PRACTICAL MANUAL

ON

Principles of Agroforestry

FSA 201 3(2+1)

For B.Sc. Forestry III Semester students

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2018

RANI LAKSHMI BAI CENTRAL AGRICULTURAL UNIVERSITY, JHANSI

Principles of Agroforestry FSA 201 3(2+1)

Practical: Visit to social / Urban / Community forestry plantations and study their impact on socio – economic status of rural people- Traditional agroforestry systems in the country and visits to some of the local agroforestry systems. Agroforestry systems in different agroecological zones- their structural and functional features. Visit to on farm agroforestry models. Studies on fodder banks and live fences. Studies on light and below ground interactions in agroforestry systems- MPTs and Nitrogen fixing trees in agroforestry- Studies on allelopathy- Design & Diagnostics exercise in agroforestry- Land capability classification of various topographic regions- Visit to industrial plantations

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Objective: Visit to Social forestry plantations area

- Word social forestry was coined by **Jack Westoby** and used in the ninth commonwealth forestry congress in **1968**.
- "Forestry outside the conventional forests, which primarily aims at providing continuous flow of goods and services for the benefit of peoples" (Prasad, 1968).
- Social forestry aims at growing forests of the choice of the local population.

Aim: The aim of social forestry adopted by the NCA (1976) were based on the economic needs of the community aimed at improving the conditions of living. The main aims are:

- Fuel wood supply to the rural area and replacement of cow dung
- Small timber supply
- Fodder supply
- Protection of the agricultural fields against wind and recreational needs.

Components:

- Farm forestry
- Extension forestry: Mixed Forestry, Shelterbelts, Linear Strip Plantations
- Rehabilitation of degraded forests
- Recreation forestry.

Benefits:

- Increase the supply of fuel wood and fodder
- Generate rural employment
- Maintain ecological balance
- Appropriate use of wastelands
- Promote village and cottage industries
- Induce environmental and tree consciousness among people
- Relieve pressures from natural forests
- Stabilize agricultural production

Criteria for choice of species:

- Trees suitable for road side planting should be hardy, evergreen or winter deciduous, wind firm, fast growing at least in the early stages and fairly tall.
- Species should be suited to climatic, edaphic, physiographic and biotic factors.
- Tree for farm forestry should have long tap roots, attenuated and winter deciduous crown so that they may not affect the productivity of the agricultural crop.
- Tree should have attractive crowns and shrubs should be amenable to pruning into attractive crown shapes.
- They should not have prominent thorns and their planting and caring should be easier and economical.

Field Exercise:

1. **Name of the visiting sites:**
   …………………………………………………………………………

2. **Date of visit:** ………………………………… **Day:** …………………………………………………

3. **Locality:**
   ……………………………………………………………………………………………………

4. **Area (m²):**
   ……………………………………………………………………………………………......

5. **Geographical location:** ………………………………………………………………………………

6. **Altitude:** ……………………………………………………………………………………..

7. **Slope:** ……………………………………………………………………………………..

8. **Presence of multipurpose tree species in social forestry plantation area**

S. No.	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

9. **Achievements of plantation area to socieo-economic status of local people:** …………………….
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10. **Important schemes being implemented for social forestry:** ………………………………………
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11. **Conclusion:** …………………………………………………………………………………………
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Exercise-2

Objective: Visit to Industrial forestry plantations area

It is the specific land use system where in the industrial utility tree species are planted in an agro-forestry system which include both agro and farm forestry.

Aim:

- To meet the requirement of timber, pulp and paper industries
- Raw material supplies of plywood and vencer, match splints, boxes, pencil, packing and dendro-powder industries.
- To ensure the requirement of huge volume of wood to the bio-fuel and construction industries.

Policy directions:

National forest policy, 1988: Directed all the wood based industrial in the country to generate their own raw material needs without depending on the forest depart supply. It also facilitating quality seedling supply technological support, credit and insurance facility and promote agro-forestry plantations.

The national agro-forestry policy, 2014: Intensified the promotion of industrial agro-forestry plantations. It directed the government to liberalize the timber transit rules and attract farmers towards agro-forestry. It also directed to extend credit and insurance facilities to agro-forestry plantations besides establishing necessary market mechanism.

Field Exercise:

1. **Name of the visiting industrial sites:** ....
2. **Date of visit:** ....
3. **Locality:** ....
4. **Area   (m^2):**
   ....
5. **Presence of prioritized tree species to the specific industrial plantation sites:**

S. No.	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

11.						
12.						
13.						
14.						
15.						

6. Achievements of industrial plantation area to socieo-economic status of local people: ………

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7. Major Wood based industries and prioritized species:

| **Major industry** | **Species promoted and deployed** |

Timber and construction industry …………………………………………………………………………..

…………………………………………………………………………..

Paper and pulp …………………………………………………………………………..

…………………………………………………………………………..

Plywood …………………………………………………………………………..

…………………………………………………………………………..

Match wood …………………………………………………………………………..

…………………………………………………………………………..

Dendro biomass …………………………………………………………………………..

…………………………………………………………………………..

Bio-fuel …………………………………………………………………………..

…………………………………………………………………………..

Others …………………………………………………………………………..

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8. List of successful industrial plantations: ………………………………………………………….

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9. Important schemes being implemented for industrial forestry:

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10. Conclusion:

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Exercise-3

Objective: Visit to Community forestry plantations area

- Community forestry is defined as raising of trees on public or community land rather than on privately owned lands as in case of farm forestry.
- The common feature of this programme is to provide benefits or services to the community as a whole. This is also known as rural forestry.

