CHAPTER IV
MATERIALS & METHODS

4.1 MATERIALS:

4.1.2 Satellite Data:

Forest type mapping was done using multispectral satellite images of November' 2001 acquired from NRSA, Hyderabad. The details of the data used are as follows:

- Satellite- IRS 1C /1D
- Sensors- LISS III
- Bands- 2,3,4
- Path/Row- 094/057

4.1.2 Reference Maps:

The Survey of India (SOI), topographical maps at 1:50,000 scale was used as reference map for the base map preparation. The entire district is covered by 10 topographical maps. Besides, SOI toposheets, maps provided by forest department were used for digitizing district boundary as well as village boundaries.

4.1.3 Ancillary Data:

Socio-economic data and number of cattle population of the JFM villages was obtained from the questionnaire distributed to villagers which included the *Sarpanch* (head of the village), members of executive committee of the Forest Protection Institute established in each village under the JFM program and also other villagers (Annexure 1).

Reports and records from Forest Department and other repositories have been referred to for information on extent and the management of Joint Forest Management plantations.

4.1.4 Field Data:

A quick reconnaissance survey was carried out to get acquainted with the general pattern of vegetation of the study area which can aid in preliminary interpretation of the satellite data.

One challenge in correlating satellite images to ecological studies lies in understanding spectral and spatial information in an image vis-à-vis the different vegetation patterns on the ground. To achieve this, a Global Positioning System (GPS) (MAGELLAN NAM_DLF_10™, Satellite Navigator) was used to correlate different landuse/landcover classes on ground with the satellite information wherein finally each category can be understood based on their spectral signatures. GPS was also used to precisely locate and correlate the JFM plantations of the Narmada district with that of satellite images (Table 7).

4.1.5 Software Used:

- Remote Sensing – ERDAS IMAGINE 8.5
- GIS – Arc/Info 7.2.1, ArcView 3.2.1
- Others – Microsoft Excel, Word, Power Point.

4.2 METHODS:

Initially the entire forest cover existing in the study area was classified to facilitate the understanding of JFM plantations. Secondly, these JFM areas were then highlighted to some extent, out of which finally few of them were selected for micro level assessment. Thus, these could be precisely described and explained separately in the following manner (Figure 10).

- RS & GIS Analysis
    - Forest Density Classification
    - JFM Mapping
    - Potential Sites for JFM Plantations
- Micro-level Assessment of JFM Plantations

4.2.1 RS & GIS Analysis:

4.2.1.1 Base Map preparation:

Reference topographical maps procured from SOI were mosaiced to prepare the base map for the entire district. For which the map sheets were projected and tiled after digital trimming of the map boundaries. This process enabled the contiguous representation of the topographical area and the corresponding map extent.

