VEGETATION MAPPING OF THE NILGIRI BIOSPHERE RESERVE

The vegetation mapping of the Nilgiri Biosphere Reserve (NBR) initiated in July 1989 in collaboration with the Centre for Ecological Sciences, Indian institute of Science, Bangalore is nearing completion. The map is to be printed in four sheets with an additional sheet showing bioclimates, eco-floristic zones, relief, drainage etc. After extensive ground surveys and an analysis of other vegetation maps of the French Institute the legend of the map has been finalised with 65 distinct vegetation types.The maps are to be printed in 12 colours. Base sheets for three of the maps have been prepared. SPOT and LANDSAT TM satellite interpretation of the vegetation and land use has been completed for 3/4 the of the area. The rest of the interpretation is to be completed by the end of September. It is proposed to acquire IRS IB images of the current season to verify some of the interpretation. The finalisation of the vegetation map is to be completed by November 1992 after which the final map preparation and printing is to be taken up. Population figures of the 1991 census is awaited which is to be incorporated into the final map. Considering the importance of the area for the conservation of bio diversity and the necessity of constant monitoring as a part of the scientific programme of the NBR it has been proposed to digitise the vegetation and land use map and put it on a geographical information system. The final printing of the vegetation map as well as the creation of a geographical information system is to be taken up during the current year.

PROGRESS REPORT AND SCHEDULE OF WORK ON THE NILGIRI BIOSPHERE RESERVE LANDUSE AND VEGETATION MAPPING PROJECT

The Nilgiri Biosphere Reserve (NBR) landuse and vegetation map is to be prepared at the scale of 1:100,000 in four parts with an additional sheet showing the bioclimates, eco-floristic zones, relief, drainage basins, etc on the scale of 1:250,000 (refer figure). The maps No:2,3,4 and the overall features map is to be completed as a part of my doctoral work.

The preparation of these maps involve the following:

1. Preparation of base maps: Base maps for the sheets 2,3, and 4 have already been prepared by M. Pertus.

2. Satellite image interpretation: The satellite image interpretation of the maps 2, 3 and 4 is to be done in four parts. The satellite interpretation of three parts is completed. The last part is to be completed by the 20th of September,1992.

3. Preparation of First Draft: A first draft of the satellite image interpretation in coloured ammonia print for each of the four parts is to be prepared. Such drafts for two parts is ready. Work is to be done on the third part that should take about 10 man-days.

4. Preparation of a Final Draft: The vegetation interpretation data is to be reformatted according to the the format of the final map. The final draft is to be prepared for the sheets 2, 3 and 4 overlaying these on base maps that have already been prepared. This would take about 6 weeks. It would be desirable to have these final drafts ready before M. Pascals visit to India so that the map can be finalised with his expert opinion and discussions.

5. Preparation of the final map: After the finalisation of the map and working out details of format, authorship, legend etc., the final colour seperation of the map to be printed in 12 colours can be taken up. This would require about 8 weeks of work.

6. Permission for Printing the map: Clearance is required from the Government of India for the printing of the maps. The clearances are to be sought from the Survey of India and the Ministry of Defence. The help of the Department of Environment and Forests is to be sought to hasten up the process.

7. Printing of the map: The final printing of the map is to be taken up after all the formalities is over.

GEOGRAPHICAL ANALYSIS OF NBR

Introduction :

Data base availability : Themes → Constant
→ Variable

Parametrization of various themes.

