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**MURUDESHWAR POWER  
 CORPORATION LIMITED**

REGD. OFFICE :  
 "MURUDESHWAR BHAVAN"  
 604/B, GOKUL ROAD,  
 HUBLI - 580 030. INDIA.

**Murudeshwar Power Corporation Ltd.,**  
**NAVEEN complex, 7<sup>th</sup> Floor,**  
**14, M.G.Road,**  
**BANGALORE-560001.**

**Dandeli Mini Hydel Project.**  
**CATCHMENT AREA TREATMENT PLAN.**

The Independent Catchment area at the proposed damsite is only 40 Sq.Kms. and this area has to be provided with Catchment area treatment wherever necessary.

The Catchment area of the proposed damsite lies in a comparatively steeper valley. Left bank is steep and rocky, while the right bank is gently rising with thin soil cover. The reservoir zone is occupied by massive granite formation and forest cover. Because of this the occurrence of soil erosion is found to be minimum. In view of this there is not much problem to be faced with regard to Catchment area treatment. In addition as the scheme is designed as a "RUN OF THE RIVER SCHEME" the storage from the yield from the dams own catchment is very less. Further the water flow from the upstream Supa dam is sedimented water which will not cause any soil erosion.

In view of the above even though it may not be necessary to provide any catchment area treatment it is thought of to provide some catchment area treatment in the minor valleys by the construction of protective walls, earthen bunds etc.,. A provision of Rs.3.00 lakhs is provided for Catchment area treatment.

**For Murudeshwar Power Corporation Ltd.,**


  
**NAVEEN R SHETTY,**  
**JOINT MANAGING DIRECTOR.**

EVALUATION PARAMATERS FOR LOSS OF FOREST

- A. Loss of value of timber, firewood and minor forest products on annual basis including loss of man power per annum of people who delivered live hood and wages from the harvest of these commodities.

i)	Loss of value of timber as per enumeration in 79.50Ha. of forest area (40195 Cu.M at Rs.9,000 / Cum as per value assigned to nearest Cum worked out	3618.00
ii)	Fire wood approximately 170567 Cum @ Rs. 350/ Cum	597.00
iii)	Minor Forest produces (Aproximately)	2.50
iv)	Manpower approximately man days @ Rs. 40/- per man day per year for 50 years	Nil
B.	Loss of animal husbandry productivity including loss of fodder	
i)	Animal husbandry	Nil
ii)	Fodder in Ha. @ 500.00 per Ha. per annum for 50 years	20.00
C	Cost of human settlement	Nil
D	Loss of public facilities and administrative infrastructure on forest land or which would required forest land, if these facilities were diverted due to project.	Nil
E	As per thumb rule prescribed. Environmental loss due to loss of forest area to accrue over a period of 50 years @ Rs. 181 lakhs per Ha. for 79.50Ha.	14389.50
F	Suffering of oustees	Nil
G	Others (including cost of forest land)	49.55
	<b>Total loss for 50 years (A+B+C+D+E+F+G)</b>	<b>Rs.18,676.55 lakhs.</b>
	<b>Total loss per annum</b>	<b>Rs.373.53 lakhs.</b>

For MURUDESHWAR POWER CORPORATION LTD.,

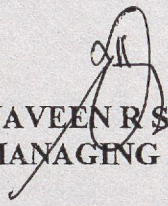
  
**NAVEEN R SHETTY**  
**JT. MANAGING DIRECTOR**

ANNEXURE 'A'

1.	Maximum capacity of power transfer	18MW
2.	Utilisation factor	85%
3.	Energy transfer (Annually)	130000000 Units
5.	Net energy transfer	130 Millions units
6.	Power tariff i.e. Rs. 3.00 per unit	Rs 390 Millions per year
7.	Generation profit component 16% on equity share i.e., $450 \times 16/100 = 72.00$ millions.	Rs72.00 Millions per year

NOTE: All the above figures show the sales/profits for one year only.

For MURUDESHWAR POWER CORPORATION LTD.,

  
NAVEEN R. SHETTY  
JT. MANAGING DIRECTOR

EVALUATION OF BENEFIT NOTWITHSTANDING LOSS OF FOREST

D) Increase in productivity to the  
Specific Project

Assumption

**Power Generation : 18 MW.**

**Load factor 85%**

**Average value added: Rs. 4.00/kwh**

**Energy sent out per year= 130000000 Units**

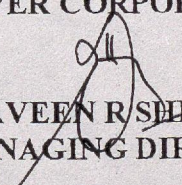
**Value added =130000000xRs 4 = Rs.5200.00 lakhs..**

Prorata cost benefit due to the project in  
Haliyal Division :

**Rs.5200.00 lakhs..**

- i) Benefit of economy : **There will be growth in agriculture and Industries..**
- ii) No. of population benefited : **Total population in Karnataka State**
- iii) Employment potential : **150 Nos.**
- iv) Cost of Acquisition of Facility on non forest land wherever necessary : **Nil**
- v) Loss of :
- a) Agriculture : 3.71 Ha. @ Rs. 1.50 lakhs / Ha..  
Rs.5.57 lakhs.
- b) Animal husbandry due to diversion of forest land : **Nil**
- Cost Benefit Ratio : (5200/373.53 ) = 1 : 14

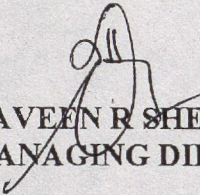
**For MURUDESHWAR POWER CORPORATION LTD.,**

  
**NAVEEN R. SHETTY**  
**JT. MANAGING DIRECTOR**

**PARAMETERS FOR EVALUATION OF BENEFIT NOT WITH STANDING  
LOSS OF FOREST**

SL NO	PARAMETERS	Nature of proposals	Remarks
1	Increase in productivity attributable to the specific project	Rs390.00 Millions /year	Refer Annexure "A"
2	Benefits to economy	Rs.520.00 Million/year	
3	Number of population benefited		In Karnataka State
4	Employment Potential due to the project	10000 Nos	Ultimate employment
5	Cost of Acquisition of Land	Rs. 14.00 Lakhs	3.71 Ha. @ Rs. 3.75 lakhs / Ha.
6	Cost of supply of firewood to the workers residing in or near forest area during the period of construction	Rs. 2.250 lakhs.	@ 1 Kg / Labour /Day for 365 days
7	Payment against replantation charges (Rs. In lakhs)	Rs.43.15 lakhs.	79.50 Ha. @ Rs.54275/-

**For MURUDESHWAR POWER CORPORATION LTD.,**

  
**NAVEEN R SHETTY**  
**JT. MANAGING DIRECTOR**

LAND REQUIREMENT FOR THE DANDELI MINI HYDEL PROJ

Sl. No.	Description	Area in Ha as per drawing survey
1	Submergence area of the River course	123.71
2	Submergence area of Islands within river course	12.31
3	Submergence area other than river course and Islands	59.06
4	Land required for infrastructure	15.00
<b>Total Land requirement</b>		<b>210.08</b>
<b>Total area of the Forest land submergence area other than river course (210.08-123.71)</b>		<b>86.37</b>

Reference to toposheet  
48 V/7

48 V/12

Comparative appraisal of the alternative sites

Sl. No.	Description	KPTCL Original Proposal	MPCL Proposal - I	MPCL Proposal - II
1	Location	15° 15' 30" N 74° 36' 0" E	15° 15' 30" N 74° 36' 0" E	15° 15' 14" N 74° 34' 10" E
2	Independent Catchment Area	70 Sq. Kms.	70 Sq. Kms.	40 Sq. Kms.
3	Av. River Bed Level	EL 441.0M	EL 441.0M	EL 452.5M
4	Top Dam	EL 475.0M	EL 463.5M	EL 475.0M
5	Height of Dam from Av. River Bed Level	34.0M	22.5M	22.5M
6	Full Reservoir Level (FRL)	EL 471.5M	EL 460.0M	EL 470.5M
7	Min. Draw Down Level (MDDL)	EL 467.5M	EL 456.0M	EL 467.5M
8	Type of Dam	Concrete Dam with earthen flanks	Concrete Dam with earthen flanks	Concrete Dam with earthen flanks
9	Gross storage at FRL	78.2M. Cum	21.8M. Cum	12.1M. Cum
10	Water Spread Area	680 Ha.	310 Ha.	195 Ha.
11	Water under Submergence other than river course and island	414 Ha.	87 Ha.	59 Ha. (59 + 12.31 = 71.31 Ha. including island)
12	Area required other than submergence area	80 Ha.	13	<del>86.31</del> Ha 15 Ha.
13	Total area required for the project other than the river course area	494 Ha.	100 Ha	86.31 Ha
14	Installed capacity	2X30 - 60 MW	2X9=18 MW	3X6=18 MW
15	Annual estimation of power generation	212 M Units	130 M Units	128 M Units

Source: MPCL

Note: The values are rounded off for convenience

L-II

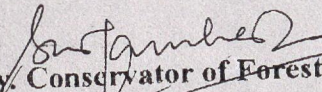
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Sample Plot Location and extent indicating No. of trees enumerated