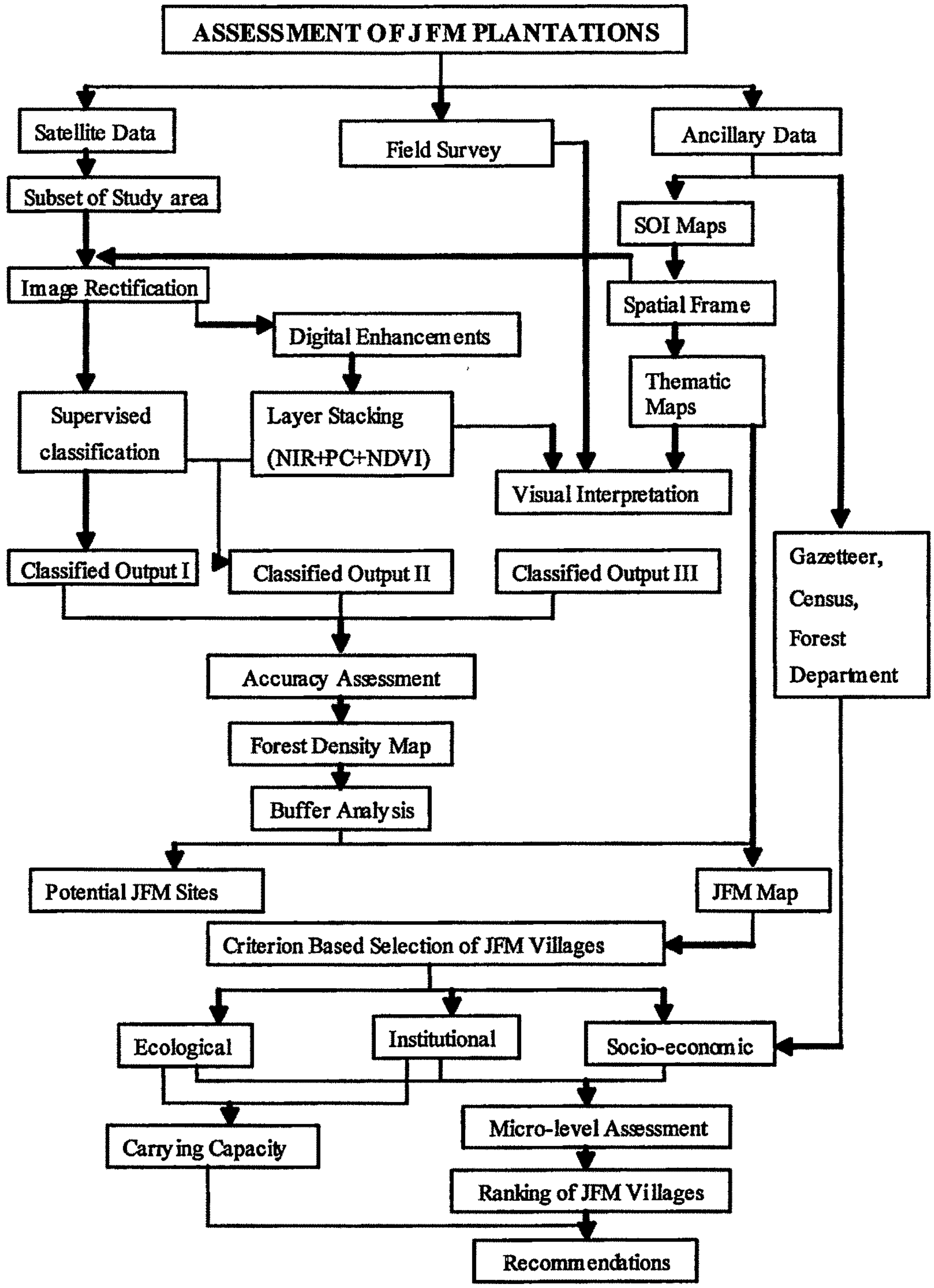

Figure 10. Methodology Flow Chart

Table 7. GPS Readings at Different Locations of the Study Area

Sr No.	Locations	Latitude	Longitude	Land Use/ Land Cover
1.	Pansar village	21^0 57.57	73^0 38.55	Rural habitation
2.	Dabka village	21^0 25.44	73^0 96.11	Rural habitation
3.	Sagbara city	21^0 32.70	73^0 47.48	Urban habitation
4.	Movi village	21^0 42.55	73^0 28.34	Rural habitation
5.	Koyalivav village	21^0 30.07	73^0 22.72	Rural habitation
6.	Dhanor village	21^0 38.74	73^0 30.31	Rural habitation
7.	Bore village	21^0 38.98	73^0 34.33	Rural habitation
8.	Godada village	21^0 36.11	73^0 46.01	Rural habitation
9.	Kothi village	21^0 54.11	73^0 45.11	Rural habitation
10.	Nr. Kothi village	21^0 54.84	73^0 44.95	Canal site
11.	Survani village	21^0 53.43	73^0 47.87	Rural habitation
12.	Jher village	21^0 52.28	73^0 46.34	Rural habitation
13.	Gora	21^0 51.66	73^0 41.40	Urban habitation
14.	Naghatpur village	21^0 53.64	73^0 46.03	Rural habitation
15.	Moti Chikhli village	21^0 47.84	73^0 28.11	Rural habitation
16.	Gagar	21^0 49.20	73^0 52.20	Reserve forest
17.	Nr. Saribar village	21^0 42.55	73^0 52.08	Stony waste
18.	Pangam village	21^0 40.50	73^0 30.50	Agriculture
19.	Nr. Karchhipada village	21^0 34.02	73^0 29.33	Agriculture
20.	Jitgadh	21^0 48.48	73^0 32.17	Banana plantation
21.	Nr. Karjan	21^0 49 07	73^0 32 21	Dam site
22.	Nr. Vadva	21^0 31.57	73^0 34.08	Agriculture
23	Nr. Jitgadh	21^0 49.30	73^0 32.48	Degraded forest area
24	Nr. Panchala	21^0 54.19	73^0 49.29	Dense forest
25.	Nr. sunderpura	21^0 50.28	73^0 32.03	Agriculture
26.	Nr. Kudvamota	21^0 50.23	73^0 41.48	Patches of dense and degraded forest
27.	Nr. Picchipura	22^0 01.05	73^0 36.27	Forest with stony waste
28.	Vajiria	22^0 02.05	73^0 35.11	Dense forest
29.	Nr. Datan amli	21^0 46.47	73^0 23.03	Patches of degraded and open jungle,
30.	Road between Panchala and Gulvant	21^0 53.44	73^0 49.30	Sparse tree cover with agriculture
31.	Nr. Kudvamota	21^0 50.48	73^0 41.44	Dense forest