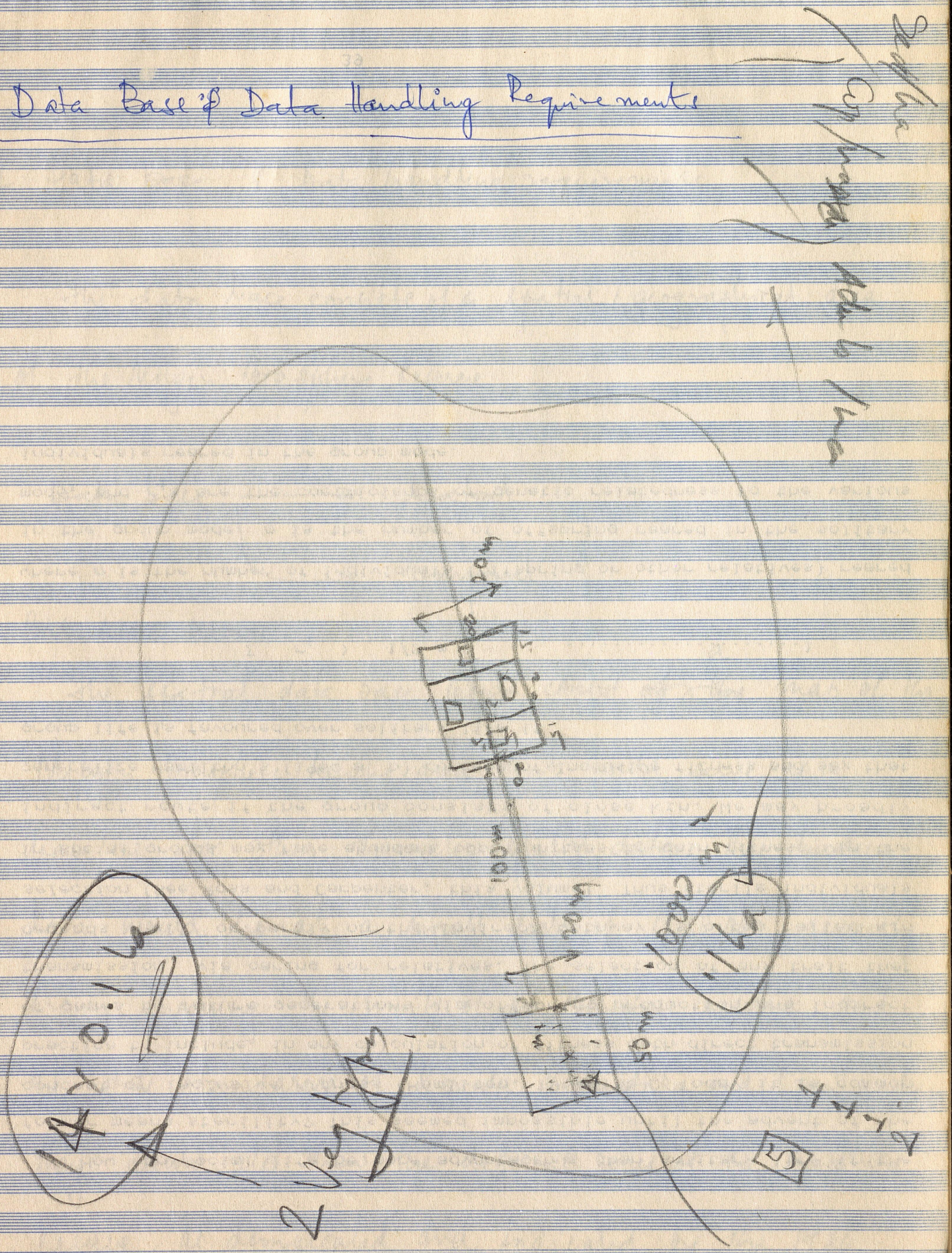
Scheme of analysis : Elements of the landscape

Framework for analysis
- * patch
- * Networks
- * Points.

Different partitionings
- Continuums : gradients
- Diffusionary : gradients along all directions
- Discreteness.

Analysis :
- Correlations
- Spatial correlations.
- Surfaces in time & space.
- Bio physical zones
- Domains
- Correspondence - one to one mappings.

Data Base & Data Handling Requirements



1 Data Base & Data handling requirements

The data base consists of the spatial / geographical area of the Nilgiri Biosphere Reserve

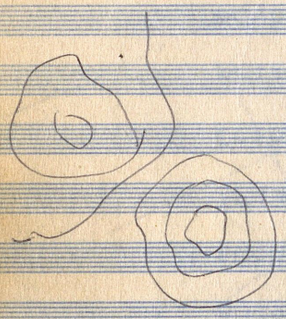
Data Base ——→ spatial
└——→ temporal.

1.1. BASE LINE MAP

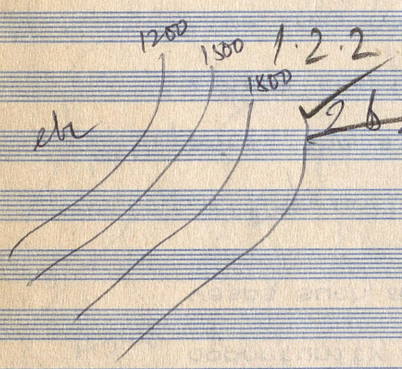
The spatial data base would consist of a map of the Nilgiri Biosphere Reserve area that would serve as a base line for other thematic spatial data. This baseline data would be at a small scale of 1:50,000, accurately drawn, showing the limits of the Biosphere reserve, and the state boundaries of Kerala, Karnataka and Tamilnadu. They would also show the different zones of the Biosphere Reserve, as demarcated and indicated by the 1980

survey of the biosphere reserve. These would be digitised from 21 seperate maps of 55cms x 55cms of the Biosphere Reserve that are contiguous to each other.