Planning of community Forestry:

- Selection and preparation of planting site
- Selection of tree species

Field Exercise:

1. **Name of the visiting sites:** …………………………………………………………………
2. **Date of visit:** …………………………………………………………………………………..
3. **Locality:** ……………………………………………………………………………………….
4. **Area** (m^2)**:**
   …………………………………………………………………………………………

5. **Presence of tree species in community forestry area:**

S. No.	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
17.							
18.							
19.							
20.							
21.							
22.							
23.							
24.							
25.							
26.							
27.							
28.							

29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						

1. **Achievements of community forestry plantation area to socieo-economic status of local people:**

   …………………………………………………………………………………………….

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   ………………………………………………………………………………………………………

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2. **Important schemes being implemented for community forestry:** ………………………………..

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3. **Conclusion:**

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Objective: Visit to Urban forestry plantations area

It is the practice of growing trees on non-forest land in urban areas for recreational purposes and aesthetic value.

Establishment and maintenance of urban forest: In urban areas, trees are planted or maintained for many purposes and different situations. Establishment of urban forest involves consideration on planting site, tree species, size of planting stock, maintenance etc.

Planting site: Several types of planting sites are unique to urban areas including street lawn, tree pit, avenue and cluster planting. There is variety of places to plant seedlings or trees such as residential and business yards, parking lots, highway medians, avenues, parks and court yards between buildings.

Field Exercise:

1. **Name of the visiting urban forestry sites:** …….………………..…………………………………

2. **Date of visit:** …….……………………………………………………………………………………..

3. **Locality:** ……………………………………………………………………………………………….

4. **Area** **(m²):** ……………………………………………………………………………………………

5. **Altitude:** ………………………………………………………………………………………………

6. **Presence of tree species in urban forestry area**

S. No.	Characters of Tree Species		Tree Species		No.	Uses	Other Information
			Common Name	Scientific Name			
1.	Grandeur of the size		………………… ………………… ………………… …………………	…………………………. …………………………. …………………………. ………………………….	…. …. …. ….	……………………. ……………………. ……………………. …………………….	
2.	Gracefulness of the branching patterns	Round	………………… ………………… …………………	…………………………. …………………………. ………………………….	….. ….. …..	……………………. ……………………. …………………….	
		Broad	………………… ………………… …………………	…………………………. …………………………. ………………………….	….. ….. …..	……………………. ……………………. …………………….	
		Square	………………… ………………… …………………	………………………….. ………………………….. …………………………..	….. ….. …..	……………………. ……………………. …………………….	
3.	Tree form	Conical	………………… ………………… …………………	………………………….. ………………………….. …………………………..	….. ….. …..	……………………. ……………………. …………………….	
		Columnar	………………… ………………… …………………	………………………….. ………………………….. …………………………..	….. ….. …..	……………………. ……………………. …………………….	
		Tapering	………………… ………………… …………………	………………………….. ………………………….. …………………………..	….. ….. …..	……………………. ……………………. …………………….	
		Arrow form	…………………	…………………………..	…..	…………………….	

			....	....	....
			....	....	....
4.	Stem character (basis on bark colour)		....	....	... .
5.	Harmony of line and symmetry of form		....	....	....
6.	Density or pattern of foliage in relation to shade		....	....	....
7.	Elegance of foliage		....	....	....
8.	Spectacular foliage colour		....	....	....
9.	Spectacular floral display colour		....	....	....
10.	Attractive fruits		....	....	....
11.	Luxury of fragrance		....	....	....

7. Achievements of urban forestry plantation area to socieo-economic status of local people:

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8. Important schemes being implemented for urban forestry: ....

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9. Conclusion:

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Exercise-5

Objective: Visit to Farm forestry model

- Farm forestry is the name given to programmes which promote commercial tree growing by farmers on their own land.
- Farm forestry was defined as the "practice of forestry in all its aspects in and the around the farms or village lands integrated with other farm operations" (NCA, 1976).

Benefits of Farm Forestry:

- Timber production
- Shelter
- Fuel wood production

Field Exercise:

1. Name of the visiting Farm Forestry Model:
   ....

2. Date of visit: ....

3. Locality: ....

4. Area (m^2):
   ....

5. Presence of tree species in Farm Forestry Area:

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
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21.						
22.						
23.						
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26.						
27.						
28.						
29.						
30.						

6. **Achievements of farm forestry plantation area to socieo-economic status of local people:**
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7. **Management techniques of farm forestry model:** ……………………………………………….…
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8. **Conclusion:**

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Objective: Visit to farmers' field to acquaint traditional agroforestry system

- **Agroforestry** is unique in many respects, both as a science and as a practice. One such aspect is its inseparable mixture of **biophysical principles and social objectives**.

- This is particularly apparent when agroforestry is viewed from the development perspective, with special emphasis on **tree-people relationships**.

- In other words, the rural poor are commonly considered as the primary beneficiaries of agroforestry; consequently, agroforestry technologies are expected to be especially relevant and applicable to small-scale land-users with low capital- and energy-requirements, and to yield products and benefits directed to immediate human needs rather than commercial advantages.

- Farmers have developed their **own agroforestry systems** but social acceptability and their uses are much more important measure of success for local agroforestry model than for commercially-oriented, high-input agricultural and forestry technologies.

Field Exercise:

1. **Name of the visiting sites:** …………………………………………………………………………

2. **Date of visit:** ………………………………… **Day:** …………………………………………………

3. **Locality:**

………………………………………………………………………………………………

4. **Area** **(m^2):**

………………………………………………………………………………………………....

5. **Geographical location:** …………………………………………………………………………

6. **Altitude:** ……………………………………………………………………………………………..

7. **Slope:** ……………………………………………………………………………………………..

8. **Presence of agroforestry tree species in the sites**

S. No	Tree Species		No.	Uses	Distance		Other Information
	Common Name	Scientific Name			Rows (m^2)	Plants (m^2)	
1.							
2.							
3.							
4.							