32.	Nr Shekhbar	21^0 48 47	73^0 46 49	Stony waste
33.	Nr. Jher	21^0 55.01	73^0 44.19	Eucalyptus plantation
34.	Nr. Singalgabhan RF	21^0 43.29	73^0 47.54	Dense forest
35.	Nr. Kunbundi	21^0 36.32	73^0 39.45	Sparse tree cover with agriculture
36.	Kokam	21^0 44.09	73^0 50.04	Sparse trees with settlement & agriculture
37.	Nr. Magardev	21^0 39.21	73^0 29.57	Dense forest
38.	Nr. Kokam	21^0 44.12	73^0 50.38	Degraded site
39.	Nr. Saribar	21^0 38.40	73^0 37.03	Sparse tree cover with agriculture
40.	Nr. Amletha	21^0 49.16	73^0 30.21	Open jungle
41.	Nr. Timarva	21^0 54.19	73^0 46.57	Open jungle
42.	Nr. Mota Tavadiya	21^0 49.54	73^0 43.27	Dense forest
43.	Nr. Nivalda	21^0 37.08	73^0 34.02	Reserve forest
44.	Bogoj	22^0 39.62	73^0 34.83	Reserve forest

4.2.1.2 Spatial Frame Work:

The SOI topographical map was used for developing a master tic mark based on the latitude-longitude values on the four map corners. This helped in generation of spatial frame work covering entire study area.

4.2.1.3 Thematic Map Generation:

The SOI maps were also used for generation of thematic layers for the study area on the spatial frame work. The four major thematic layers generated from the topographical maps are-

- Settlements (Rural and Urban Habitation)
- Forest boundary
- Road and Rail Network
- Rivers and Streams

All these thematic layers were generated using Arc/Info software, which formed the benchmark for the forest density classification as well as study of the JFM plantations.

4.2.1.4 Importing Satellite Data:

The digital data of IRS 1C/1D LISS III was initially loaded into the computer hard disk in band sequential format (BSQ), using ERDAS imagine 8.5 Image processing software. Prerequisite information such as number of pixels, rows, columns and bands was filled up while importing data.

4.2.1.5 Sub-setting:

Using the subset utility of the ERDAS 8.5 Image software module, the exact area under the study was extracted. This subset which covered the entire district was then subjected to geometric correction.

