REMOTE SENSING FOR LAND-USE PATTERN ANALYSIS AND BIO-MASS ESTIMATES

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TECHNICAL REPORT 11

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Aim: Study of land-use patterns and estimate of biomass for the selected regions in/around Sirsi.

1. Introduction.

Remote sensing of surface features is needed in order to minimize the manual labour of collecting data, especially when large areas are involved. In order to arrive at a methodology for collection and processing of data, a remote sensing survey of a part of Sirsi Taluk, covering an area of about 100 sq.kms (Fig. 1) was conducted in February - March 1984.

The area under consideration has been the subject of extensive study in the ECOLOGY PROGRAM of the Institute. Implicit in this experiment of remote sensing survey is an attempt to establish an aerial/satellite data acquisition and processing system on the basis of which one could, conceivably, arrive at the seasonal variation of land - use patterns and biomass estimates, with minimal ground collection of data.

It is expected that the present mode of data acquisition (in the form of aerial pictures) will, in future, be replaced by on-board (digitals) computer compatible tapes, thereby facilitating the automatic

analysis of remotely sensed data. At the moment, however, the digitized version of the Color infrared images will be used to develop suitable algorithms for land use pattern analysis bio-mass estimates. Ihe digitization is accomplished by a scanner. See Fig. 2 for the block schematic of the Institutes Interactive Image processing System whcih is used in the automatic interpretation of selection frames of the Sirsi data.

2. DATA ACQUISITION RELATED TO SIRSI TALUK

A schematic of the Sirsi remote sensing operation is shown in Fig.3, wherein the part enclosed by broken lines has been completed.

Ihe flights were made using the Institute's aircraft (Pushpak), fitted with Hasselblad cameras (Table 1) containing Kodak aerial films (Table 2). Optial filters have been chosen to match the film characteristics and the image data specifications for classification.

In general, the scale of photography is 1:20,000 with an overlap of 60% and side lap of 40% to facilitate preparation of a mosaic and a stereoscopic analysis of the image data (for volumetric estimates). Three sets of flights were made over the selected regions of the Sirsi Taluk. See Fig.1 for details of the (flight) passes made.

On each day, the films were processed immediately

after the flights, in the improvised dark room at Harihar Polyfibers. The image frames have now been indexed and cleared by the DGCA (security division) of the Govt. of India.

Table 1. Camera Details

Camera : Hasselblad EL 500/70

No. of Cameras : 3

Magazines : 16 ft rolls

Lenses 80 mm focal length (f/28)

Film format : 70mm.

Frame format : 55mm x 55mm.

Overlap in films : 60%

Side lap in films : 40%

Scale of photography : 1:20,000.

Table 2. Films used.

	Film (Kodak)	Filter used	Camera setting	Intervalometer
1.	CIR 2443 sp 494 70mm	Yellow	11 Apr 1/125 sec	12 sec
2.	Trix Aero-graphic 2403 sp494 70mm	Yellow	8 Apr 1/125 sec	12 sec

Table 3. (See also Fig 1.)

Flight Passes and frames

Date	Film	Flight Pass	No. of frames
19.2.1984	CIR/	A	72
		B	74
	Pan	A	64
		B	83
20.2.1984	CIR	C	29
		D	19
		E	78
	Pan	C	70
		D	46
21.2.1984	CIR	F	83
		G	71
		H	69

The black and white prints made from the CIR/ Panchromatic frames have been mosaicked with the toposheet of the area forming the base map. In preparing the mosaic, the ground features as found on the contact prints as visually matched with those on toposheet, thereby generating a 'semi-controlled' mosaic. As Pushpak's flying height above terrain does not remain constant, and the terrain features are also variable, a completely controlled mosaic cannot be prepared with the existing prints. However, in our case, the mosaic merely serves to provide us with

information on the actual area coverage, scale of photographs gaps in the flights as also the frames relevant to photointerpretation.

3. VISUAL PHOTOINTERPRETATION

In order to develop a suitable procedure for visual interpretation, we require representative ground data for the area under study. To this end, the following test sites have been chosen for detailed examination:

Goudadoppa, Marigudde, Bengale, Kalgundikoppa Navanagere, Hebbatti, Banavasi, Kalli and Bidarahalli.