5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

9. **Criteria for selection of tree species:** ……………………………………………………………………
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………
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10. **Identification of agroforestry systems (On the basis of structure and function):**

S. No.	Name of agroforestry system	Components		
		Trees	Crops	Pasture
1.	Agri-silvi			
2.	Silvi-pasture			
3.	Agri-silvi-pasture			
4.	Others			

11. **Diagrammatic representation:**

12.   Benefits of agroforestry systems to socieo-economic status of the family: ………………….

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13.   Net amount of money gains by adapting particular agroforestry system: ………………..

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14.   Suggestion: ………………………………………………………………………………………

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14.   Conclusion:

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Exercise-7

Objective: Study of agroforestry systems in different agro-ecological zones

- The type of agroforestry system found in a particular area is determined to some extent by agro-ecological factors.

- Several socioeconomic factors, such as human population pressure, availability of labor and proximity to markets, are also important determinants, so that considerable variations can be found among systems existing in similar or identical agro-climatic conditions

- A significant feature that emerges from this analysis is that, irrespective of the sociocultural differences in different geographical regions, the major types of agroforestry systems are structurally similar in areas with similar ecological conditions.

- Agro-ecological zones can be taken as a basis for design of agroforestry systems. The underlying concept is that areas with similar ecological conditions can have structurally similar agroforestry systems.

Field Exercise:

1. Name of agro-ecological regions, climate and Agroforestry Research Centre present

S. No.	Agro-ecological regions	Climate	Agroforestry Research Centre
1.	Western Himalayas		
2.	Western plains		
3.	Deccan plateau		
4.	Northern plain &central highland region		
5.	Central highland and khathiaear peninsular region		
6.	Deccan plateau		
7.	Deccan plateau (Telangana)		
8.	Eastern Ghat, Tamil Nadu uplands		
9.	Northern plain		
10.	Central highland (Malwa,		

	Bundelkhand and Satpura range)		
11.	Chattisgarh/Mahanadi Basin		
12.	Eastern plateau & eastern Ghat		
13.	Eastern plains		
14.	Western Himalayas		
15.	Bengal and Assam plain		
16.	Eastern Himalayas		
17.	North eastern hills		
18.	Eastern coastal plains		
19.	Western Ghat		
20.	Island of Andaman & Nicobar		

2. **Name of agro-ecological regions and their major agroforestry System**

S. No	Agro-ecological regions	Major Agroforestry Systems	Components		
			Trees	crops	Pasture
1.	Western Himalayas				
2.	Western plains				
3.	Deccan plateau				
4.	Northern plain &central highland region				
5.	Central highland and khathiaear peninsular region				
6.	Deccan plateau				
7.	Deccan plateau(Telangana)				
8.	Eastern Ghat, Tamil Nadu uplands				
9.	Northern plain				
10.	Central highland (Malwa, Bundelkhand and Satpura range)				
11.	Chattisgarh/Mahanadi Basin				
12.	Eastern plateau & eastern Ghat				
13.	Eastern plains				
14.	Western Himalayas				
15.	Bengal and Assam plain				
16.	Eastern Himalayas				

17.	North eastern hills				
18.	Eastern coastal plains				
19.	Western Ghat				
20.	Island of Andaman & Nicobar				

3. Diagrammatic representation of major agroforestry system

4. Conclusion:

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Objective: Study of fodder banks

- Fodder banks are enclosed areas of forage legumes reserved for dry season supplementary grazing of cattle (Saleem and Suleiman, 1986).

- The concept was developed in the humid zone of Nigeria by **ILCA** scientists and has been mainly tested in this area with some measure of success.

- The main objective of fodder banks is to overcome the protein deficiency of the grass which is of low quality in this zone and fluctuates seasonally, with protein content often going below the 6% required for adequate intake

Field Exercise:

1. **Name of potential tree species to be used in fodder bank**

S. No.	Tree Species		Other Information
	Common Name	**Scientific Name**	
1.			
2.			
3.			
4.			
5.			
6.			
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12.			
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2. **Criteria for selection of tree species for fodder bank:**
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………………………………………………………………………………………………………
………………………………………………………………………………………………………
………………………………………………………………………………………………………
………………………………………………………………………………………………………

3. **Significance of fodder bank:** ………………………………………………………………
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………………………………………………………………………………………………………
………………………………………………………………………………………………………

4. **Diagrammatic representation:**

5. Harvesting of tree fodder in agroforestry systems:

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6. Harmful side effects of tree fodder: …………………………………………………………………………

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7. Management of fodder bank: …………………………………………………………………………..

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8. Conclusion: …………………………………………………………………………………..

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Exercise-9

Objective: Study of Live Fence

- Living fences are lines of trees or shrubs planted on farm boundaries or on the borders of home compounds, pastures, fields or animal enclosures.
- Their mean purpose is to control the movement of animals or people.
- This purpose is what differentiates them from other agroforestry technologies based on trees planted in lines, such as boundary plantings, contour strips or hedgerow intercropping.
- Besides their main function to control human and animal movement living fences may provide fuel wood, fodder and food, act as windbreaks or enrich the soil, depending on the species used

Field Exercise:

1. Name of potential tree species to be used in live fence

S. No.	Tree Species		Other Information
	Common Name	Scientific Name	
1.			
2.			
3.			
4.			
5.			
6.			

7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			

2. **Criteria for selection of tree species for live fence:**

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3. **Diagrammatic representation:**

4. **Establishment and spacing of live fence:**

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5. **Management of live fence:** …………………………………………………………………………..

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    ………

6. **Significance of live fence:** …………………………………………………………………………

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7. **Conclusion:** …………………………………………………………………………………………..