4.2.1.6 Image Rectification:

The multispectral satellite data and the corresponding topographical map sheet area were used to process the satellite data for geo-rectification using ERDAS s/w. In this process, the projected map sheet area served as reference where as satellite data as slave image. The identification of Ground Control Points (GCPs) on the satellite image and the corresponding map sheet position were carefully selected and assigned in a well-distributed fashion across the entire image set. Enough emphasis has been laid on the orientation of GCPs at precise locations and then identification on the satellite image. After the image transformation model, the residual errors with respect to various GCPs selected have been carefully assessed for reducing the overall RMS (Root Mean Square) error. Through out this process some of the outliers GCPs were rejected to obtain an overall RMS accuracy of 0.45. It was also ensured that all the map sheets were projected using Everest spheroid in the Polyconic projection.

4.2.1.7 Image Enhancement:

Image enhancement was done to improve the image visualization and to highlight the information required on forest classes as well on the JFM plantations. Band combination technique was attempted to select the best band for vegetation analysis. Various contrast enhancements techniques such as Linear, Gamma, Gaussian and Histogram equalization were attempted.

Histogram equalization was adopted wherein the original histogram was redistributed to produce a uniform population density of pixels along the horizontal DN axis. This helped in amalgamating the classes with relatively low frequency while the classes with higher frequency had been spaced out more widely than they were originally placed. This applied great contrast enhancement in the center of the range while reducing contrast at the margins.

4.2.1.8 Band Ratioing:

The enhanced image was subjected to band ratioing in order to further highlight the required information from the satellite image. For the present study two band ratioing were attempted viz. Simple Ratio (R/IR) and NDVI. Rouse *et al.,* 1974, developed the most widely adopted vegetation index i.e. Normalized Difference Vegetation Index (NDVI).

$$NDVI = \frac{NIR - R}{NIR + R}$$ where, NIR = Near Infra Red

R = Red

4.2.1.9 Principal Component Analysis (PCA):

The Principal Component Analysis (PCA) or Karhumen-Loeve analysis was used to compress the multispectral data sets by calculating a new coordinate system. Thus the redundancy in the multiple data sets was avoided and the image was compressed.

4.2.1.10 Layer Stacking:

Various permutations and combinations of different bands such as Red and NIR bands of LISS-III, NDVI, PC1, PC2 and PC3 were tried in order to decide the best combination with the maximum separability among the different classes within the forest administrative boundary. The final combined image with the best results was then subjected to forest density classification and JFM mapping of the study area.

4.2.2 Forest Density Classification:

The enhanced satellite image was subjected to both digital as well as visual analysis for the purpose of forest density classification.

4.2.2.1 Supervised Classification:

The image was classified digitally by using supervised classification with the option of maximum likelihood classifier. Appropriate signatures /training sets for corresponding land cover and vegetation classes were provided before initiating classification. Ground truth information was incorporated in refining the training sites selection during the final classification of image.

4.2.2.2 On-screen Visual Interpretation:

In addition to digital classification an interactive visual interpretation of satellite image was achieved using the image characteristics. The basic elements comprising tone/colour, size, shape, texture, pattern, location, association and shadow have played a vital role in interpreting and drawing the vector boundaries using the on screen digitizing option. Considering these basic elements of interpretation along with ground truth and ancillary information collected during the preliminary reconnaissance survey, an interpretation key for different classes was developed (Table 8).

Preliminary image interpretation was done based on the interpretation key and field survey data. The vector layer generated was edited for removing the

Table 8. Interpretation Key for Visual Interpretation of Predominant Vegetation Types

No.	Classes	Spectral Signature	Tone	Texture	Shape	Association
1.	Dense forest		Deep red	Coarse	Contiguous	Irregular
2.	Open forest		Pinkish	Smooth	Contiguous	Irregular
3.	Degraded forest		Greenish-white	Smooth/ Coarse	Contiguous	Irregular with grains
4.	Spare tree cover with agriculture (STA)		Greenish white with scattered bright red to pink color patches	Coarse	Contiguous	Irregular
5.	Agriculture		Mosaic of red and deep green	Coarse	Regular patches	Irregular-rectangular to squarish
6.	Canal		Cyan-whitish	Smooth	Linear	Regular
7.	River		White-deep blue	Smooth	Linear	Regular

errors and correspondingly pre-decided class assignment/polygon-id was attributed to each polygon. A spatial relationship between features was created by building up the topology which generated the attribute table in the system. The subjectivity of human intelligence and knowledge by the interpreter due to prefield familiarity and post field improvements enhanced the accuracy of the image. At the end of completion of image interpretation, area statistics were obtained representing the different forest classes of Narmada district.