The features identified in these sites are: Agricultural/nonagricultural vegetation (with details on growth stage, visual features, state (stressed/ non-stressed), height, neighbouring vegatation, soil and the like), nature of terrain, water bodies and cropping pattern employed (in the case of agricultural crops).

In the interpretation laboratory, the CIR frames are enlarged to 4 times on a modified B2 Enlarger . The interpreter delineates the various land - use categories and crops based on the photointerpretation key given in Table 4, which is formulated on the basis of the ground data from the test sites prior to (and, when necessary also synchronous with) the flight

operations.

A part of the aerial CIR data has been interpreted. Fig.5,6 and 7 give results of such an interpretation. -

The following work remains to be done:

1. Completion of visual interpretation and area calculations for land - use patterns analysis.
2. Stereoscopic interpretation for (volumetric) biomass estimates.
3. Digital processing of selected CIR frames.

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Appendix

ABBREVIATIONS USED IN TABLES

C = Coarse

F = Finger Print like

I = Irregular

L = Linear

M = Medium

Me = Meandering

O = Oval

R = Regular

RF = Rectangular Field

Ro = Round

S = Smooth

SF = Square Field

SS = Star-Shaped

U = Uniform

V = Varying

Table

KEY FOR INTERPRETATION OF CIR IMAGERY

Units	Feature for identification	Elements of Interpretation				
		Tone	Texture	Pattern	Shape	Size
1	2	3	4	5	6	7
A. AGRICULTURAL						
A1 Rice Paddy	Paddy fields appear as compact square blocks in bright purplish pink color to dull brownish pink with irregular rosy patches, medium to smooth. Harvested field appears in brownish tone with dull blue background	Purplish pink with rosy patches -dull brownish pink	M to S	R	RFtoSF	V
A2 Sugarcane	Crop appears medium pink to bright pink when young and dull pink to brownish rosy when mature with canopy protruding well above the soil surface harvested fields are seen in dull white and dull grey to dark grey when the field is burnt.	Medium pink to brownish rosy	M to C	R	RF	V

Contd.

1	2	3	4	5	6	7
A3 Ragi	Pure crop of ragi appears in medium pinktone with medium texture. Some times dry soil can also been seen in between where the crop growth is not uniform or crop is young	Medium pink	M	U	RF or O	V
A8 Pine-apple	Pineapple field are seen in bright pink to brownish rosy with canopy protruding above the soil surface. The fields are seen with columnar lines of planting bunds side by sides.	Bright pink	C	U	RF	V
A9 Other crops	Unidentified crops can be put in this category	Pink	S to M	R	RF or O	V
A10 Fallow land	Uncropped recently ploughed fields appear very light blue with smooth texture. A field ploughed longback can be seen with dull white tone and Medium texture brown patchy growth of grass appear in medium texture and field bunds can be seen very easily. Soil in between can be seen unevenly exposed because of weeds	Light blue to dull white with brown patches	S to M	U	RF or O	V
B. ORCHARDS						
B1 Coconut	Trees with star shape canopy appear in bright pink tone. Individual canopy has coarse texture. Trees often cast shadows whose blunt edge can be seen. Many time pink background may also appear where some crop or vegeta-tion are growing.	Bright pink	C	R	SS	V

1	2	3	4	5	6	7
B2 Areca	Look similar to coconut orchards but has a very dense and coarse texture. Star shape canopy is not very clear. Tree shadows can be seen.	Bright pink	C	I	SS	V
B3 Mixed Others	A mixed orchard of coconut with arecanut and sapota with guava appears with well grown dense canopy where individual species cannot be seperated.	Medium pink to scarlet pink	M toC	I	RO and SS	V
D. FOREST						
D1 Plantation	Regularly planted trees mostly on contoars with medium pink canopies of varying sizes casting dark shadows. These plantations covery very larger area at a stretch.	Medium pink back-ground white or brownish pink	M	R	F	L
D2 Natural	Scattered trees of varying size usually growing on hilly terrain. Plant canopy has bright to medium pink tone and coarse texture.	Bright to medium pink	C	I	I	L or NS
E Misc. lands						
E2 Waste barren lands	Large pieces of land having no field bunds only same grasses in brownish pink tone or stones in light brown tone	Brownish pink to light brown	M to C	I	I	V

Contd..