Sl No	Sample plot location		Forest Range	Area in Ha.	No. of Trees Enumerated	Estimated in Cu.M		Remarks
	Village	Block & Compartment No				Timber	Firewood	
1	Badagunda	IV-4	Dandeli	1	505	62.017	313.30	No. of Trees Are Arrived At by Extrapolating the sample Plot Data to The total Extent.
2	Badagunda	IV-4	Dandeli	1	271	71.055	188.20	
3	Badagund	Iv-3	Dandeli	1	96	63.061	300.05	
4	Badagunda	Iv-1	Dandeli	1	139	37.963	189.80	
5	Veerampalli	III-31	Virnooli	1	389	50.875	240.80	
6	Veerampalli	III-31	Virnooli	1	714	35.338	169.00	
7	Veerampalli	III-31	Virnooli	1	782	66.243	315.50	
8	Veerampalli	III-32	Virnooli	1	730	20.959	160.00	
9	Islands	River Course	-	0.2	50	18.482	114.00	
			<b>Total</b>	<b>8.20</b>	<b>3676</b>	<b>425.993</b>	<b>1991.10</b>	

  
 Dy. Conservator of Forests,  
 Haliyal Division,  
 HALIYAL

## Details of Compensatory Afforestation Plan

Reference to toposheet	Name of Village	Survey number	Extent in hectares	
48 I/7	Kesarle	34	0.92	
		91	1.69	
	Vade	5	1.27	
		2	1.12	
	Chapoli	63	0.73	
		Durga	13	0.55
	Kamre	90	1.23	
			110	0.53
			114	0.41
	Boregall	29	2.26	
Konshet		9	0.96	
		12	2.07	
Payasvadi	28 A1/3	1.21		
	Aile	11	7.29	
Vatle	56/1C	1.11		
	48 I/12	Virnoll	46	0.93
		49	2.18	
		89	0.50	
		90	0.58	
Chapkhand		6	0.59	
	17	3.87		
Samjoida	24	1.27		
	29	0.20		
Phanasoli	28	2.99		
	29	1.19		
Bapeli	18	1.88		
	15	3.03		
Saagve	30/A	2.09		
	31	3.76		
	33	4.98		
	43	5.26		
	46	4.65		

HYDEL PROJECT

Area in Ha as

per drawing

survey

23.71

12.31

59.06

5.00

10.08

6.37



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MPC/DMHP/ 679/2001

Dated: 4<sup>th</sup> June 2001.

The Deputy Conservator of Forests,  
Haliyal Division,  
Haliyal.

**Brief Note on the Project.**

**Ref: Letter No.A5(2)/GFL/GL/2452/2000-01 dated: 29-11-2000 from PCCF's Office.**

**Sub: Construction of Dandeli Mini Hydel Project: Acquisition in forest area of Haliyal forest division in Uttara Kannada District of Karnataka State.**

With reference to the above cited letter and as required vide Sl.No.20 of Check List the Brief Note on the Project is as follows:

The Dandeli Mini-Hydel Project, proposed by Murudeshwar Power Corporation Ltd., has been allotted by the Government of Karnataka vide G.O.No.CI/101/SPI/2000, Bangalore, dated: 6-7-2000. The proposed scheme is to use the water released from the Supa Dam Power House, which is at present impounded at Bommanahalli balancing reservoir for power generation at Nagjhari Power House. This project proposes to utilize the head available between Supa dam and Bommanahalli balancing reservoir for Power generation. The proposed dam is located in Joida Taluk of Uttara Kannada District at Longitude 74 32'10" E and Latitude 15 15' 14" N. The Proposed scheme is designed as a "RUN OF THE RIVER" scheme with an installed capacity of 2 units of 9 MW each (Installed capacity 18 MW) and will generate 130 million units of power per annum.

The original Dandeli Hydro Electric Project as conceived by the Karnataka Power Corporation Ltd., was to construct a dam across river Kali near Mavalanga 8 Kms. down stream of Supa Dam. This dam would have submerge an area of 414 Ha. However Murudeshwar Poer Corporation proposed to construct a dam 3 Kms. upstream of the Karnataka Power Corporation Ltd., 's original proposal and would submerge only 69 Ha. There by saving 345 Ha. of forest area. This Project would generate 130 Million units of Power per annum against the Karnataka Power Corporation Ltd., proposal of 212 Million units per annum. Thereby by utilizing about 16.50% of original forest land and yet generate more than 60% of original Power generation. Hence the Proposal of Murudeshwar Poer Corporation Ltd., is more eco friendly and economically viable Project.



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The Project cost is estimated to be Rs.180.00 Crores, which includes Civil, Electro-mechanical and associated works and also the interest incurred during Construction. Power generated at Dandeli Mini Hydel Project will be transmitted to KPTCL Grid through transmission lines from Power House to Ambewadi Sub-station near Dandeli.

The Dandeli Mini Hydel Project will contribute to the cause of improving the present power situation of the Karnataka State.

Thanking you,  
Yours faithfully,  
For Murudeshwar Power Corporation Ltd.,

  
**NAVEEN R SHETTY,**  
**JOINT MANAGING DIRECTOR.**



**Ecological Assessment of proposed site  
for Dandeli Mini Hydel Project in  
Karnataka**

**Project Team**

**K. K. Mohapatra  
Dr. M. A. Khalid  
Vergeese Paul  
Ravi Hegde**

**Photographs: Dr. M. A. Khalid**

**Draft Final Report**

**Submitted to**

**Murdeswar Power Corporation, Karnataka**

**Forestry & Biodiversity Area  
Tata Energy Research Institute  
New Delhi  
January 2002**

## Photographs

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- Photograph 1 Location of proposed dam site at Full Reservoir Level
- Photograph 2 Location of proposed dam in Dandeli on Kali river.
- Photograph 3 Natural forest of Dandeli range in the submergence zone
- Photograph 4 Damage caused by wild elephants in the submergence zone.
- Photograph 5 Huge Terminalia spp. in the impact area. And the survey team
- Photograph 6 Dense primary forest in the submergence zone.
- Photograph 7 Dense vegetation in the submergence zone in the backdrop of Kali river.
- Photograph 8 Another view of vegetation in the submergence zone in Dandeli.
- Photograph 9 View of an island in Kali river under submergence zone.
- Photograph 10 Vegetation profile of an island in Kali river.
- Photograph 11 Island ecosystem in submergence zone.
- Photograph 12 Lagoon on an island in Kali river.
- Photograph 13 Rich flora of an island in submergence zone
- Photograph 14 Elephant dung seen on an island in Kali river.
- Photograph 15 Malabar pied hornbill – a commonly seen bird species of Dandeli are
- Photograph 16 Commonly found fish species in Kali river.
- Photograph 17 Leopard scat found in the submergence area.
- Photograph 18 Sloth Bear faeces commonly found in the submergence / impact area.

## Ecological Environment

An ecological assessment of the forest area both downstream and upstream of the proposed hydel project on river Kali (Map) by the Murdeshwar Power Corporation (MPC) at Dandeli in Uttar Kanara district in Karnataka was undertaken for two consecutive seasons (between 20<sup>th</sup> February and 2<sup>nd</sup> March 2001 i.e Pre-monsoon and between 6<sup>th</sup> December to 14<sup>th</sup> December 2001 i.e post- monsoon seasons). The study caters to aquatic and terrestrial ecosystems of the said area.

Ecological investigations were carried out in the Dandeli forest (refer Map) areas falling on either side of Kali river, immediate to the proposed mini-hydel project dam site. Dandeli and Virnolli ranges of Haliyal forest division in Joida taluk will be the affected areas due to proposed dam. As per our assessment the impacted area may extend upto 200 ha which includes Islands and the river course (part of RF area) and also the road infrastructure requirement on either side of the river. Impacted forest blocks and compartments of Haliyal and Karwar forest division are:

Forest Division	Range	Forest Block	Compartment	Area to be Impacted (ha)
Haliyal	Dandeli	VI	1	22.0
Haliyal	Dandeli	VI	3	06.0
Haliyal	Dandeli	VI	4	25.0
Haliyal	Vimolli	III	31	22.0
Haliyal	Vimolli	III	32	12.0
Revenue land in left and right bank				05.5
About 10 Islands in the Kali river course				45.0
River course				60.0
Karwar Forest Division				02.5
Total Area to be Impacted (ha)				200.0

The TERI team who undertook the study comprised of Mr K. K. Mohapatra, Dr M. A. Khalid, Mr Ravi Hegde and Mr vergheese Paul who have expertise in Wetland Ecology, Wildlife Ecology/Biology, Agro-Forestry and Forestry respectively.