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Exercise-10

Objective: Study of above ground interaction in Agroforestry

- The interactions refer to the influence of one component of a system on the performance of the other components as well as the system as a whole.
- The other, ICRAF used the equation for assessing viability of agroforestry system. The equation is called tree crop interaction.

$$I = F - C$$

I– it is determined by considering positive effects of tree and crop yield
F – soil fertility enrichment
C – negative effects through competition

If F>C, the interaction is positive; the agroforestry system is productive and beneficial
If F<C, the interaction is negative; the agroforestry system is unproductive and harmful
If F=C, the interaction is neutral; the agroforestry system is neutral.

The above ground interaction takes place among tree, crops and animals above the ground level.

Field Exercise:

1. **Kinds of above ground interaction**

Name	Description	Effect

2. Tree-crops association for above ground interaction in agroforestry

Name	Description	Examples
Complementary		
Supplementary		
Competitive		

3. List of positive above ground interaction with examples:

………………………………………………

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4. List of negative above ground interaction with examples: ………………………………………………..

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5. **Above ground interaction management techniques:** ....

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6. **Conclusion:** ....

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Exercise-11

Objective: Study of below ground interaction in Agroforestry

- The interactions refer to the influence of one component of a system on the performance of the other components as well as the system as a whole.
- The other, ICRAF used the equation for assessing viability of agroforestry system. The equation is called tree crop interaction.

$$I = F - C$$

I–   it is determined by considering positive effects of tree and crop yield

F –   soil fertility enrichment

C –   negative effects through competition

If F>C, the interaction is positive; the agroforestry system is productive and beneficial

If F<C, the interaction is negative; the agroforestry system is unproductive and harmful

If F=C, the interaction is neutral; the agroforestry system is neutral.

The below ground interaction takes place among tree, crops and animals above the ground level.

Field Exercise:

7. **Kinds of below ground interaction**

Name	Description	Effect

8. **Tree-crops association for below ground interaction in agroforestry**

Name	Description	Examples
Complementary		
Supplementary		
Competitive		

9. **List of positive below ground interaction with examples:** ……………………………………….
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10. **List of negative below ground interaction with examples:** ………………………………………..
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11. Below ground interaction management techniques: ……………………………………………..

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12. Conclusion: ………………………………………………………………………………………….

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Exercise-12

Objective: Study of MPTs in Agroforestry

- One of the key components in any agroforestry system is the multipurpose trees.
- MPTs are woody perennials which are deliberately kept or grown in a land use system to produce multipurpose products and benefits.
- Multipurpose trees and shrubs are those which deliberately grown or kept managed for preferably more than one intended use, usually economically or ecologically motivated major products and services in any multipurpose land use
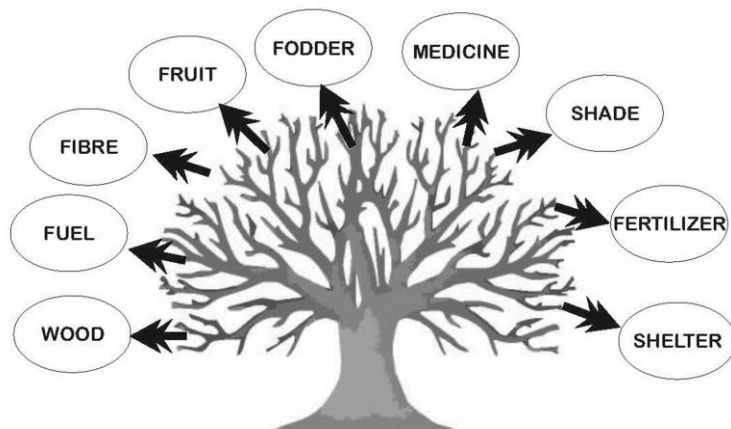
Schematic representation of multipurpose trees

system, especially agroforestry system (**Burley and von Carlowitz, 1984**).

Aim:

- To meet the farmers need such as small timbers, housing, fodder, fuel woods, fruit and minor tree products.
- To supplement crop productivity through moisture conservation, addition of organic matter and maintaining the sustainability of soil.
- To provide economic gains to farmers by supplying raw materials to wood based industries in that area.

Field Exercise:

1. Common multipurpose tree species suitable for agroforestry

S. No.	Tree Species		Climate	Uses
	Common Name	**Scientific Name**		
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				

2. Purpose wise multipurpose tree species

S. No.	Purpose	Tree Species	
		Common Name	**Scientific Name**
1.	Wood yielding MPTs		
2.	Fuel wood based MPTs		
3.	Fodder based MPTs		

4.	Fertilizer based MPTs		
5.	Fruit based MPTs		

3. **Selection criteria for multipurpose trees:** …………………………………………………………….

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4. **Benefits of MPTs:** …………………………………………………………………………………….

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5. **Conclusion:**

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Exercise-13

Objective: Study of Nitrogen fixing trees in Agroforestry

- Nitrogen fixing trees play most important and dominant role in agroforestry system. Basically, the trees ideal to be incorporated in various agroforestry system are called the multipurpose trees.
- More than 650 species are known to fix Nitrogen.
- Most trees used in agroforestry grow relatively quickly, whilst many also fix nitrogen i.e. many MTPs are fast growing and nitrogen fixing.

Role of nitrogen fixing trees:

- Fixing atmospheric nitrogen and providing in plant available form.
- Deep nutrients capture from sub soils through roots.