1.2. SPATIAL THEMATIC MAPS.

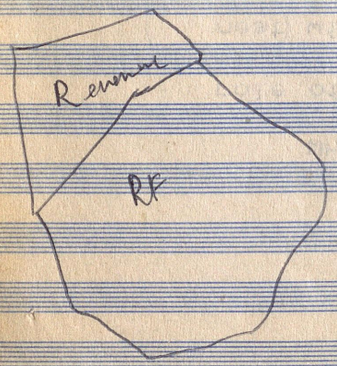


1.2.1
2a. Contour ~~maps~~ lines of the area showing the slopes and elevation of all the ~~points~~ in the area. This could be on the scale of 1:50,000 or 1:250,000 and a defined contour interval of 20m and 100m respectively, or of select chosen contours.



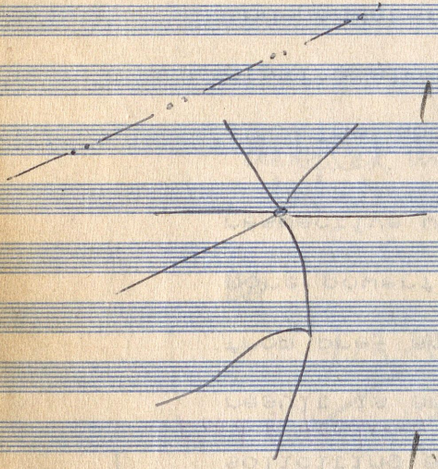
1.2.2
2b. Bio-climates map and average annual rainfall ~~figure of~~ ~~select~~ values of 350 stations in the area. This would be at the scale of 1:250,000 and 1:500,000.

1.3. SPATIO-TEMPORAL THEMATIC MAPS:



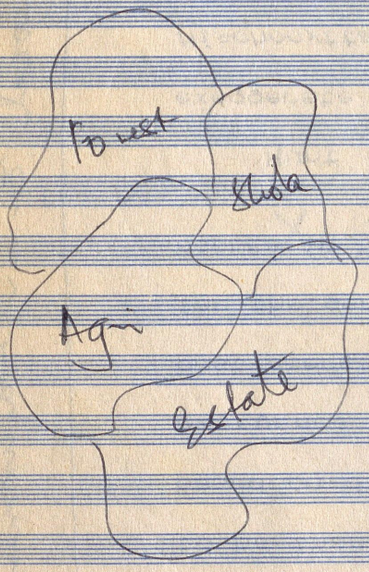
~~3a.~~ 1.3.1 Cadastral limits: giving the limits of the reserve forests and village/revenue lands on a scale of 1:50,000 and 1:250,000 at different periods for which the survey was conducted: ie, 1847, 1905, 1950, 1970.

1.3.2 ~~3b~~) Water Resources: Perennial streams as line features, and water bodies and human artifacts like channels and pipe line altering flow, swamps, etc. on a scale of 1:50,000 and 1:250,000 at different periods of survey 1905, 1950, 1970, 1990.
1847



~~3c~~)
1.3.3 Communications: Roads, paths, etc as well as power and telephone lines etc. as linear elements forming a network over the geographical area. These will be on a scale of 1:50,000 and 1:250,000 at different periods of survey 1847, 1905, 1950, 1970, 1990

1.3.4
~~3d~~) Land use: These will be represented as patches of homogenous vegetation of forests, grasslands, scrub, cultivation, estates, habitation, plantations etc. For the current scenario, 65 vegetation types are identified with the help of satellite imageries and extensive ground truthing. These would be on the scale of
1:50,000
1:250,000
1:100,000
available at different periods of survey
1847, 1905, 1950, 1970, 1990.



3e) Human population

1.4. MISC. SPATIO-TEMPORAL FEATURES:

✓ Various other miscellaneous spatio-temporal features would be represented on a map ~~too~~ — mainly point features like polluting industrial sources, urban areas, archeological remains of different types, tourist centres, shepherd camping sites; triangulation points or error adjustment points; Habitations of different ~~as~~ communities etc, Vegetation sample points, detailed village survey locations etc. These features can be represented on 1:250,000 and 1:50,000.

~~DD~~

1.3.5
~~3e.~~ Human population figures from the 1871 census onwards taken every 10 years till 1991 can be represented on the map on the scale of 1:250,000 for every ~~gram~~ panchayat village.

1.3.6
✗ ~~3f.~~ Live stock census figures from 1900 onwards taken every 5 years can be represented on the map for each panchayat village. These can be put on 1:250,000 scale.

2.0 DATA HANDLING REQUIREMENTS OF GIS.

The GIS software should have adequate and user-friendly interactive systems for feeding in data and editing the data with an easy conversion from raster to vector mode and vice versa.