## Aquatic Ecology

( The aquatic ecosystem of the area comprises of primarily the Kali river and the lagoons present on a few Islands along the river course. The Kali is West flowing and is located between latitude 15 16 30 N and Longitude 74 31 30 E. The river Kali is perennial in nature,) which forms a part of the study area

Kushavali

Joida

originates in Digga village of Supa taluk in Uttar Kanara and drains its water into the Arabian Sea after meandering for about 184 Kms. In the upper reaches it is strengthened by 5 tributaries with a total catchment area of 4850 Sq Km. Kali river has a low lying area of about 486 ha. The river water is mainly tapped for irrigation and hydel projects for which several dams are constructed on the main axis of the river. The riverine ecosystem of Kali comprises several unique niches and the notable ones are the lagoons on few of the Islands which holds rich aquatic life such as Zooplanktons, Phytoplanktons and several species of Fishes. ]

### Normal and sensitive aquatic locations

There are approximately 10 islands of varying sizes along the Kali river course, lying upstream of the proposed dam site. These islands fall in the submergence zone. They have high ecological and biological value as they hold diverse flora and fauna. A few islands are as big as 10-15 ha in area and hold huge trees with large boles. Island number 3 & 5 (refer Map) are of great significance because they hold a number of encapsulated water bodies in the form of lagoons (Phot nos. 11 & 12) which support rich plankton and fish fauna. These islands are frequently visited by a good number of wild animals like Sambar (*Cervus unicolor*), Chital (*Axis axis*), Civet Cat (*Viverriculla indica*), Snakes and a variety of bird species. Incidentally Black Panther (Pers Com. Pollard, 2001) was sighted in one of these islands. During the post-monsoon survey, the team found evidences of Elephant movement on Island number 5 (photo no. 14). A huge Python of 14-16 feet was also seen on one of the islands (Pers Com: Pollard, 2001).

### Aquatic flora and fauna

In order to study the aquatic flora and fauna of Kali rivers and its lagoons, water samples (14) were collected all along the river course both upstream and downstream of proposed dam site. For collection of plankton, plankton net of mesh size 70 micron was used by 3 min surface sweeping, after which the contents were transferred to collection bottles and subsequently fixed in 4% Formalin. The process of decantation followed for separation of phyto and zoo planktons and were identified under the microscope as per standard guidelines.

### Status of Phytoplankton in Kali River

In the present work, phytoplankton study was made to assess the phytoplankton composition and their distribution, in different locations of proposed dam site

and submergence area. For this purpose 14 different station were selected, including in the islands. On the left bank 10 and on the right bank 2 sampling stations were selected. In the islands 2 sampling stations were selected, where samples were collected from two different pools. Station-1, 2, 3, 4, 5, 6, 7, 8, 9 and 12 were on the left bank and Station-13 and 14 were on the right bank. Station-10 and 11, which were small pools, were in the islands.

### Materials and Methods

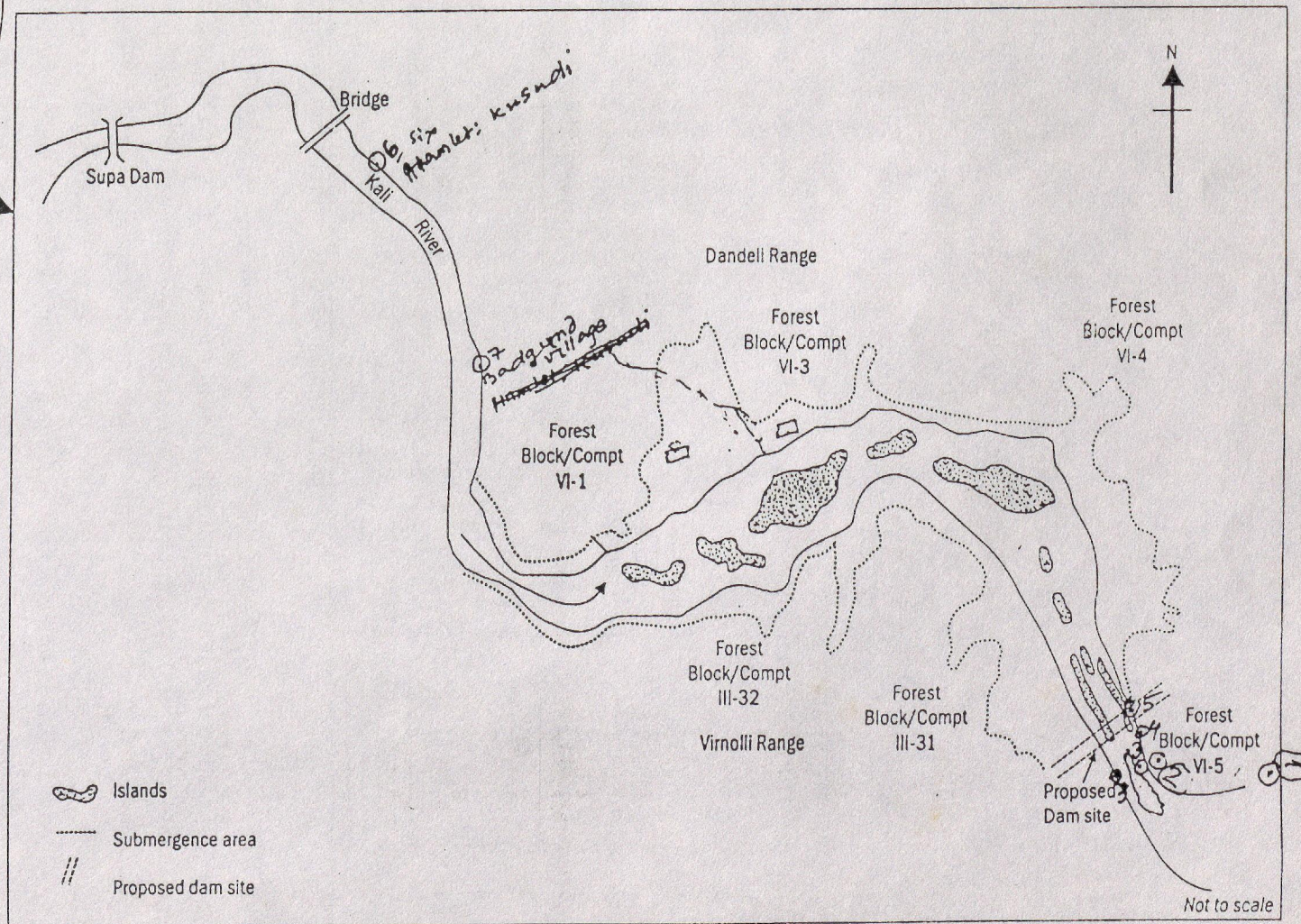
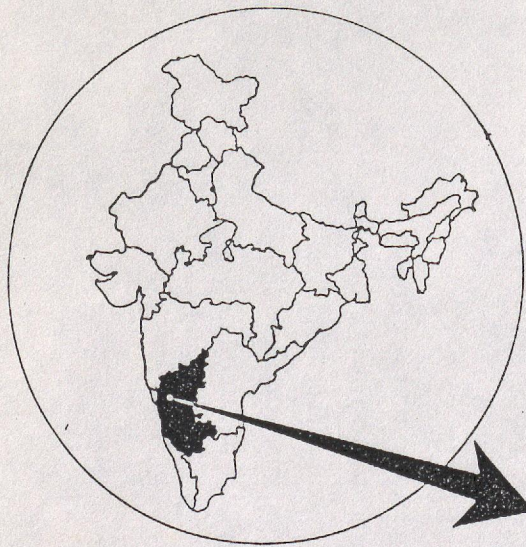
In each sampling site phytoplankton collection were made by towing a net, made up of bolting silk net No. 25 for 3 minutes. Sedimentation of phytoplankton was made in 4% formaldehyde for counting of phytoplankton Haemacytometric method was followed. The results are expressed as organisms per ml (O/ml). For the identifications of phytoplankton algal monographs of ICAR publications were used.

Table-3 : Distribution of phytoplankton Groups in Kall river.

Algal groups	Stations														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacillariophyceae (Diatoms)	Genus	4	5	9	7	3	4	4	5	6	9	4	6	5	4
	Species	5	5	14	10	7	8	4	8	6	12	5	8	5	6
Desmidiaceae	Genus	3	3	5	4	3	4	4	3	3	2	5	3	3	2
	Species	5	3	7	5	6	7	10	7	8	2	10	8	8	6
Chlorococcales	Genus	2	1	3	2	-	1	1	2	2	2	2	2	2	3
	Species	2	1	4	2	-	1	1	2	2	2	2	2	2	3
Cyanophyceae	Genus	2	2	1	1	2	2	1	1	1	1	3	2	3	3
	Species	2	2	1	1	2	2	1	1	1	1	3	2	3	3
Euglenophyceae	Genus	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	Species	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Dinophyceae	Genus	-	1	1	1	1	-	-	1	1	-	-	-	1	-
	Species	-	1	1	1	1	-	-	1	1	-	-	-	1	-
Total	Genus	11	12	19	15	9	11	10	12	13	15	14	13	14	12
	Species	14	12	27	19	16	18	16	19	18	18	20	20	19	18

Table-4: Species composition of phytoplankton in Kall river.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total individuals O/ml)	624	816	8704	1184	784	736	784	1472	1008	20416	1552	1248	1088	1
Total Species	14	12	27	19	16	18	16	19	18	18	20	20	19	1
Species richness	2.01	1.64	2.86	2.54	2.25	2.35	2.25	2.46	2.45	1.71	2.58	2.66	2.57	2
Species diversity (Shannon)	2.48	2.40	2.95	2.65	2.49	2.56	2.51	2.75	2.73	1.00	2.81	2.91	2.68	2



Map 1. Schematic sketch of the study area in proposed Dandeli mini hydel project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Simpson-Dominance	0.09	0.09	0.07	0.09	0.10	0.09	0.10	0.07	0.07	0.64	0.06	0.05	0.09	0.09
Evenness index	0.94	0.96	0.89	0.90	0.89	0.92	0.90	0.93	0.94	0.34	0.93	0.97	0.91	0.89

Table-5 : Palmer's Pollution Index Values at sampling stations sites In Kali river.