1	2	3	4	5.	67	7
E4 Marshy land	Areas by the sides of water bodies having stagnant water. Marshy vegetation appear in purplish pink tone with medium texture	Purplish pink	M	I	I	V
F. Water bodies						
F1 Tanks	Fairly large water bodies with irregular shape bund on one side and streams towards higher gradient side. Weeds appear in different tone of pink from purplish to rosy pink	Light blue to dark blue with patches of purplish pink to rosy pink	S to C	I	I	V
F2 Streams and drains	Blue or dull bluish white depending upon presence or absence of water. Some times on the margin pink line can be seen because of some vegetation.	Blue or dull bluish white	S to M	I	Me	V
F3 Rivers	Dark blue water body with marshy land irregularly bordering on both sides.	Dark blue	S	I	Me	V
F6 Ponds and Other water bodies	Appear in dark to light blue patches sometimes surrounded by some vegetation appearing pink in tone	Dark to light blue/ pink	S	I	I	V

Contd..

1	2	3	4	5	6	7
G. Public Use						
G1 Road	Tar roads appear as medium blue lines of uniform width. Unmetelled road appears dull white usually tree lin- ingon both sides. Wavy course.	Medium blue - dull white	S	R	-	-
G3 Habi- tation	Tiled roof tops of houses appear as light grey rectangles cemented roofs appear dull white to dull grey. Individual houses have smooth texture but overall texture is coarse.	Light grey dull white	S to C	R	I	V