Litter returns nutrients to soil

N2 from air fixed in nodules

Surface soil nutrients

Root growth and dieback enriches soil

Nutrients mined from subsoil
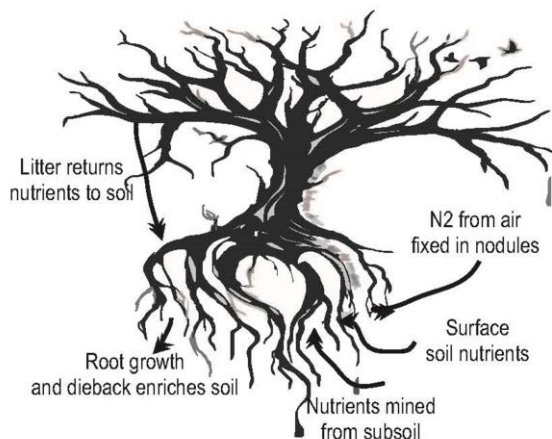
Schematic representation of nitrogen fixing trees

- Addition of organic matter, nitrogen and other nutrients to the top soil through leaf fall.
- Addition of nitrogen and other nutrient to soil by decaying roots.
- Improvement of soil physical conditions.
- Improvement of soil chemical condition.
- Affecting soil biological processes and conditions.

Field Exercise:

1. **Nitrogen fixing tree species in different regions:**

S. No.	Regions	Tree Species	
		Common Name	Scientific Name
1.	Arid and semi-arid		
2.	Humid and sub humid		
3.	Tropical highlands		

2. **Purpose wise nitrogen fixing tree species:**

S. No.	Purpose	Tree Species	
		Common Name	Scientific Name
1.	Timber yielding NFTs		
2.	Forage yielding NFTs		
3.	Green manure yielding NFTs		

4.	Fuel wood yielding NFTs		

3. **Selection criteria for nitrogen fixing trees:** …………………………………………………………..

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4. **Benefits of NFTs:** …………………………………………………………………………………………

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5. **Conclusion:** ……………………………………………………………………………………………….

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Exercise-14

Objective: Studies on Allelopathy in Agroforestry

- Inhibitions of growth of one plant by chemical compounds that are released into the soil from neighboring plants are called allelopathy.

- It is also defined as the phenomenon of one plant having detrimental effect on another through the production and exertion of toxic chemicals compounds is called allelopathy

Release of allelochemicals from one plant and affecting other plants

- It is first detected by Davis in 1928 in black walnut tree (*Juglans nigra*) whose foliar leachates containing Juglone was found to damage germination and seedling growth of crops beneath the tree.

- The term allelopathy was first used in 1937 by the Australian professor Hans Molish.

- In 1971, Whittaker and Feeny defined allelochemicals as all chemical interactions among organisms.
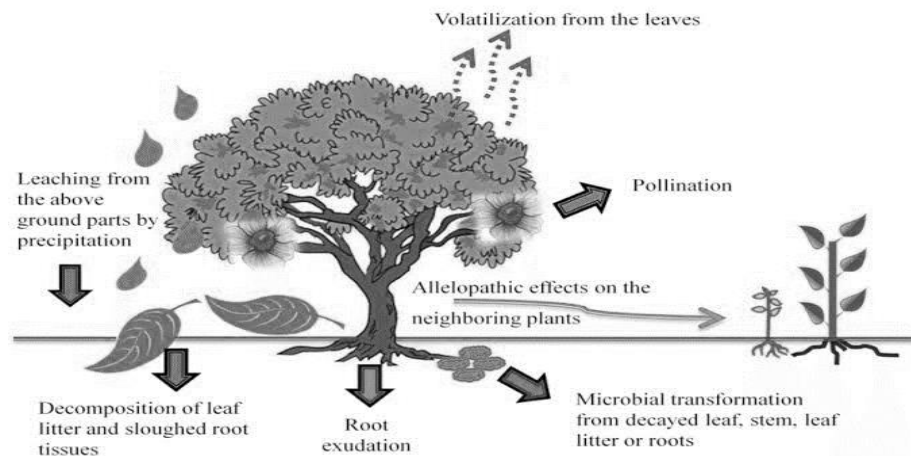
Sources of allelochemicals

Effect of allelopathy:

- It inhibits soil germination and establishment of certain crops.

- Inhibition on germination, shoot length , root length , and total dry weight.

Field Exercise:

1. **List of agroforestry tree species, their released allelochemicals and targeted species:**

S. No.	Tree Species	Allelochemicals	Targeted species
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			

20.			

2. Sources   of   allopathic   chemicals   from   the   plants:

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3. **Use of allelopathy in agroforestry:** …………………………………………………………………

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4. **Conclusion:** ……………………………………………………………………………………..

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Exercise-15

Objective: Studies on Design & Diagnostics exercise in agroforestry

- D & D is a methodology for the diagnosis of land-management problems and the design of agroforestry solutions.
- It was developed by ICRAF to assist agroforestry researchers and development fieldworkers to plan and implement effective research and development projects.
- D & D is simply a systematic approach to the application of this principle in agroforestry.

Key features of D & D:

- **Flexibility**: D & D is a discovery procedure which can be adapted to fit the needs and resources of a wide variety of land users.

- **Speed**: D & D has been designed to allow for a "rapid appraisal" application at the planning stage of a project with in-depth analysis occurring during project implementation.

- **Repetition**: D & D is an open-ended learning process. Since initial designs can almost always be improved, the D & D process need not end until further improvements are no longer necessary

Basic procedures of the Diagnosis and Design (D & D) methodology:

D&D Stages	Basic questions to answer	Key factors to consider	Mode of inquiry
Pre-diagnostic			
Diagnostic			
Design & Evaluation			
Planning			
Implementation			

Studies on **Pre-diagnostic & Diagnostic** stage under **D &D** exercise in agroforestry

Pre-diagnostic stage:

1. **Planning   the   study:**

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2. **Regional reconnaissance:** ………………………………………………………………………

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3. **Land-use system:** ………………………………………………………………………………

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4. **Site Selection**

   - **On   the   basis   of   severity   of   problems:**

     …………………………………………………………………………

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- **Agroforestry potential:** ....

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- **Regional representativeness:** ....

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- **Priority   by   land   use   systems:**

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- **Priority by region:** ....

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- **Selected land-use systems:** ....

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Diagnostic stage:

5. **Diagnostic survey:** ....