Genera	Stations													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Gomphonema</i>	1	1	1	1	1	1	1	1	1	-	1	1	1	1
<i>Navicula</i>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<i>Synedra</i>	2	2	2	2	-	-	-	-	2	-	-	2	2	-
<i>Oscillatoria</i>	4	4	4	4	4	4	-	4	4	4	4	4	4	4
<i>Melosira</i>	-	1	1	-	-	1	1	1	1	-	1	1	1	1
<i>Stigeoclonium</i>	-	-	2	2	-	-	-	-	-	-	-	-	-	-
<i>Nitzschia</i>	-	-	-	3	-	-	-	-	-	3	-	-	-	-
<i>Ankistrodesmus</i>	-	-	-	-	-	-	2	2	-	-	-	-	-	-
<i>Phacus</i>	-	-	-	-	-	-	-	-	-	2	-	-	-	-
<i>Pandorina</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	-
<i>Microcystis</i>	1	-	-	-	-	-	1	-	-	-	1	1	1	1
Total score	11	11	13	15	8	9	8	11	11	13	10	12	12	10

✓ The examination of the 14 stations of Kali river showed a moderate phytoplankton population. The phytoplankton in these stations were represented by the members belonging to Bacillariophyceae (Diatoms), Desmidiaceae, Chlorococcales, Cyanophyceae, Euglenophyceae and Dinophyceae. A total of 95 species, belonging to 43 genera were recorded during the sampling period. Of these, Bacillariophyceae dominated with 41 sps., followed by Desmidiaceae with 32 sps., Chlorococcales with 12 sps., Cyanophyceae with 7 sps., Dinophyceae with 2 sps. and Euglenophyceae with a single species. The qualitative dominance of the phytoplankton was in the order of Bacillariophyceae > Desmidiaceae > Chlorococcales > Cyanophyceae > Dinophyceae > Euglenophyceae. ✓

✓ In general, occurrence of phytoplankton in left and right bank is almost similar while in island (Station 10-pool) it was different. From the Table (3) it is clear that, in general Bacillariophyceae species were dominant over all other species followed by Desmidiaceae. Species composition of Chlorococcales and Cyanophyceae was moderate and that of Dinophyceae was very low. Species of Euglenophyceae were recorded only in Station-10 (pool).

✓ Among the total Phytoplankton species *Gomphonema longiceps* and *Navicula viridula* were common in all the stations except in Station-10 (Island). Since Station-10 (Island) was a pool characterized by its stagnant nature showed

totally different species composition as compared to other stations. Many species were exclusive to this station. *Oscillatoria limnosa* with its bloom dominated in this station. However in other island i.e., Station-11 (pool), phytoplankton composition was almost similar to other stations.

From the Table (4) it is clear that in general phytoplankton species composition was almost similar in all the stations. However their population varies with the stations. Highest number of total individual and total species were recorded in Station-3 and lowest in Station-2. Highest individuals and species of phytoplankton in Station-3 can be attributed to its stagnant nature of water as this station was in the crevice of the forest of island near to left bank. However among islands, where phytoplanktons were collected in 2 different pools (Station-10 and Station-11), highest individuals of phytoplanktons were recorded in Station-10 where the *Oscillatoria limnosa* formed the bloom resulted in highest total individuals.

From Table (4) it is also clear that species richness and species diversity was almost similar in all the stations. It might be because of the similar species composition of phytoplankton in all the stations. However slight increased values (species diversity and species richness) were recorded in Station-3 with its slight increased total individuals and total species values. It is mainly because of highest species (27 spp.) of this station. Further, the low value of Simpson dominance (0.07) and high value of evenness index (0.34) are in support of the slighter higher species diversity of this station. In Station-10 even though the total individual value is very high (20416 O/ml) with 18 species, the species diversity is very low (1.0). It is mainly because of *Oscillatoria limnosa* which was dominated over other species. Thus for total individuals of Station-10 *Oscillatoria limnosa* alone contributed more with 16320 O/ml. Further it is evident from the high Simpson dominance (0.64) and low evenness index value (0.34) that the dominance of *Oscillatoria limnosa* is the main reason for the low species diversity of this station.

#### **Phytoplankton as pollution indicators :**

Phytoplankton are one of the most rapid detectors of environmental pollution. This is because of their quick response to toxicants and other chemicals. Pollution stress reduces the number of algal species but increases the number of their individuals. A marked change in algal community severely affects the species diversity. Eutrophication or organic pollution of aquatic ecosystem results in replacement of algal groups. It has been observed that many species

are sensitive to the nutritional loading but equally good number are pollution tolerant. Good number of indices have been evolved to determine the trophic level of fresh water ecosystems like Nygaard's algal indices (1949) and Palmer's algal pollution indices (1969).

Palmer (1969) has listed top 8 pollution tolerant genera, the *Euglena*, *Oscillatoria*, *Chlamydomonas*, *Scenedesmus*, *Chlorella*, *Nitzschia*, *Navicula* and *Stigeoclonium*. Further he has given the algal pollution indices developed for use in rating water samples for high or low organic pollution (based on 20 genera) In analysis of a water sample, all of the 20 genera of algae that are present are recorded. An alga is called 'present' if there are 50 or more individuals per ml. The pollution index factors of the algae present are then totalled. A score of 20 or more for a sample is taken as evidence of high organic pollution, while a score of 15-19 is taken as probable evidence of high organic pollution. Lower figures indicate that the organic pollution of the sample is not high.

From the Table (5) it is clear that total score of none of the station exceeded the score of high organic pollution. However in Station-3, 4, 12 and 13 the score is nearer to probable evidence of high organic pollution.

In Station-10 Palmer's pollution Index values showed probable evidence of organic pollution. This can be attributed to the dominance of *Oscillatoria limnosa* which might have suppressed the growth of the other pollution indicating species in this station. Further it is evident from the Palmer's list of pollution indicating phytoplankton that *Oscillatoria limnosa* flourish well in organically polluted water.

### **Status of Zooplankton in Kali River**

In present work zooplankton study was made, to assess the zooplankton composition and their distribution in different stations of proposed dam site and submerging area. For this purpose 14 different station were selected including in the islands. On the left bank 10 and on the right bank 2 sampling stations were selected. In the islands 2 sampling stations were selected. In the islands samplings were made in two different pools. Station-1, 2, 3, 4, 5, 6, 7, 8, 9 and 12 were on the left bank and Station-13 and 14 were on the right bank. Station-10 and 11, which were small pools, were in the islands.

### **Materials and Methods:**

In each sampling zooplankton collection were made by towing a net, made up of bolting silk net No. 25 for 3 minutes. Sedimentation of zooplankton was made

in 4% formaldehyde. For counting of zooplankton drop count method was followed. The results are expressed as organisms per milliliter (O/ml). For identification, zooplankton monographs of Karnataka University Publications were used.

Table-6: Distribution of Zooplankton Groups In Kali river.

Zooplankton groups	Stations														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cladocera	Genus	9	5	7	8	5	6	6	5	5	1	5	4	7	6
	Species	11	7	8	11	6	7	7	6	6	1	6	5	8	7
Copepoda	Genus	1	4	3	2	3	2	2	3	3	2	2	3	2	3
	Species	1	4	3	2	3	2	2	3	3	2	2	3	2	3
Ostracoda	Genus	1	1	1	2	2	1	1	1	1	1	1	1	1	2
	Species	1	1	1	2	2	1	1	1	1	1	1	1	1	2
Rotifera	Genus	3	3	3	4	3	4	4	3	3	4	3	1	4	3
	Species	3	4	3	4	4	5	4	3	3	4	3	1	4	3
Total	Genus	14	13	14	16	13	13	13	12	12	8	11	9	14	14
	Species	16	16	15	19	15	15	14	13	13	8	12	10	15	15

Table-7: Species composition of Zooplankton in sampling stations in Kali river.

	Stations →													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total individuals	228	270	300	285	179	182	203	203	272	233	266	190	249	185
Total Species	16	16	16	18	15	15	14	13	13	8	12	10	15	15
Species richness	2.76	2.67	2.62	3.00	2.69	2.69	2.44	2.24	2.14	1.28	1.97	1.71	2.53	2.68
Species diversity (Shannon)	2.50	2.36	1.98	2.54	2.65	2.33	2.30	2.25	2.11	1.68	2.03	1.92	2.13	2.11
Simpson-Dominance	0.10	0.15	0.23	0.11	0.07	0.14	0.13	0.14	0.15	0.20	0.16	0.18	0.16	0.17
Evenness index	0.89	0.84	0.76	0.88	0.92	0.85	0.86	0.85	0.84	0.79	0.83	0.81	0.83	0.82

The zooplankton study of the 14 stations of Kali River showed moderate population. The zooplankton in 14 stations were represented by the members belonging to Cladocera, Copepoda, Ostracoda and Rotifera. A total of 41 species belonging to 31 genera were recorded during the sampling period. Of these Cladocerans dominated with 19 spp. followed by Rotifera with 14 spp. Copepoda with 5 spp and Ostracoda with 3 spp. The qualitative dominance of the zooplankton was in the order of Cladocera > Rotifera > Copepoda > Ostracoda.