4.2.2.3 Accuracy Assessment:

The accuracy assessment was done on the final classified image by plotting random points on the image. Overall mapping accuracy and classification accuracy was calculated. KAPPA analysis was also performed on the classified output.

The detailed ground survey was carried out to check the discrepancy of the interpreted data. The random points plotted were checked using Global Positioning System.

The confusion matrix was prepared to assess the overall classification accuracy and mapping accuracy. The KAPPA analysis yield a K_{hat} statistics (An estimate of KAPPA) that is a measure of agreement or accuracy was calculated (Rosenfield & Fitz-patrick-Lins, 1986; Congalton, 1991). The following formulas were used to calculate the accuracy.

Overall classification accuracy = ($\sum$Ni/ $\sum$Ti) x 100 (Jensen,1996)

where,

$\sum$Ni = Total number of correctly classified points.

$\sum$Ti = Total number of points checked on ground.

Overall Mapping Accuracy = $\sum$Ni / $\sum$Ni + $\sum$Ei x 100 (Jensen,1996)

where,

$\sum$Ni = Total number of corruptly classified points.

$\sum$Ei = Total number of erroneous points.

$$K_{hat} = \frac{N\sum_{i=1}^{r} X_{ii} - \sum_{i=1}^{r} (X_{i+} \times X_{+i})}{N^2 - \sum_{i=1} (X_{i+} \times X_{+i})}$$

where,

r = number of rows in the matrix

X_{ii} = number of observations in row i and column i

X_{i+} and X_{+i} = marginal totals of row i and column i respectively

N = total number of observations.

In addition to the final accuracy testing, different points were visited to find out the precise correlations between the classes delineated on the spatial data with the ground.

4.2.3 JFM Mapping:

In order to correlate the JFM plantations on the ground with that of the satellite data the GPS readings of the JFM plantations were collected (Table 9). In each plantation site, reading was taken. Buffering was done around this point for facilitating delineation.

4.2.4 Potential Sites for JFM Plantations:

Based on the forest density classification obtained from the on-screen visual interpretation, villages falling in the 500 m radius of the degraded forest patches were marked with the help of buffer analysis. Thus, the number of potential JFM villages in each taluka could be derived wherein JFM program can be implemented with the active participation of the locals.

4.2.5 Micro-Level Assessment of JFM Program:

4.2.5.1 Selection of JFM Villages for Micro-level Assessment:

Reports available from forest department reveal that in Narmada district 114 villages have been registered under the JFM program (as on 31/3/2001). Narmada district which comprise of four distinct talukas as mentioned in the site of study, has the maximum proportion of JFM villages in Dediyapada taluka covering 53.51% of the total JFMCs. Rajpipla, Sagbara and Tilakwada talukas also have JFM villages covering 34.21%, 11.40% and 0.88% respectively. Out of the total JFM villages present in this district, 13 villages were selected for the detailed analysis, falling in Rajpipla, Dediyapada and Sagbara talukas. Tilakwada had the minimum percentage of JFM villages and also these villages have not been registered under the JFM program so these have not been included in the present study.