On the Nilgiri Biosphere Reserve data base, the base map of the NBR would be digitized on a 1:50,000 scale, and all other thematic and miscellaneous maps will be at various scale like 1:250,000; 1" = 1 mile; 4" = 1 mile 16" = 1 mile, 1:100,000 etc. In addition numerical data would be available on a raster mode as X & Y coordinate values on X & Y of

R Squared 0.2626068
No. of Observations 15
Degrees of Freedom 13
X Coefficient(s) 0.04042048
Std Err of Coef. 0.01878565

the geographical base-line map.

The GIS system should be able to layer these various spatio-temporal themes and miscellaneous data ~~on the base~~ which would be on various scales, on the base line maps. These thematic maps should be automatically overlaid with "Local Error Adjustment" based on the control points ~~suggested~~ or control lines suggested or inputed by the user on the base map and the thematic map. Further there should be a facility of interactive ~~editing and~~ shape manipulation and editing to make the fit of the overlay on the overlays to the satisfaction of the user.

And finally there should be a facility to overlay raster data on the baseline map of the NBR.

In Summary:

2.1) Overlay facility ~~and storage~~

2.2) Operation at different scale

2.3) local Error Adjustment for overlay necessary base and control points

2.4) An Interactive facility for overlay adjustment

2.5) Overlay of Raster data.

2.6) Vector - Raster conversions

2.7) Import - Export facility with other softwares standard software.

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3.0 GEOGRAPHICAL ANALYSIS OF THE NBR

A spatio-temporal analysis of the NBR is done with the cartographic data base outlined above, with the use of additional data that may help in parameterization of the thematic maps for relevant for our analysis. The geographical analysis can be looked at in the following levels/hierarchical

1. Thematic analysis
2. Multi-thematic analysis
3. Parameterised - thematic analysis.
4. Parametrised - multi-thematic analysis

203 NEST MAP FIRST FILE
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3.1. Thematic analysis & ~~Parametrised thematic analysis~~.

3.1.1 a. Seperation of the geographical area into bio-physical zones based upon the contour maps. and calculation of areas on the following criteria.

CONTOUR)

a) Elevation above sea level.
~~in~~ ~~Parametrised by slope~~
~~Slope~~ ~~Parametrised by catchments.~~

3.1.2 b. Seperation of ~~zones~~ the geographical area into bio-physical zones based on the bio-climates map. and calculation of areas on the following criteria.

BIOCLIMATES)

i) Rainfall isohytes.
ii) Rainfall regimes.
iii) temperature
(iv) d) Dry months.
~~Parametrised by total water resources integral~~

3.1.3 c) Changes in legal categories of land over time.

CADASTRAL)

RF areas.
Village forest areas
Reserve lands. ~~Parametrised by access.~~
~~of different groups - gradings~~

3.1.4 d) (i) Perennial stream order / Seasonal stream order computation.

WATER RESOURCES.)

ii) Stream length ~ Stream order relation.

iii) Changes in stream orders over time.

3.1.5 e) Changes in communication length over time.

a) Roadways :
b) Paths
c) Railways.

Length to township / commercial centres

Parametrised by accessibility of areas with values ranging from 1 to 0, on

3.1.6 f) Land use. Hab scale to

Changes in land use over time w.r.t.

a) Agricultural areas
b) Natural forest areas
c) Commercial Estates
d) Forest Plantations - species wise
e) Habitation area
f) No. of Habitations.

Parametrised on the basis of cover

g)

3.2. Multi thematic analysis. / Parametrised multi-thematic maps.

These use the method of overlays and to determine relations between the thematic data available.

2d 2000 2,50,000

Further data from field surveys and other sources data are used to parameterise different ecological and socio-economic-cultural aspects and correlate with the geographical information

sample village surveys.
Further data from field surveys and other sources are used to parametrise ecological and cultural objects and to analyse the temporal changes in resource use.

2

~~[illegible]~~

~~[illegible]~~

In general the thematic ~~data~~ maps can be viewed as contours of different parameters in the NBR area

A series of overlays of different continuous variables represented as contours over the NBR area, and various nominal or discrete variables represented as patches over the entire area. These nominal and continuous variables would be parametrised from the cartographic data base with the help of additional information from field surveys and other

potential reproductives.

Communal agriculture / subsistence agriculture / commercial agriculture

agricultural extension

10/—

sources. Examples of such variables would be slope, elevation, biomass, species diversity. Area cover, tree density, human population density, livestock density, accessibility etc.

The method of analysis would essentially be overlaying these variables and determine unions, intersections, and compliments of them; & and to ease

subject these to statistical analysis and determine significant correlations between these various parameters.

Analysis would also be done on the rates of these parameters with distance along different directions and determine diffusional directions of the parameters over the landscape.

Then the GIS facility should have features to overlay and compute unions, intersections, and compliments with a facility for ~~programming~~ custom / on interaction and custom programming for analysis.

Nadugani (2)

Nadurattam

Mandagadi — Anaikatti

Sirur (1) (2)

Mangalapatti