From the Table (6) it is clear that distribution of zooplankton is almost similar in all the stations except in station-10 which was in island, where the water sampling was made in a pool. In this station the zooplankton composition was comparatively less. Thus from the Table (6) it is clear that in general Cladocera species dominated over all other species followed by Rotifera and Copepoda. Species composition of Ostracoda was low in all the stations.

Among the total zooplankton species, *Daphnia pulex* and *Daphnia carinata* were common to all the stations, except station 10 where the zooplankton species composition was almost different from other stations of left and right bank. In this station occurrence of Cladocera was very negligible with only one species of *Dunhevedia*. This can be attributed to the bloom of *Oscillatoria limnosa* (organic pollution indicating alga) which might have resulted in depletion of Cladocerans in this station. However in other pool (station-11) the zooplankton composition was almost similar to other stations of left and right banks.

Species composition of zooplankton in Kali river is almost similar (Table 7) in all the stations. However their population varies with the stations. Highest population of zooplankton was recorded in station-3 (300 O/ml) while lowest in station-5 (179 O/ml). Species richness was high in station-4 (18 species) and low in station-10 (8 species) where the sampling was made in a pool. Even though total individual value is more in station-3 its Shannon diversity value is low (Table 7). This is mainly because of dominance of *Daphnia pulex* which contributed more in the increased population of zooplankton in this station. Further it is evident from the high Simpson dominance (0.23) and low evenness index values (0.76). Vice versa was true with station-5 where, when the total population was very low, Shannon value is high (Table 7). In this station all the species contributed equally to the total population, which is indicated, by the higher evenness index value, and lower Simpson dominance value.

Lowest Shannon diversity value in station-10 can be attributed to lowest species number (8 sps.) and lowest value of species richness (1.28). Dominance of *Oscillatoria limnosa* (a pollution indicating alga) indicates the presence of organic pollution in this station. May be because of organic pollution in station-10 the species composition was lowered and resulted in lower Shannon diversity value.

#### ✓ Fishes

Kali river flowing through the proposed project area has a rich fish fauna which, was observed through fish catches and its sale in the local market. The river

harbours a variety of fish species ranging from carps to chela. Among the major, carps, Rohu (*Labeo rohita*) and catla, (*Catla catla*), constituted a sizable portion of the catch and were of large size ranging between 3 to 4 Kg (Photo 16). The fishes as observed in the Kali river are shown in Annexure-VII.

## Terrestrial Ecology

### Description of forest

As per Champion and Seth (1968) the vegetation of the area is classified as 3 B type i.e South Indian Moist Deciduous Teak Forest and bamboo species (*Bambusa arundanacea*, *Dendrocalamus strictus*) is the characteristic of the area. Dandeli WLS is situated approximately 8 km from the Dandeli RF boundary and the vegetation profile of the WLS and the submergence zone are in ecological continuity which represents moist deciduous forest flora

The study area extends to Dandeli and Virnolli ranges of Haliyal forest division. The reserve forest on the left bank of Kali river comes under Dandeli range, where as the forest on the right bank is under Virnolli range. As per the project document prepared by MPC the total forest land that is likely to be submerged is around 69 hectares (ha) upstream and another 15 ha towards laying of transmission line and road infrastructure etc., thus bringing it to 84 ha.

The team surveyed all the habitat types present in the study area comprising mainly of moist deciduous forest extending from plain to undulating hilly terrain, plantation areas, natural forest areas and Island ecosystems.

### Methodology

An ecological assessment of the flora was undertaken by using standard methods. Intensive sampling were done through transects and sample plots selected randomly after stratification of the area as per the habitat. A total of 5 transects of 1 Km each were laid in both the ranges. In addition 10 sample plots (50x40m or 0.2 ha area) were also laid in both the ranges. Sampling plots were established along transects at 100m intervals. Vegetation sampling was carried out following method described by Dombois and Ellenberg (1974) and Greig-Smith (1983). Data on tree species composition, abundance of individual tree species, species richness and diversity was collected in 10m circular plot. GBH measurements were taken for all individuals within the sampling plot.

Canopy cover was assessed using a mirror of 25x25cm superimposed with a grid system of 5x5cm. The canopy cover was estimated at 4 locations randomly selected inside each sampling area. Shrub species composition and

abundance was studied in 3m radius circular plot inside 10m circular plot. The grass and herb composition, species richness and abundance was measured in 1x1m square quadrats at each sampling point for 4 random locations.

Regeneration status was assessed in 5x5m circular plot within the 0.2 ha sample plots at 4 randomly selected areas. All regenerating woody species of <50cm were classified as seedlings and individuals >50cm to 2m were considered as saplings. Data analysis for above three categories were carried out by using standard formulae (Shanon Weiner Index).

## ✓ Terrestrial Flora and Fauna

### ✓ Vegetation Profile

The commonly found species in the area are Teak (*Tectona grandis*), Rosewood (*Dalbergia latifolia*), Nandi (*Lagerstromia lanceolata*), Matti (*Terminalia tomentosa*), Kindal (*Terminalia paniculata*), Jamba (*Xylocarpus xylocarpa*), Honne (*Pterocarpus marsupium*) etc. A checklist of common tree species found in Dandeli WLS is given in Annexure-Ia, Shrubs and climbers (Annexure-Ib) and Bamboo & Canes (Annexure-Ic) (Management Plan, KFD, 1996-2001).

During the field study the major tree species encountered in transects and sample plots are Jamba (*Xylocarpus xylocarpa*), Kindal (*Terminalia paniculata*), Karambal (*Dillenia pentagyna*), Kaval (*Careya arborea*), Matti (*Terminalia tomentosa*), Nelli (*Emblica officinalis*), Daman (*Grewia tilifolia*), Nandi (*Lagerstroemia lanceolata*), Teak (*Tectona grandis*), Kajra (*Strychnos nuxvomica*), Kakke (*Cassia fistula*), Banni (*Bauhinia racemosa*) etc. Almost all the plant species found in Dandeli WLS are likely to be seen in the impacted area however in limited time period of study we could observe following major tree, shrub/climber species (Annexure-II).

### ✓ Faunal Profile

A rapid ecological survey of the reserve forest of Haliyal forest division covering Dandeli and Virnolli ranges, which are going to be impacted by the proposed mini Hydel project reveals the presence of rich faunal diversity. Since the forests of Dandeli Wildlife Sanctuary are in ecological continuity with that of the proposed submergence area, it is very likely that the wild animals occurring in this sanctuary would also be seen in the impacted area. The list of wild animals occurring in Dandeli WLS is appended in Annexure-III.

The presence of various wild animals in the study area were confirmed through direct sightings and or indirect evidences and through local enquiry from villagers and forest officials/staff. Sightings of Leopard have been reported

from the cliffs on the left bank of Kali river (which was confirmed by the team through identification of scat during the transect laying) along with some interesting sighting of Black Panther (*Panthera pardus*) from the right bank of Kali river (Pers Com: Mr Pollard: 2001). Sloth Bear (*Melursus ursinus*) are quite common especially in Block IV and Compartment number 4 of left bank as evident from their fairly scattered faeces (Photo no. 18). Sambar and Chital were, sighted by the visiting team and pellets confirmed their presence in almost all the areas including the scattered islands inside Kali river. Malabar Giant squirrel (*Ratufa bicolor*) is fairly common in the area. Presence of Porcupine (*Hystrix indica*) and Pangolin (*Manis crassicaudata*) were confirmed by frequent sighting of quills and burrows/diggings. Occasional sightings of Tigers were reported by the forest officials of the area. Although in the past wild elephants were reported to frequent the valley of Kali river, after construction of the Supa Dam, their natural corridor has been delinked which has been reestablished after a gap of 9 years. Although during the pre-monsoon survey, there was no evidence of elephant movement in the study area but during the post-monsoon survey the team could come across few evidences of elephant movement in the study area Photo nos. 4 & 14). Indian Gaur (*Bos gauras*) has been reported from the area since they have a good population in Dandeli WLS, (Pers Com: Pollard, 2001). Amongst primates Common Langur (*Semnopithecus entellus*) and Bonnet monkey (*Macaca radiata*) were frequently encountered. The presence of Jungle Cat (*Felis chaus*), Indian Civet (*Viverricula indica*) and Malabar Civet (*Viverricula megaspilla*) were confirmed from indirect evidences. Occurrence of Mugger (*Crocodylus palustris*) were confirmed by the team through its sighting in the downstream of Kali river. It is interesting to note that the Muggers of this river have developed the peculiar habit of feeding on pulpy effluent released from West Coast paper mill located at Dandeli. Invariably they congregate at the point where effluent is released and this is the time one can see them in good numbers. As regards to the reptiles of the area, Cobra (*Naja naja*) is very common where as King Cobra (*Naja hannah*) is rare. Presence of Python (*Python molurus*) of nearly 16 feet size was reported from an island falling in the proposed submergence zone (Pers. Com: Pollard, 2001). During the rapid survey the animals observed through direct sighting / indirect evidences in the study area are appended in Annexure-IV.