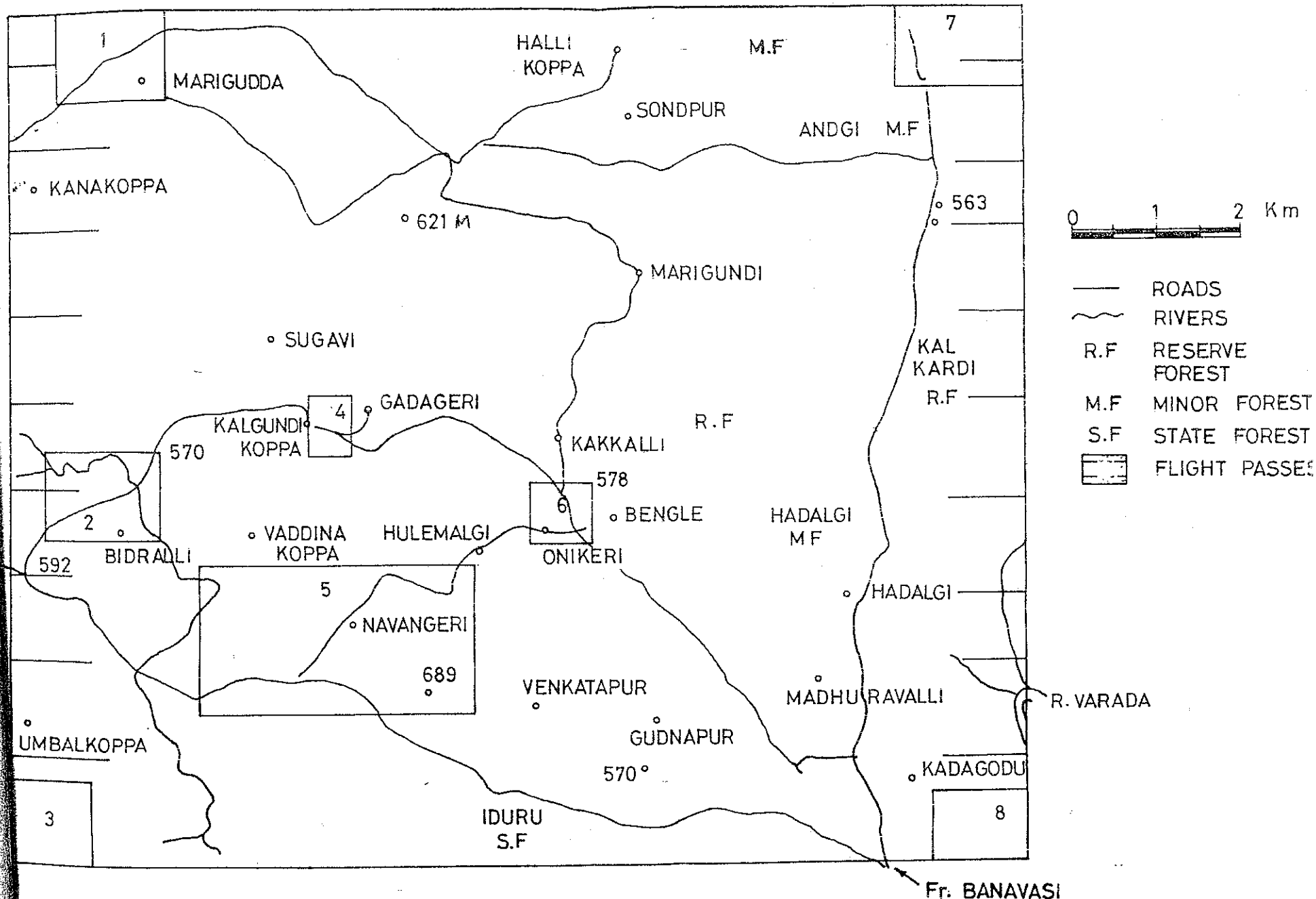

1
MARIGUDDA
HALLI KOPPA
M.F
7
SONDPUR
ANDGI M.F
KANAKOPPA
621 M
563
0 1 2 Km
MARIGUNDI
ROADS
RIVERS
R.F RESERVE FOREST
M.F MINOR FOREST
S.F STATE FOREST
FLIGHT PASSES
SUGAVI
KAL KARDI
R.F
4
GADAGERI
KALGUNDI KOPPA
570
R.F
KAKKALLI
578
6
2
BENGLE
HADALGI M.F
VADDINA KOPPA
HULEMALGI
BIDRALLI
592
ONIKERI
HADALGI
5
NAVANGERI
689
VENKATAPUR
MADHURAVALLI
R. VARADA
UMBALKOPPA
GUDNAPUR
570
KADAGODU
3
8
IDURU S.F
Fr. BANAVASI