Table 9. GPS Readings of JFM Plantations of Study Area

Sr. No.	JFM plantations	Latitude	Longitude
	Tilakwada taluka		
1.	Namaria plantation	22^0 02.52	73^0 36.52
	Rajpipla taluka		
2.	Naghatpur plantation	21^0 53.799	73^0 46.541
3.	Limkhetar plantation	21^0 54.551	73^0 50.280
4.	Panchala plantation	21^0 54.267	73^0 48.810
5.	Nani Chikhli plantation	21^0 47.313	73^0 28.402
6.	Moti Chikhli plantation	21^0 47.134	73^0 28.396
	Dediyapada taluka		
7.	Kunbar plantation	21^0 35.364	73^0 31.826
8.	Magardev plantation	21^0 38.18	73^0 29.52
10	Pansar plantation	21^0 38.427	73^0 39.043
11.	Bore plantation	21^0 39.233	73^0 34.448
12.	Dhanor plantation	21^0 38.920	73^0 30.660
13.	Singalvan plantation	21^0 37.401	73^0 31.519
14.	Tilipada plantation	21^0 30.493	73^0 32.810
15.	Koylivav plantation	21^0 36.926	73^0 32.206
16.	Nighat plantation	21^0 36.870	73^0 33.387
17.	Nivalda plantation	21^0 37.028	73^0 34.291
18.	Bogoj-Koliwada plantation	21^0 39.855	73^0 34.832
19.	Chuli planataion	21^0 34.539	73^0 31.191
20.	Moskut plantation	21^0 30.745	73^0 34.159
21.	Zarnawadi plantation	21^0 36.450	73^0 33.388
22.	Khokhara umar plantation	21^0 36.540	73^0 36.068
23.	Besana plantation	21^0 39.116	73^0 36.410
24.	Babda plantation	21^0 31.520	73^0 31.525
	Sagbara taluka		
25.	Kodba plantation	21^0 32.667	73^0 46.096
26.	Godada plantation	21^0 35.573	73^0 45.583
27.	Dabka plantation	21^0 25.308	73^0 46.123

The selection of these villages was based upon pre-decided criterions. The specific feature based on which these villages were selected have been highlighted in Plate 2. In addition to the 10 villages depicted in the plate 2, three more villages were selected from each taluka of the Narmada district owing to their report of these being the best JFM villages in the study area. These were Nani Chikhli from Rajpipla taluka, Kunbar from Dediyapada taluka and Godada village from Sagbara taluka were selected in order to assess its present status and condition.

Selection of different villages based on these criterions was mainly directed towards the dependence of locals on the forest for sufficing the daily needs of fuel-wood and fodder and human & cattle pressure on the forest.

4.2.5.2 Phytosociological Analysis:

The phyto-sociological analyses have been carried out for the selected 13 JFM villages of Narmada district using basic ecological methods (Odum, 1971). For tree species belt transect was laid (20 m X 10m) while for undercover 1m X 1m quadrate was laid down in three replicates at each site. For recording the herbaceous understorey vegetation, the quadrate was laid at the two extreme ends and in the centre of the belt transect. Density, frequency and dominance were obtained by measuring the Girth at Breast Height (GBH). GBH was measured at the height of 1.37m and correspondingly the basal area was calculated. In each transect all the stems having 30 cm and above girth were considered as trees, while those measuring less than 30 cm but greater then 3 cm were considered as shrubs while others were considered as undercover or herbaceous population (Pande, 2005).

Basal area (BA)of individual tree and Total Basal Area (TBA) of the forest were calculated as follows (Ravindranath, 2000);