#### ✓ Avifauna

The forests of Uttar Kanara in general and that of Haliyal forest division in particular hold high potential for bird diversity and richness. This is evident

from various studies carried out on the avifauna of this region in last 2 decades. Significant research work on this aspect have been conducted by Muralidharan (1984-86) covering Joida and Haliyal taluk, who reported 247 species. However Kartikeyan et al (1988-92) reported 155 species from Haliyal forest division. Uttangi (1994) also surveyed the avifauna in the North Western Ghat specifically focussing on Anshi National Park. A list of 196 bird species found in Dandeli WLS is appended (Annexure-V) (Management Plan, Dandeli WLS, 1996-2001).

During the present survey a total of 77 species (Annexure-VI) of birds were sighted both upstream and downstream of Kali river (from the proposed dam site) on either side covering approximately a distance of 3 km. Some of the interesting bird species, which were sighted during the study are Malabar Pied Hornbill (*Anthracoceros coronatus*), Grey headed Fishing Eagle (*Ichthyophaga ichhyaetus*), Stork billed Kingfisher (*Pelargopsis capanensis*), Tickell's Blue Flycatcher (*Cyornis tickelliae*) etc. Frequent sighting of Malabar Pied Hornbill (*Anthracoceros cornatus*) (Photo no. 15) in the area is an indication of healthy and dense forest status since this avian species prefers trees of huge bole and height.

#### Ecologically Sensitive areas

✓ The study team during their survey identified certain areas as ecologically sensitive based on the assessment of primary data.

##### a. Sanctuaries / National Park / Protected Areas

The location of Dandeli Wildlife Sanctaury (WLS) in close proximity to the reserve forest of Dandeli and Virnolli range indicates that the vegetation of both the areas are in ecological continuity. Study area when viewed from Nagjeri valley top in Dandeli WLS, presents a very pristine forest area having 11 km trek passing through Satgunda waterfall, which resembles similar vegetation type as seen in Maulongi area (site for proposed dam).

##### b. Riverine Islands

✓ The Kali river course holds 10 Islands between downstream of Supa Reservoir and proposed dam site near Moulongi. These Islands (Photo nos. 9 & 10) holds good vegetation and are frequented by wild animals. Some of the rare and endangered species like Elephant (*Elephas maximus*), Black Panther (*Panthera pardus*) and Python (*Python molurus*) has been reported from these Islands indicating the sensitivity of the area. The team surveyed two major Islands

having an area of more than 10ha and studied vegetation profile of these Islands (Table 1).

Table 1: Common plant species found on Islands in Kali river at Dandeli

Sl No.	Common name	Scientific name
1.	Neeral	<i>Syzygium cumini</i>
2.	Honge	<i>Pongamia pinnata</i>
3.	Chandarkal	<i>Macaranga pellata</i>
4.	Haiga	<i>Hopea wightiana</i>
5.	Halgere	<i>Holigama grahamii</i>
6.	Hale	<i>Wrightia tinctoria</i>
7.	Murugal	<i>Garcinia spp.</i>
8.	Kedige	<i>Pandanus furcatus</i>
9.	Bamboo	<i>Bambusa arundinacea</i>
10.	Nandi	<i>Lagostromia lancolata</i>
11.	Mango (Appemidi)	<i>Mangifera indica</i>
12.	Hole matti	<i>Terminalia arjuna</i>
13.	Bobbi	<i>Calophyllum apetalum</i>
14.	Surahonne	<i>Callophyllum elatum</i>
15.	Akkarkala	<i>Linociera malabarica</i>
16.	Matti	<i>Terminalia paniculata</i>
17.	-	<i>Buccanania sps</i>
18.	Alad	<i>Ficus bengalensis</i>
19.	Kawlu	<i>Careya arborea</i>
20.	Baranige	<i>Vitex alata</i>
21.	Adchere	<i>Memecylon edule</i>

(Source: TERI Study, 2001)

### ✓ Migratory Path

The team was convinced regarding the movement of wild animals like Elephants, Indian Gaur and Panther which occasionally migrate from Dandeli WLS towards the proposed dam site through Betki valley and Nagjeri valley. Based on the indirect evidences and the local information, it is certain that Dandeli WLS serves as a link between Anshi NP on one end and Dandeli Reserve Forest (RF) on the other.

Another probable migratory path for wild elephants and Gaur could be forest connecting Balgund to Ganeshgudi. It is evident from the crop depredation by wild elephants in Dandeli range (Table 2) that Elephants

commonly moved in small herd of 4-5 individuals in Konnada, Harregadi, Usoda areas near and on way to Ganeshgudi and in Kondapa area near Moulongi areas very frequently. Herds ranging from 13 to 22 individuals were not uncommon in Kondapa area.

Table 2 : Crop depredation by wild elephants in Dandeli Range.

S. No	Date of crop depredation	Village / Area	No of elephants
1	11.6.2001	Konnada / Left of Ganeshgudi	4-5 (Herd)
2	18.6.2001	Usoda / On way to Ganeshgudi	4-5 (Herd)
3	10.7.2001	Usoda / On way to Ganeshgudi	4-5 (Herd)
4	19.8.2001	Harregali / On way to Ganeshgudi	4-5 (Herd)
5	5.9.2001	Kondapa / near Maulongi	13-14 (Herd)
6	12.10.2001	Usoda / On way to Ganeshgudi	4-5 (Herd)
7	16.10.2001	Kondapa / near Maulongi	20-22 (Herd)
8	17.10.2001	Kondapa / near Maulongi	20-22 (Herd)
9	30.10.2001	Harregadi / On way to Ganeshgudi	4-5 (Herd)
10	29.11.2001	Konnada / left of Ganeshgudi	4-5 (Herd)

## Ecological Environment

### Impact on Terrestrial and Aquatic Ecosystems

#### Terrestrial Ecosystem

Analysis of primary data collected during pre-monsoon survey (February 2001) reveals that the average tree density ranges between 248 and 460 per ha in Dandeli range and between 423 and 1155 in Virnolli range. Similarly average tree density for the post monsoon season (December 2001) range between 220 and 496 per hectare for Dandeli and 428 to 563 per hectare for Virnolli ranges. The study was not repeated for compartment No. 32 of Virnolli range in the post monsoon season since it's a plantation area. Probably the higher figure for Virnolli range is due to gap filled mixed plantation done by forest department. In general, the tree density for all the studied forest compartments is fairly good. Trees with good height (30-32m) and GBH (250-300cm) with an average GBH of 97cm were frequently encountered in the submergence / impacted area (photos 5, 14, 15). Tree density obtained from sample plots and transects are shown in Table 8. As regards canopy cover, the percentage varies between 50 to 74% in studied compartments of both the ranges during pre-monsoon (Feb 2001) and 54 to 79 % for post-monsoon season (Dec 2001). The canopy cover value in percentage indicates dense forest as per Forest Survey Of India (FSI) classification (Table 8).

The study area shows a species richness of more than 21 plant species which, were identified from transects / sample plots. Analysis of seedlings and

saplings of main tree species indicate a good regeneration status (Table 9). Diversity Index calculated for the study area varies between 0.12 to 0.22 (Table 10) for pre-monsoon and between 0.14 to 0.22 (Table 13) for post-monsoon period. Hence, there is no significant change in the vegetation profile of the study area as observed between pre and post monsoon seasons.

### Pre-monsoon data (Feb 2001)

Table 8 Vegetation data analysis for the study area

Forest range/block	Compartment	Tree density by transect	Tree density by sample plot	Average tree density	Shrub density (3X3 m)	Grass and herbs cover (%) (1X1 m)	Canopy cover (%)	Classification of Forest as per FSI guidelines
Dandeli/VI	1	248	-	248	4138	21	55	Dense forest
	3	-	460	460	-	-	-	Dense forest
	4	273	493	383	9444	20	74	Dense forest
	5	286	-	286	2759	36	64	Dense forest
Vimolli/III								
	31	270	575	423	2157	57	50	Dense forest
	32	-	1155*	1155*	-	-	-	Dense forest

- Gap filled mixed plantation area.;

FSI Guideline says <10% Scrub; 10-40% Open and >40% Dense)

Table 9 Regeneration status of study area

Forest range/block	Compartment	Seedlings (#/ha)	Main species	Saplings (#/ha)	Main species	Remarks
Dandeli/VI	4	345	Jamba	25	Kajra	Good
			Bendi		Chirkal	
			Bamboo			
Vimolli/III	31	395	Jamba	25	Kindal	Good
			Kajra			
	32	625	Jamba	30	Haiga	Good
			Kindal			
			Kuda			

Table 10 Diversity Index calculated for the study area

Forest range/block	Compartment	Diversity index
Dandeli/VI	1	0.12
	3	0.16
	4	0.18
	5	0.20
Vimolli/III	31	0.22

Post-monsoon data (Dec 2001)

Table 11 Vegetation data analysis for the study area

Forest range/ block	Compartment	Tree density by transect	Tree density by sample plot	Average tree density	Shrub density (3X3 m)	Grass and herbs cover (%) (1X1 m)	Canopy cover (%)	Classification of Forest as per FSI guidelines
Dandeli/ VI	1	220	-	220	4253	32	58	Dense forest
	3	-	432	432	-	-	-	Dense forest
	4	252	496	375	9602	28	79	Dense forest
	5	290	-	290	2834	31	61	Dense forest
	31	260	563	428	2236	65	54	Dense forest

FSI Guideline says <10% Scrub; 10-40% Open and >40% Dense)