FIG. 1

Fig.2

HP L 1000/45 INTERACTIVE DIGITAL IMAGE PROCESSING SYSTEM

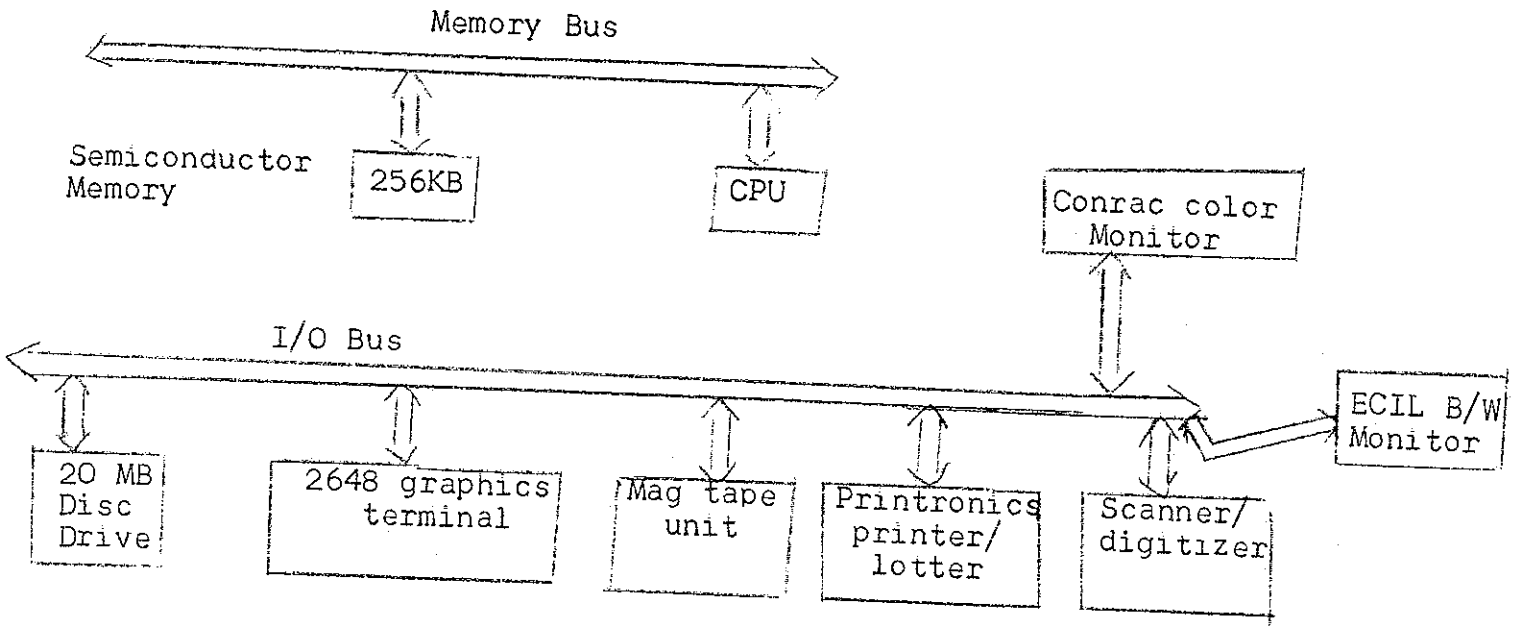
