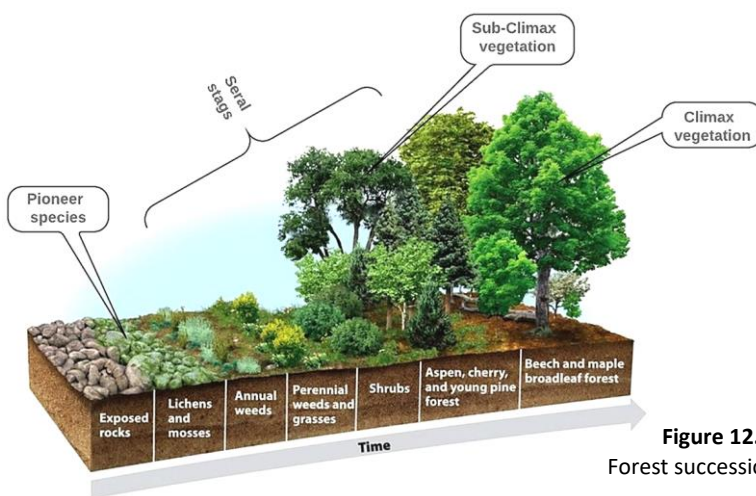


Figure 12.1 : Forest succession.

The 1<sup>st</sup> species that encroach and start to grow (established themselves) in a new area is called = the *Colonizer* or *Pioneer* species. *Sere* or *Seral Stages* (sometimes used term *Consolidation Phase* in a loose sense) are the intermediate stages during which plant communities grow and improve soil conditions and gradually change themselves into another more progressive community.

- And the last, *Climax Stage* - A mature, final and stable community that maintains itself for an extended period in equilibrium with that particular environmental condition.
- The development and movement of vegetation from one stage to another stage (*i.e.*, grassland to tree land) are called = *succession*.

## 12.1 PROCESS OF SUCCESSION

- **Nudation\*** : the process of development of a bare area (barren land), it may be due to erosion (Soil/water), Volcanic eruption, forest fire, erosion, and deposition etc.
- **Invasion\*** or **Migration** : migration of seeds & spores of

## Chapter Outline

### 12.1 Process of Succession

### 12.2 Types of Succession

### 12.3 Causes of Succession

### 12.4 Examples of various types of Succession

- ✿ Mt. Temperate forest
- ✿ Riverain forest
- ✿ Estuarine succession
- ✿ Sand dunes

### 12.5 Theories

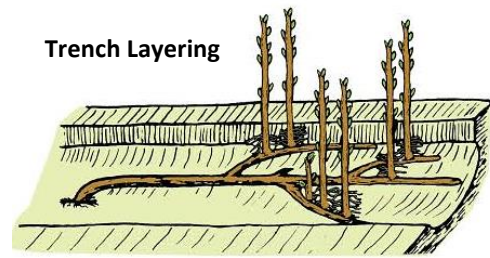
- ✿ Mono-climax theory
- ✿ Poly-climax theory
- ✿ Climax pattern hypothesis
- ✿ Information theory
- ✿ Mosaic theory

✿ Succession term was given by "*Hault*".

✿ With every stage in succession complexity and diversity increase.

✿ When COLONIZER starts growing on barren land where there no residue of previous Organic matter is called *Primary Succession* . If it starts growing on previously availed Organic Matter, called – *Secondary Succession*).

- **Mound (Stool) layering** : Shoots are cut back to the ground, and soil or rooting substrate (sawdust) is mounded around them to stimulate roots to develop at their bases.
- **Trench layering** : The initial stem used to establish the layering system is laid horizontally in a trench. Shoots develop from nodes along the stem that are then covered with the mounded rooting substrate (sawdust) similar to mound layering.