Table 12 Regeneration status of study area

Forest range/ block	Compartment	Seedlings (# / ha)	Main species	Saplings (# / ha)	Main species	Remarks
Dandeli/ VI	4	367	Jamba	42	Kajra	Good
			Bendi		Chirkal	
			Bamboo			
Vimolli/III	31	422	Jamba	28	Kindal	Good
			Kajra			
Vimolli/III	32	680	Jamba	35	Haiga	Good
			Kindal			
			Kuda			

Table 13 Diversity Index calculated for the study area

Forest range/ block	Compartment	Diversity index
Dandeli / VI	1	0.14
	3	0.16
	4	0.16
	5	0.22
Vimolli / III	31	0.20

## Aquatic Ecosystem

### a. Phytoplankton

In Kali river, in general phytoplankton population is moderate indicating the lower organic pollution. It might be because of its lotic nature. However if the water would become stagnant (due to proposed Dam) there would be every chance of increasing the pollution by siltation. Siltation is a common character

of stagnant water. Stagnating water results in addition of soil particles along with litter material (from surrounding forest area) to the bottom of the water body during rainy season. Lotic water is the naturally non-polluted water and lentic water is polluted one. This is also indicated by the nature of water in pool of island which is stagnant and that of waters in left bank and right bank where the water is flowing with lower organic pollution. Further due to stagnation of water (by proposed dam) the phytoplankton diversity of flowing water may be affected. Phytoplanktons are primary producers, on which many higher level organisms like zooplanktons and other aquatic higher animals are directly or indirectly dependent. So changing the habitat of the phytoplankton from lotic to lentic (stagnant) will affect the food chain. Due to this, the organisms which, were in equilibrium with habitat earlier will be unable to cope up with the changed environment and may disappear slowly (pl. refer to sec. 3.5.1.2 for details).

#### **b. Zooplankton**

From the zooplankton study of Kali river it is clear that, species composition of zooplankton is moderate. In all the stations population of zooplankton is accordingly with population of phytoplankton which are grazed upon by zooplankton. If the physical nature of the water is changed from lotic (floating) to lentic (stagnant) by proposed dam, the zooplankton species (on which large number of fishes are dependent) will not be able to cope up with changed environment. Hence the species composition and population of higher organisms which are dependent on zooplankton will drastically be lowered. Many species of zooplankton including fishes are habitat-sensitive. Changed habitat may affect population of zooplankton and other organisms depending upon them. Hence proposed dam will affect the entire food chain of river ecosystem. Further, it is evident from this study that Cladocerans which were dominated in all the stations (flowing), showed very poor occurrence in station-10 which was a pool (stagnant). This is clear evidence for the impact of changed habitat on Cladocerans which were luxuriantly occurred in flowing water (right and left banks) showed almost absence in stagnant water (station-10) This indicates that Cladocerans with other groups may be affected if their habitat will be changed from lotic to lentic (pl. refer to sec. 3.5.1.2 for details).

#### **I. Impacts on Biodiversity**

From the analysis of primary data, it is evident that Dandeli forest range has, rich biodiversity ranging from microfauna to large mammals. Any change in the

physical environment will hamper the ecological environment and thereby adversely affect the biodiversity value of the region.

## **II. Impacts on Forests**

The documented flora of the area represents 101 tree species, 54 Shrubs and Herbs and more than 12 Grass species (KFD, 1996). The major plant species which contributes towards the qualitative growth of the forest in the area will be affected by the proposed project.

## **III. Impacts on Wildlife**

The area harbours 29 species of mammals and 196 species of birds (KFD, 1996). There are 21 fish species (TERI, 2001) that occur in Kali river besides various other reptiles and amphibians which exclusively use the riverine ecosystem. Change in water level and disruption in water current will affect the wildlife of the area. Home ranges of major mammalian species like Elephant, Indian Gaur, and Leopards will be affected.

### ***4.5.2 Mitigation Measures***

In the present scenario, no mitigation measures can help prevent the damage to the proposed project area, however the following mitigatory measures may prove useful:

1. The dam should be maintained at such a level that Islands present in Kali river should not get completely submerged.
2. Although compensatory afforestation is a possible mitigation measure it can not restore the original forest loss.
3. In order to restore lost migratory path, corridor planning should be undertaken with the assistance of Geographical Information System (GIS) and field surveys to identify areas actually utilized by wild animals.
4. Corridor planning should also take into consideration the catchment area utilization.
5. Designing of wildlife corridors should also take into consideration the species those are going to be affected, their ecology and habitat requirement.
6. It is necessary to consider the effect of barriers to movements of wild animals so that strategies can be developed to facilitate their movement across potential barriers.

## 5.5 Ecological Environment- Environmental Management Plan

Compensatory afforestation and greenbelt development around the project site contribute to certain extent towards mitigation measures, but the real problem lies in finding alternate site for undertaking these operation. In no case the objectives will be achieved since restoration of original habitat is not at all possible, to whatever extent one goes for afforestation measures. Afforesting certain areas away from the impacted site is in no way going to benefit the original terrain. Hence we feel that there is no reason for recommending compensatory measures for the proposed project impact site. Cost of Environmental Management Plan (EMP) is beyond the scope of our study.

### Conclusion

From the primary field survey and secondary information, it is observed that the proposed submergence zone holds an excellent forest cover with high biodiversity value. The area holds important endangered species like Tiger, Panther, Pangolin, Python, Crocodile, Lesser adjutant Stork, Grey headed Fishing Eagle, White rumped Vulture etc. The present survey establishes that the area has rich floral and faunal values. Since the reserve forest of Dandeli is in ecological continuity with that of Dandeli WLS and Anshi NP, the migratory path of major mammalian species will be disrupted in case the proposed project is executed. Analysis of primary data and the secondary information collected from pre-monsoon and post-monsoon study indicates that construction of the proposed dam on river Kali would adversely affect biological/ecological attributes like vegetation, fish/aquatic life, birds and terrestrial animals and thus will exert a negative impact on the entire ecosystem.

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## Annexure I a

### List of common tree species of Dandeli wildlife sanctuary

S.No	Botanical name	Common name
1	<i>Acacia catechu</i>	Kaggali, Kachu, Khair
2	<i>Acacia ferruginea</i>	Banni
3	<i>Acacia polyacantha</i>	Mulvara, Manni, Mulghnara
4	<i>Actinodaphne malabarica</i>	Haggodgimara, Ambastala, Kanboorga, Tudgensu, Ambari
5	<i>Ailanthus excelsa</i>	Halmaddi, Hebbavu
6	<i>Ailanthus malabarica</i>	Guggulghup
7	<i>Albizzia amara</i>	Chujjalu, Tugli, Sujjala
8	<i>Albizzia lebbeck</i>	Bage, Siris, Kallbage
9	<i>Alseodaphne semecarpifolia</i>	Mase, Mashe, Phudgus, Nelthare
10	<i>Anacardium occidentale</i>	Godambi, Kaju
11	<i>Anona squamosa</i>	Sethapphal
12	<i>Anogeissus latifolia</i>	Dindiga, Dindal
13	<i>Anthocephalus cadamba</i>	Kadwal, Neerubale
14	<i>Aporosa lindleyana</i>	Challe, Sali
15	<i>Arenga wightii</i>	Dadasalu, Dadsei
16	<i>Artocarpus hirsuta</i>	Hebbaiasu, Aini
17	<i>Artocarpus heterophyllus</i>	Halasu, Jackfruit tree
18	<i>Artocarpus lakoocha</i>	Pulinchekke, Wotemba, Wome
19	<i>Atalantia monophylla</i>	Kadu-nimbe
20	<i>Atalantia racemosa</i>	Kad-Kanchi, Kad-limbu
21	<i>(Bassia latifolia) Madhuca indica</i>	Sanna-ippe, Kadippe
22	<i>Bauhinia racemosa</i>	Banne, Basavanpada
23	<i>Bombax ceiba (Bombax malabaricum/Salmalia malbarica)</i>	Buruga, Bural, Semul
24	<i>Boswellia serrata</i>	Sambrani, Salai, Biledhupa
25	<i>Butea monosperma</i>	Muttugal, Muttala
26	<i>Calophyllum apetalum (Calophyllum wightianum)</i>	Bobbi, Iral, Hole-honne
27	<i>Calophyllum elatum (Calophyllum tomentosum)</i>	Surhonne, Poon
28	<i>Canarium strictum</i>	Kai-dhupa, Dhupada-mana, Raidhupa
29	<i>Careya arborea</i>	Kawlu, Kaval
30	<i>Caryota urens</i>	Bugani, Bains
31	<i>Cassia fistula</i>	Kakke, Baya
32	<i>Cassia siamea</i>	Karethangadi, Simethangadi
33	<i>Cinnamomum zeylancium</i>	Dalchini, Nisani
34	<i>Dalbergia latifolia</i>	Beete, Shisham, Rosewood
35	<i>Dillenia indica</i>	Bettakanagalu, Machiru
36	<i>Dillenia pentagyna</i>	Kaltega, Mamagalu, Karambal
37	<i>Diospyros melanoxylon</i>	Tupra, Tumi, Tendu