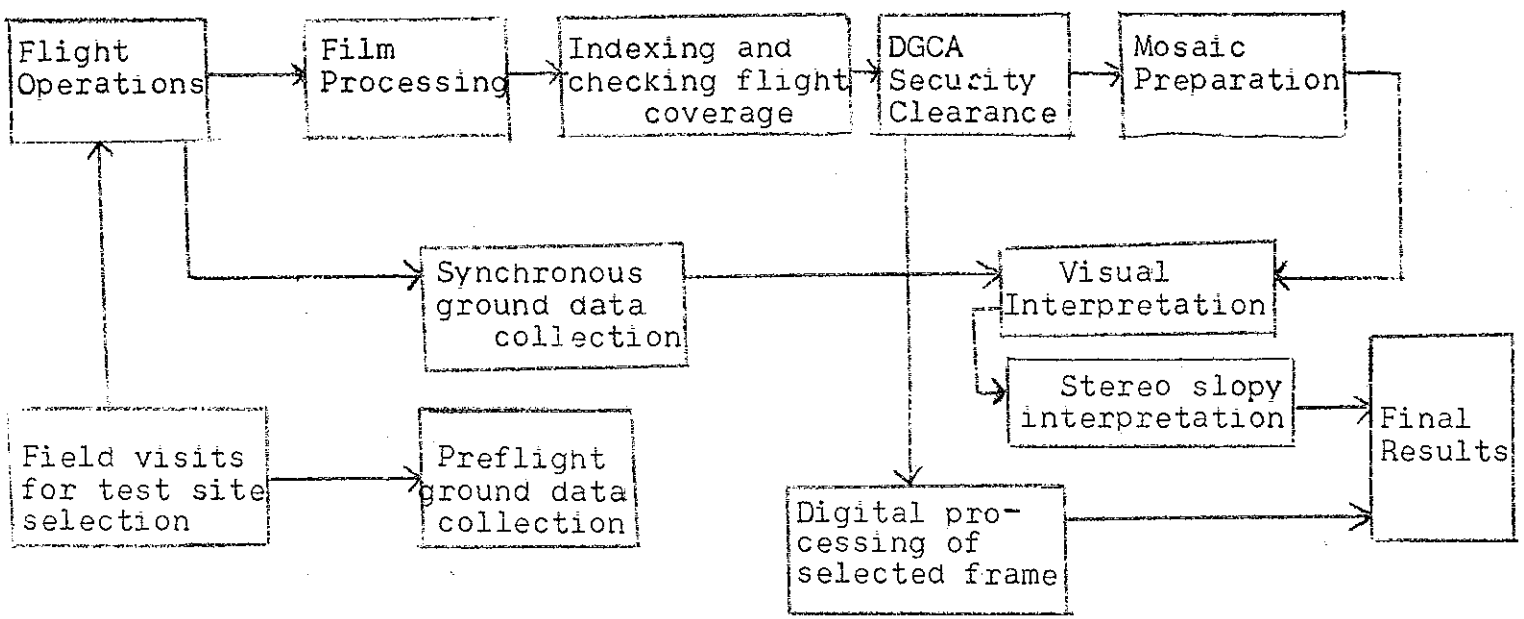
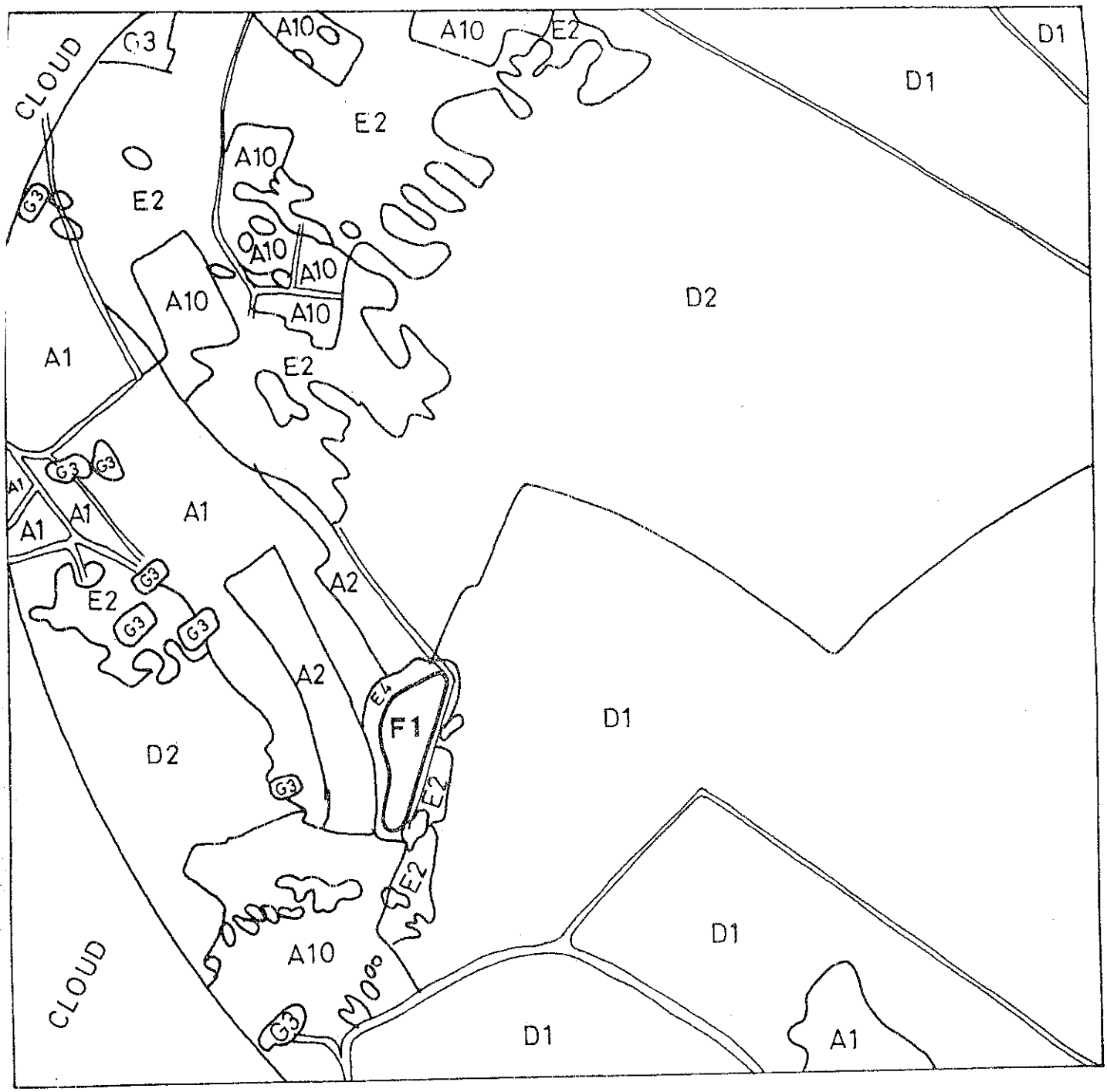