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6. **Diagnostic analysis:** ....

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7. **System specifications:** ....

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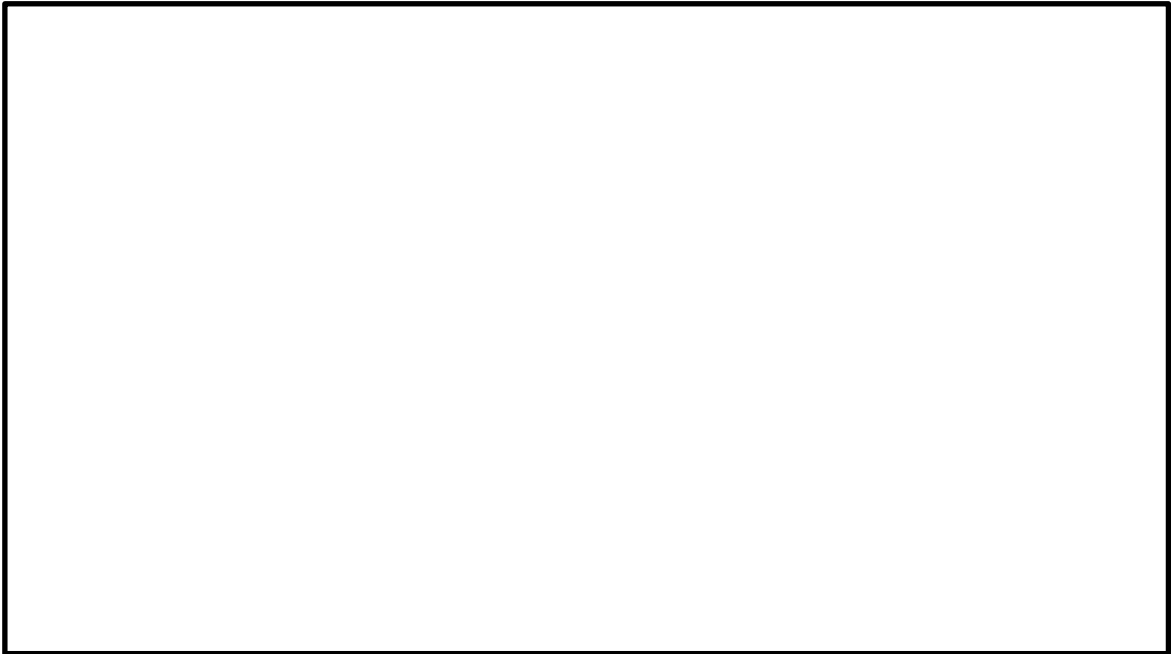
Exercise-16

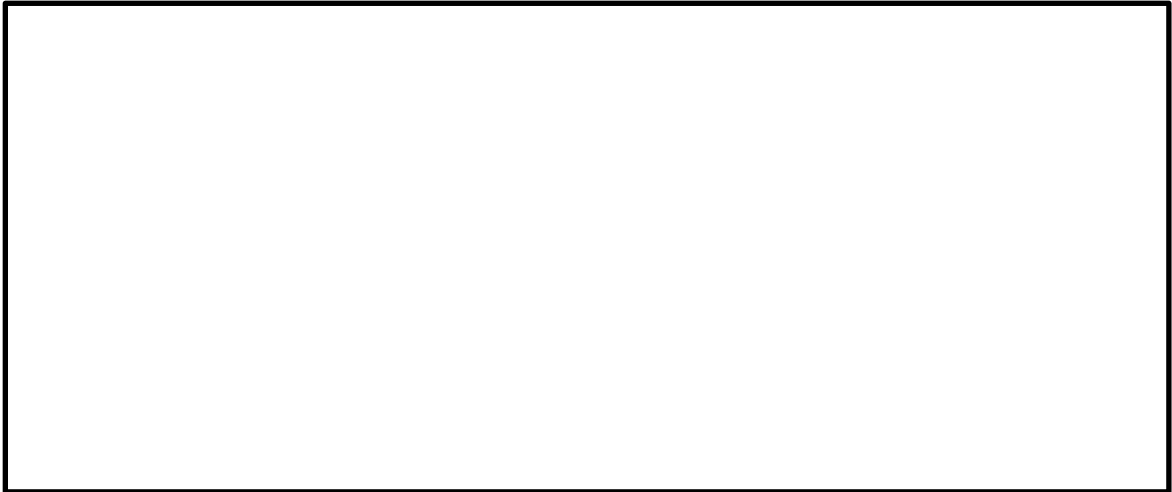**Objective: Studies on Design & Evaluation stage under D & D exercise in agroforestry**

Technology design:

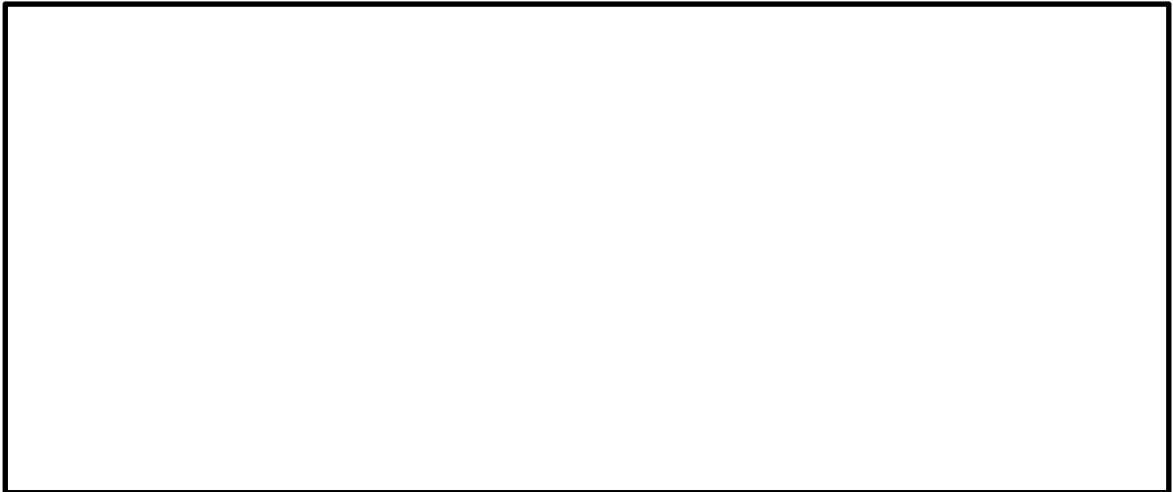1. **Candidate technologies:**

2. Technology specifications:

3. Technology Design:

Evaluation & redesign:

4. Ex-ante evaluation & redesign:

Suitability Classification:
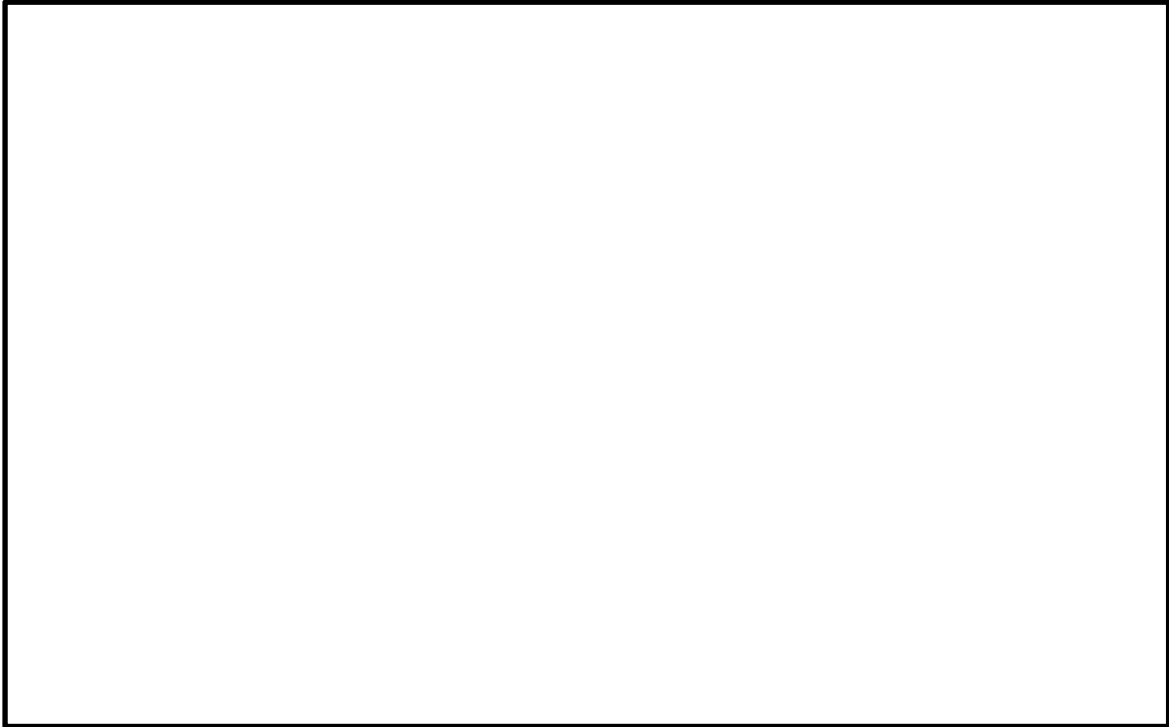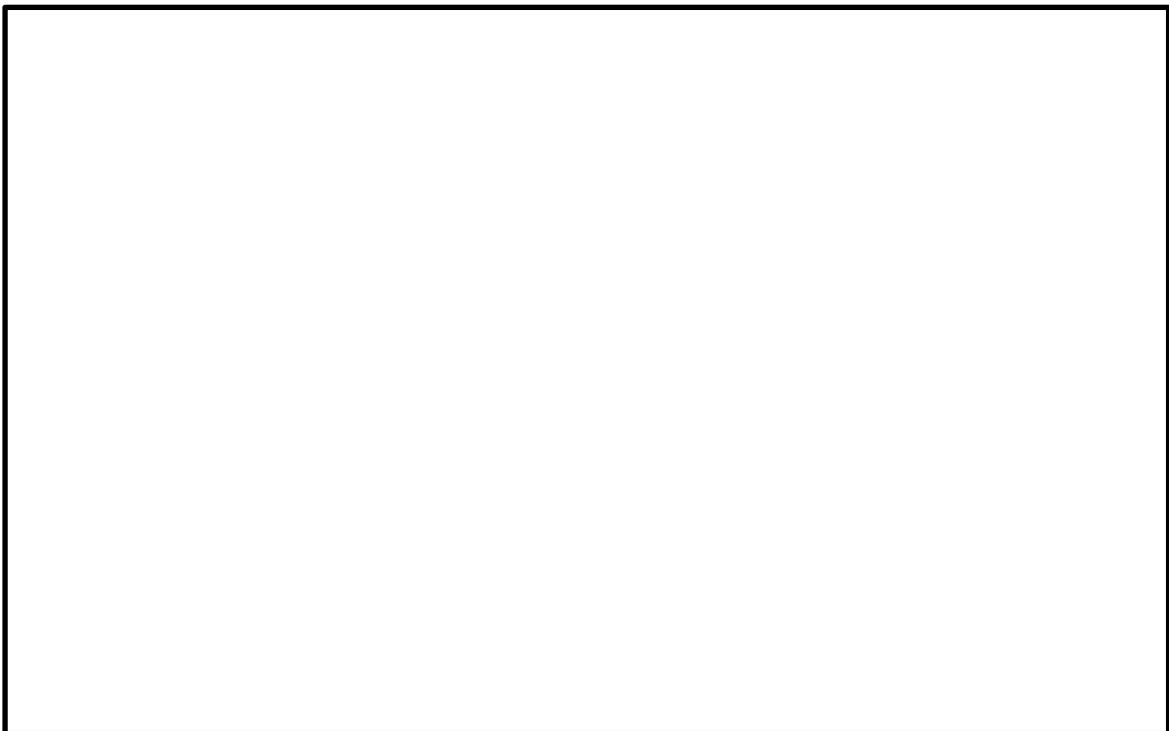
Objective: Studies on Planning & Implementation stage under D & D exercise in agroforestry
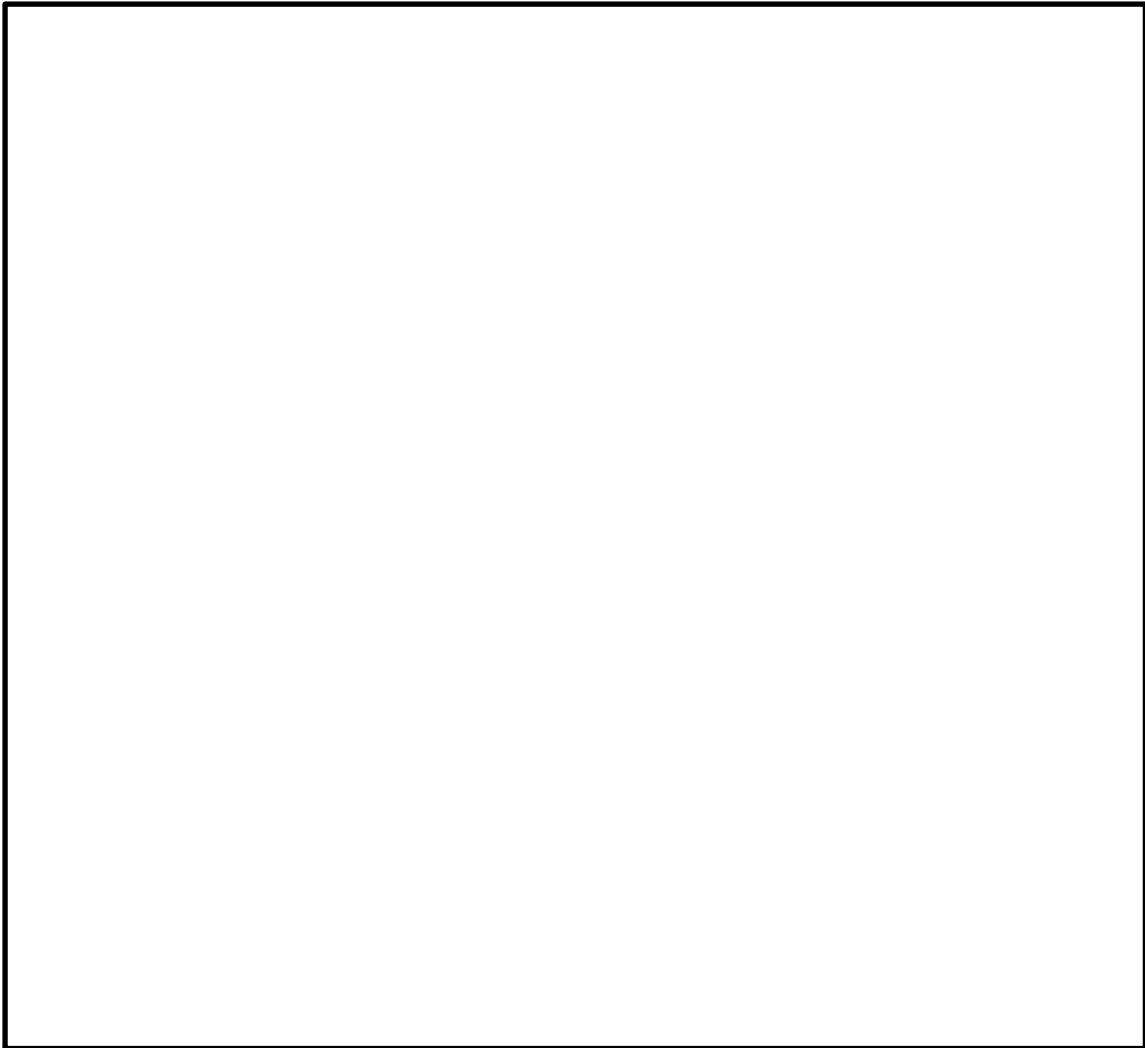
Planning stage:

1. **Research needs:**

2. **Research and extension plans:**

Implementation stage:

3. Programme implementation:

Conclusion: …………………………………………………………………………………………..

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Objective: Studies on Land capability classification of various topographic regions

➢ Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time.

➢ Land capability classification is subdivided into capability class and capability subclass nationally. Some states also use a capability unit.

Field Exercise:

1. **Name of the topographic region:** …………………………………………………………….

2. **Soil:** ……………………………………………………………………………………………..

3. **Altitude:** …………………………………………………………………………………………..

4. **Slope:** ……………………………………………………………………………………………..

5. **Land suitable for cultivation:**

S. No.	Class	Percentages	Characteristics	Examples	Other Information
1.	Class I				
2.	Class II				
3.	Class III				
4.	Class IV				

6. Land not suitable for cultivation

S. No.	Class	Percentages	Characteristics	Examples	Other Information
1.	Class V				
2.	Class VI				
3.	Class VII				
4.	Class VIII				

7. Advantages of land capability classification:

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8. Limitations: ……………………………………………………………………………………………..

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9. **Conclusion:** ………………………………………………………………………………………….

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