$$BA\ (cm^2) = (GBH/2\pi)^2 \times \pi$$

$$TBA\ (\text{in } m^2 \text{ per ha}) = \sum BA/10{,}000$$

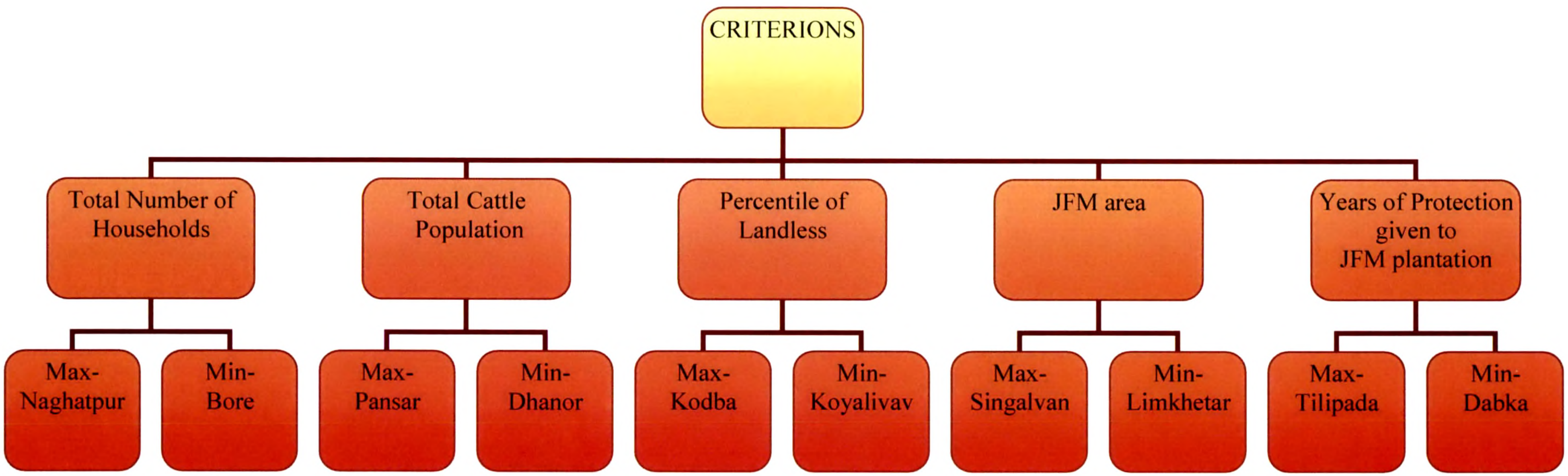

Plate 2. Criterions for selection of JFM villages

4.2.5.3 Taxonomical Identification:

Species identification was done while carrying out the enumeration (either botanical name or local name). The specimens were also collected with proper field information (plot number, locality, habitat etc.) and preserved as per standard procedures and were brought to BARO (Baroda Herbarium), Dept. of Botany, The M.S. University of Baroda, where the specimens identified were cross checked and confirmed with the help of literature and existing authentic specimens.

4.2.5.4 Primary Data Analysis:

Field data collected was subjected to various ecological methods for assessment of the species diversity and dominance pattern of the JFM plantations sites. Different ecological indices were used to show the species compositional package and distribution pattern. These indices include:

Importance Value Index **(IVI)** (Curtis, 1956; Phillips, 1959; Misra, 1966)

IVI = Relative Frequency (RF) + Relative Density (RD) + Relative Dominance (RDo)

where,

$$\text{RF of a species} = \frac{\text{No. of occurrence of species}}{\text{No. of occurrence of all the species}} \times 100$$

$$\text{RD of a species} = \frac{\text{No. of individuals of the species in all quadrates}}{\text{No. of individuals of all species in all quadrates}} \times 100$$

$$\text{RDo of a species} = \frac{\text{Total basal area of the species in all the quadrates}}{\text{Total basal area of all the species in all the quadrates}} \times 100$$

Index of General Diversity **(H)** (Shannon & Wiener, 1949, Margalef, 1968)

$$H = -\sum (ni/N). \log (ni/N)$$

where,

ni = Number of individual of each species in all the quadrates

N = Total no of species

Index of Dominance (C) (Simpson, 1949)

$C = (ni / N)^2$

where,

ni = Number of individual of each species in all the quadrates

N = Total no of species

Index of Similarity (S) (Sorenson, 1948)

$S = 2C / (A+B)$,

where,

A = Number of species in sample A

B = Number of species in sample B

C = Number of species common in both the samples

4.2.5.5 Secondary Analysis:

Based on the primary plantation analysis, secondary analysis was carried out. Basal area per hectare is an indicator of growing stock of the forest, the approximate size of trees and standing biomass. The growing stock was calculated using the following regression equation given by Ravindranath, 1995,

Standing woody biomass (SWB)

SWB (t/ha) = -1.689 + 8.32 X BA

where,

Standard Error of coefficient = 1.689

$R^2 = 0.5$

BA = Basal Area in m^2/ha

The records of the forest department as well as the local information proved helpful in knowing the age of the JFM plantations in each selected village. Based on the age of plantation at each protected site the carbon sequestration rates and Mean Annual Increment (MAI) was calculated as-

Carbon sequestration (Negi *et al.,* 2002).