Fig.3

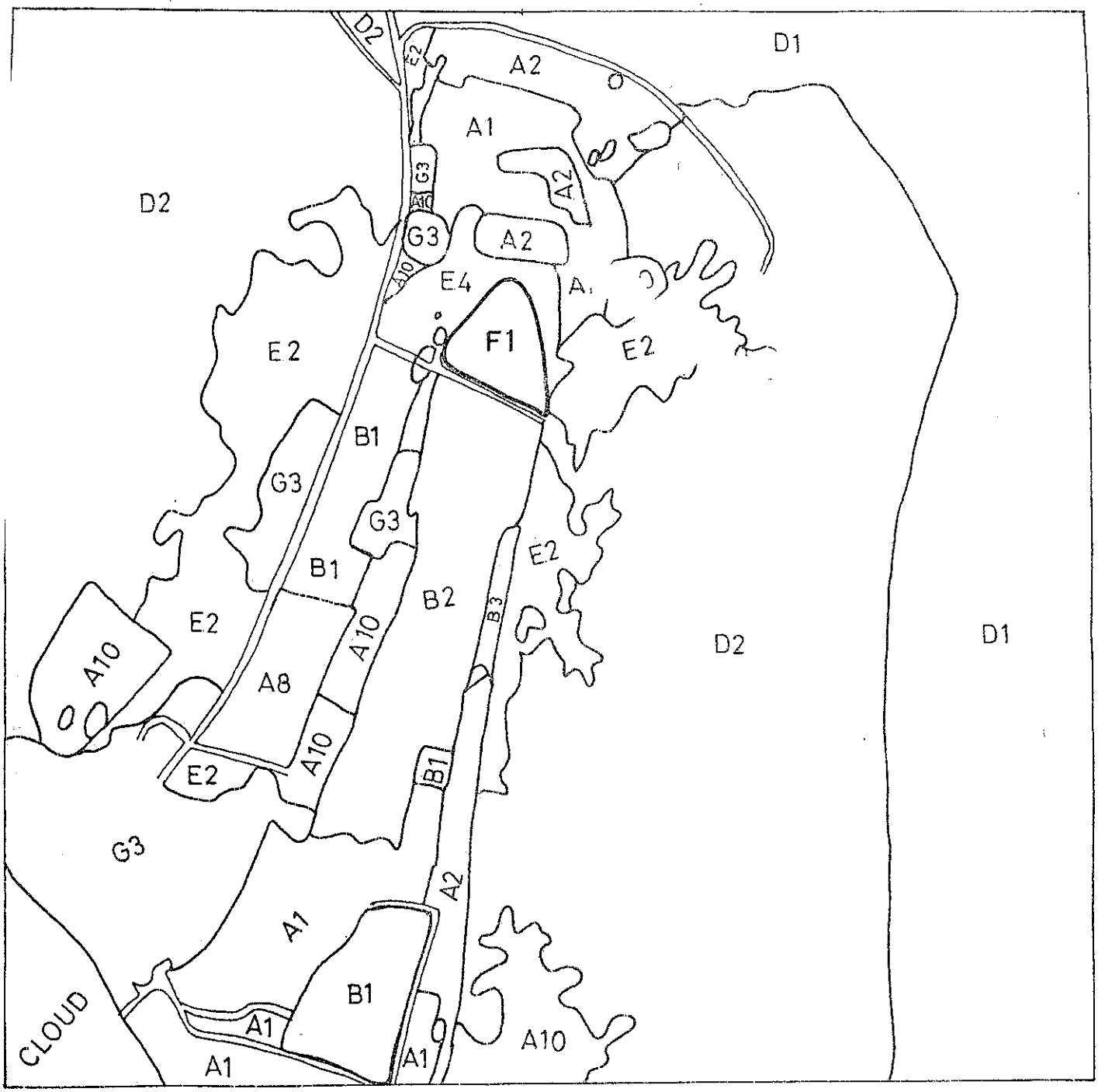
SCHEMATIC DIAGRAM OF THE SIRSI REMOTE SENSING OPERATION





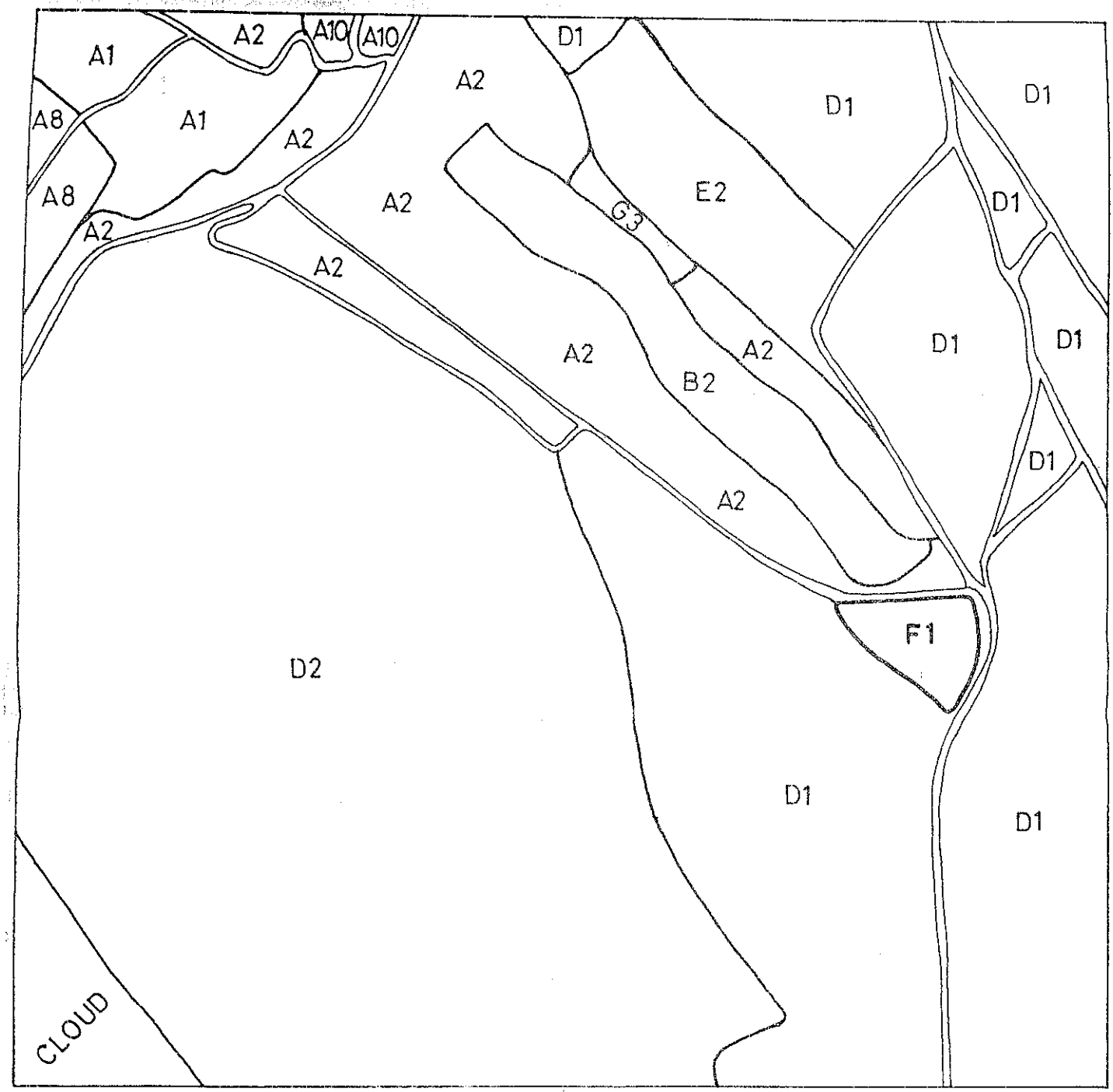
FLIGHT = E
RUN = 1
FRAME = 26
DATE OF FLIGHT = 20-02-84

Fig 5



FLIGHT = F
RUN = 1
FRAME = 27
DATE OF FLIGHT = 21-02-84

Fig. 6



FLIGHT = G
RUN = 1
FRAME = 30
DATE OF FLIGHT = 21-02-84

Fig. 7