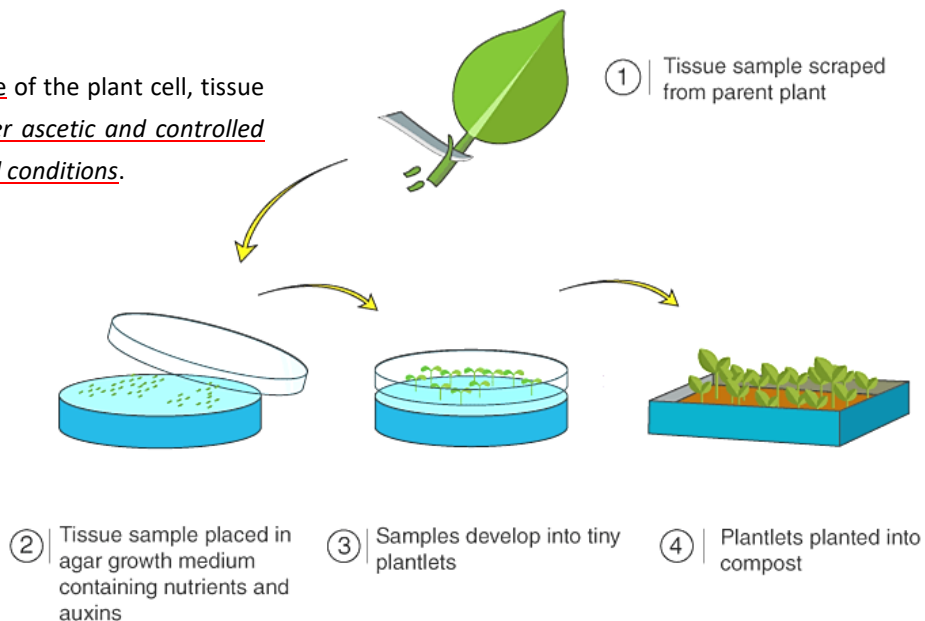


## HORMONE STIMULANT TO ROOTING

Several hormone stimulants, *i.e.*, indole acetic acid (IAA), indole butyric acid (IBA), naphthalene acetic acids (NAA) and their salts, etc., have been used in several tree species to induce rooting. Auxins have been used to induce rooting in Eucalyptus, Dendrocalamus, etc., and under controlled conditions of temperature and humidity in mist chambers.

### 19.3 MICRO-VEGETATIVE PROPAGATION (Tissue Culture)

In vitro culture of the plant cell, tissue or organ under aseptically and controlled environmental conditions.



### 19.4 GREEN HOUSE / GLASS HOUSE

A special structure designed to regulate temperature (Prime motive), and humidity under a closed environment.

- There are two basic greenhouse concepts. The first one (typical of Northern Europe) aims at achieving maximum climate control to maximize productivity, requiring the use of sophisticated greenhouses. The second concept pursues minimum climate control using low-technology greenhouses, making production possible under modified, but non-optimal, conditions at a low cost, and it is typical of Mediterranean-type greenhouses.
- **Eden project** (England) : world largest green house
- First modern greenhouse design : Charles Bonaparte (French)



# IMPORTANT INDIAN TREE SPECIES

## 25.1 ACACIA NILOTICA (BABOOL)

- *Syn. Acacia arabica*\*\*\* = Gum arabic\*\*\*
- **Family** : *Mimosaceae*\*\*\* (Leguminosae).
- **Distribution** : A tree of *Semi-arid region*\*\*\*. Hardy to handle damages created by cracking in *black cotton soil*\*\*\*, drought, and moderate frost, so, widely distributed over the north Indian plains, Rajasthan, MP, MH, etc.
- **Fruit** : *Lomentum*\*\*\* type
- **Phenology** : medium-size *deciduous* tree with brood shape crown
  - Leaf fall : April – May
  - Leaf renewal : May - June
  - Flowering : January to March
  - Fruiting : ripen from April to June
  - *Thorny branches.*



**Phenology**\*\*\* is the seasonal changes in the plant behaviors over a year; it is the study of when plants start flowering, fruiting, leaves shedding, etc.

- **SILVICULTURAL CHARACTERISTICS**
  - Drought hardy.
  - Frost resistant
  - Light demanded
  - Good copper
  - Root suckers
- **UTILIZATION** : **Gum**\*\*\* (Ladoo making), leaves **Fodder**, **Fuelwood**\*\*\*, and **Timber** for farm implements. *Tannins from Bark and Pods*\*\*\*.

## 25.2 AZADIRACHTA INDICA (NEEM)

- **Family** : *Meliaceae*\*\*\* [Non-Leguminous = Rhizobium x = **Nitrogen Fixation** x]\*\*\*
- **Distribution** : Neem generally grows in tropical dry deciduous and thorn forests in drier parts up to 1500 m.
- **Phenology** : Neem is a medium size (12 – 15 m) with a broad rounded crown.
  - It is an almost evergreen tree but becomes near leafless in dry localities for a short period during February – march [*Deciduous Tree*\*\*\*]





35

Aman Patidar



37

Devesh Trivedi



38

Arvind Singh Thakur



40

Sachin Bhondele



41

Jaikishan Sharma



42

Gaurav Trivedi



43

Durgesh Jee Pandey



44

Sourabh Kumar Chourasiya



46

Anita Surwayamshi



47

Rohit Sharma



48

Pooja Baghel



51

Ravikant Srivaiya



53

Pushparaj Singh Sikarwar



54

Shubham Kulhade



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Ashish Singh Sikarwar



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Anupam Mishra



59

Amar Singh Bhadoriya



60

Somesh Sharma



62

Keshav Meena



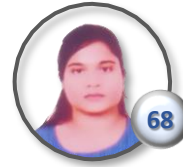
64

Sunil Singh Jadon



67

Atul Kumar Patel



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Meenakshi Suryawanshi



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Neeraj Amb



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Rohit Nagar



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Salil Tamarkar



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Deepak Bhadrassen



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Kashiram Ahirwar



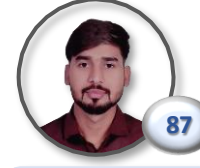
83

Jitendra Pandole



84

Abhijeet Sankla



87

Dharmendra Maida



90

Sachin Dodwe

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