Carbon Sequestration rate was calculated as 0.46 of standing woody biomass

Mean Annual Increment (MAI) (Ravindranath *et al.*, 2000)

MAI = SWB/ Y

where,

SWB = Standing Woody Biomass

Y = Age of the plantation

4.2.5.6 Carrying Capacity of JFM Plantations:

- **Evaluation of Fodder Consumption:**

Following the standard methodology proposed by Jain *et al.,* 1980 the cattle population was converted to total Animal Cattle Units (ACU) with one mature buffalo and bull counted as 1 ACU. While cow was treated as 0.85 ACU, the sheep and goat were treated as 0.19 ACU. The average consumption of grass by one ACU was taken as 2.6 tons/year.

- **Evaluation of Fuel Wood Consumption:**

Fuel wood consumption from each JFM village was estimated based on the requirement of fuel wood per household which was derived from questionnaire.

- **Supply Potential of the Plantations:**

MAI values were used to calculate the potential limit of harvest. To suggest the limits of harvest it was by and large believed that nearly 50% or a range of 33-50% of the current annual biomass productivity could be harvested in a sustainable way without affecting the forest regeneration (Ravindranath *et al.,* 2000)

4.2.6 Ranking of Villages:

The selected JFM villages were ranked based on the assessment of synergic effect of certain specific ecological and socio-economic parameters.

➤ **Ecological Parameters:**

Villages were ranked based on the ecological parameters derived from primary and secondary plantation analysis such as diversity & dominance index and carbon sequestration rate of each JFM plantation. The estimation of gochar land available per ACU and forest area available per household has also taken into consideration during ranking (Table 10).

The range of points assigned to all these parameters was based on the minimum and maximum values of each parameters obtained during the analysis from the selected 13 JFM villages. Each variable based on their ecological significance have been assigned specific points whose sum total, ultimately helped in assigning the final rank to the village.

Table 10. Assigning Point Values to Different Ecological Parameters

Sr. No.	Parameters	Points Assigned				
		2	4	6	8	10
1.	Carbon Sequestration (t/ha/yr)	0.2-1.5	1.6-2.8	2.9-4.1	4.2-5.4	5.5-6.7
2.	Gochar land/ACU (ha)	0-0.55	0.56-1.1	1.2-1.65	1.66-2.2	2.3-2.75
3.	Forest/House-hold(ha)	0-2.0	2.1-3.9	4.0-5.8	5.9-7.7	7.8-9.6
4.	Shannon-Wiener Diversity Index	0-0.22	0.23-0.44	0.45-0.66	0.67-0.88	0.89-1.1
5.	Simpson's Dominance Index	1.0-0.80	0.81-0.60	0.61-0.40	0.41-0.20	0.21-0.0

➤ **Socio-economic Parameters:**

Socio-economic features selected for the present study for ranking of the JFM villages are presented in Table 11. The weightage of the points assigned in this case mainly concentrated on the economic returns and the awareness about the JFM amongst the villagers.

Table 11. Assigning Point Values to Different Socio-Economic Parameters

Sr. No	Parameters	Points Assigned		
		10	5	0
1.	Initiation of JFM program	Self Initiated	NGOs/Forest Department	-
2.	Membership in the VSS	100%	>50%	<10%
3.	Involvement of women	Active participation in Decision making process	Salient membership in the Committee	No role
4.	Awareness	No cases of illicit felling	Illicit felling from the neighboring village due to lack of protection but not from this village	Illicit felling by members of VSS
5.	Fodder requirement	Sufficed from agri-waste and gochhar area	Dependent on the forest as well as on agri-waste	Totally dependent on the forest
6.	Landless (%)	>50%	>10% and <50%	<10%