S.No	Botanical name	Common name
38	<i>Dysoxylum malabaricum</i>	Agil, Bilidevar, White cedar
39	<i>Embica officinalis (Phyllanthus emblica)</i>	Nelli, Amla
40	<i>Erythrina suberosa</i>	Mullu-muthga, parivala, Pangra
41	<i>Erythrina indica</i>	Harivan
42	<i>Eugenia caryophyllaea (Syzygium caryophyllatum)</i>	Kunti-neeral
43	<i>Fagara budrunga (Zanthoxylum rhetsa)</i>	Jamba, Triphal (Camp-cot wood)
44	<i>Ficus benghalensis</i>	Ala
45	<i>Ficus glomerata (Ficus racemosa)</i>	Atti, atthi
46	<i>Ficus infectoria (Ficus virens)</i>	Basari, Karbasari
47	<i>Ficus mysorensis (Ficus drupacea var. pubescens)</i>	Golimara, Conimara
48	<i>Ficus nervosa</i>	Kadpara, Nyatte
49	<i>Ficus religiosa</i>	Arali
50	<i>Ficus tsiela (Ficus amplissima)</i>	Bili basari
51	<i>Flacourtia montana</i>	Sampi, Hansampige, Gudda
52	<i>Garcinia morella</i>	Panpulli, Arasinagurgi
53	<i>Garcinia cambogia</i>	Oopagi, Kadapgulu-muruga
54	<i>Garcinia indica</i>	Murukalgurgi, Murugal, Bhirand
55	<i>Gloriosa superba</i>	Kolikalu, Karadi-kanninagadde
56	<i>Gmelina arborea</i>	Shivane, Gamhar
57	<i>Grewia tiliifolia</i>	Tadasalu, Dhaman, Toda
58	<i>Holigama grahamii</i>	Doddaholigeri, Holigeri
59	<i>Holigama amottiana</i>	Malegeru, Holigeri, Sannale
60	<i>Holigama beddomii</i>	Doddale, Hologara
61	<i>Hopea wightiana</i>	Hyga, Kabri
62	<i>Hopea parviflora</i>	Kiralbhogi, Bhogi
63	<i>Hymenodictyon obovatum</i>	Gandale, bogi, Hiremara
64	<i>Ixora brachiata</i>	Gurani, Garable
65	<i>Lagerstroemia lanceolata (Lagerstroemia microcarpa)</i>	Nandi, Nana, Benteak
66	<i>Lagerstroemia speciosa (Lagerstroemia flos-reginae)</i>	Holedasavala, Holedasal
67	<i>Linociera malabarica</i>	Akkarkal
68	<i>Macaranga roxburghii (Macaranga peltata)</i>	Baltuchandrica, Chandbal, Chandoda
69	<i>Machilus macrantha</i>	Gulmavu
70	<i>Madhuca longifolia (Bassia longifolia)</i>	Dodda-ipp, Moha, Movaro
71	<i>Mangifera indica</i>	Mavu
72	<i>Memecylon edule (Memecylon umbellatum)</i>	Archeti, Adcheri
73	<i>Mimusops elengi</i>	Nauja, Rangia, Bakul, Wovali
74	<i>Mitragyna parvifolia</i>	Kadambolu, Kadabu, Kalamb, Kadavala
75	<i>Pongamia pinnata (Pongamia glabra/Derris indica)</i>	Hulugal, Honge, Torangalu

S.No	Botanical name	Common name
76	<i>Pterocarpus marsupium</i>	Home, Honni, Asana, Kine, Bijasal
77	<i>Santalum album</i>	Srigandha, Gandha, Chandan
78	<i>Saraca indica (Saraca asoca)</i>	Ashoka, Kusge
79	<i>Schleichera oleosa</i>	Sagade, Kusum, Kodlunnurka, Kendale
80	<i>Semecarpus anacardium</i>	Geru, Markng-nut
81	<i>Spondias acuminata</i>	Kadambada, Ambatte, Kaderate
82	<i>Spondias mangifera (Spondias pinnata)</i>	Amte
83	<i>Sterculia urens</i>	Kempudale, Buthala, Karai
84	<i>Streulia guttata</i>	Happusavage, Hulithordu
85	<i>Strychnos nux-vomica</i>	Kajra, Ittemajura, Kasaga, Nanjinmara, Kasarka
86	<i>Syzygium cumini</i>	Neralu, Jamun
87	<i>Tabernaemontana heyneana (Ervatamia heyneana)</i>	Nagarkunda, Maddarsa, Madlemara
88	<i>Tamandus indica</i>	Hunase, Imli
89	<i>Tectona grandis</i>	Sagvani, Tega, Teak
90	<i>Terminalia tomentosa (Terminalia alata)</i>	Mathi, Banapu
91	<i>Terminalia paniculata</i>	Hunal, Kindal, Hongalu, Bilimathi
92	<i>Terminalia arjuna</i>	Thora-mathi, Hole-mathi
93	<i>Terminalia bellirica</i>	Thare, Ghotung
94	<i>Terminalia chebula</i>	Alale, Gallnut, Harda
95	<i>Tetrameles nudiflora</i>	Bondaio, Kadbende, Velahini
96	<i>Trema orientalis</i>	Budikeri, Gorakalu
97	<i>(Vateria indica) Vateria malabarica</i>	Saldupa, Vellapayin
98	<i>Vitex altissima</i>	Naviladi, Balge, Bharanige
99	<i>Vitex negundo</i>	Lokki-Gida, Wekky
100	<i>Wrightia tinctoria</i>	Hale, Kadumurka, Makab
101	<i>Xylia xylocarpa</i>	Jamba, Jabmba

(Source: Draft Management Plan for Dandeli WLS, 1996-2001, Karnataka Forest Dept.)

## Annexure-I b

### List of Shurbs and Climbers

S. No	Botanical name	Common name
1	<i>Acacia concinna</i>	Sigekai, Shige
2	<i>Acacia pennata</i>	Shembi, Shemberti
3	<i>Adhatoda vasica</i>	Adsole, Adusoge
4	<i>Allophylus cobbe</i>	Kasabally, Murelebhendy
5	<i>Ardisia humilis</i>	Chitmitlmune gidda, halad, Havalad
6	<i>Asparagus recemosus</i>	Satvari
7	<i>Baliospermum axillare</i>	Danti, Jamalgota
8	<i>Bauhinia vahlii</i>	Chambuli, Chambil
9	<i>Barleria species</i>	-
10	<i>Callicarpa lanata</i>	Towdatti, Maradi, Tegdatti
11	<i>Calyopteris floribunda</i>	Bill-yaadi
12	<i>Carissa carandas</i>	Kavali balli, Karekai
13	<i>Cassia tora</i>	Tagate
14	<i>Curcuma aromatica</i>	Kad-Arshina
15	<i>Clerodendron infortunatum</i>	Bhandira, Bhat, Kahi
16	<i>Cocculus macrocarpus</i>	Vatoli, Vatyel, Ramrick
17	<i>Colebrookia oppositifolia</i>	Tuggigida, Falia
18	<i>Combretum ovalifolium</i>	Zalloosey, Mabdel
19	<i>Crotalaria species</i>	-
20	<i>Cryptolepis buchanani</i>	Kurbuntum-balli
21	<i>Datura stramonium</i>	Datura
22	<i>Desmodium species</i>	-
23	<i>Dioscorea species</i>	Kadu-Korand
24	<i>Entada scandens</i>	Ane Balli, Dodda-ganpi
25	<i>Flemingia species</i>	-
26	<i>Gardenia gummifera</i>	Bhicky, Kalkambi
27	<i>Glycosmis pentahylla</i>	Manikyan
28	<i>Helicteres isora</i>	Kavargi, Kempu-kowri
29	<i>Holarhena antidysenterica</i>	Korchu, Kodamurki, Kuda
30	<i>Indigofera species</i>	-
31	<i>Ipomoea species</i>	-
32	<i>Ixora arborea</i>	Gorvi, Karji, Gurga
33	<i>Lantana camara</i>	Chadurang
34	<i>Leea aspera</i>	-
35	<i>Leca sambucina</i>	Nurche, Totmudki, Midicki,
36	<i>Loranthus species</i>	-
37	<i>Millettia racemosa</i>	-
38	<i>Mimosa pudica</i>	Hadergitte
39	<i>Murraya pudica</i>	Pandry
40	<i>Murraya exotica</i>	Karibevu
41	<i>Randia dumetorum</i>	Kare, Upkare, Mangari
42	<i>Rauwolfia serpentina</i>	Sarpagandhi, Garudapatala

S. No	Botanical name	Common name
43	<i>Sida rhombifolia</i>	Jungly-methi, Bala
44	<i>Smilax macrophylla</i>	Gotvel
45	<i>Solanum giganteum</i>	Kutri, Chunna
46	<i>Spatholobus roxburghii</i>	Phulasn
47	<i>Strobilanthes callosus</i>	Karvi
48	<i>Linospora cordifolia</i>	Ane-bule, Amruthi-Balli, Palia-bilu
49	<i>Ventilago calyculata</i>	Kuriyadi Gapsandi-bally
50	<i>Vitis species</i>	-
51	<i>Wagatea spectra</i>	Hooliganji, Vagati
52	<i>Woodfordia floribunda</i>	Dayati, Dhaiphal, Phusati
53	<i>Zizyphus oenoplia</i>	Purgi
54	<i>Zizyphus rugosa</i>	Soona-Boori

(Source: Draft Management Plan for Dandeli WLS, 1996-2001, Kamataka Forest Dept.)

## Annexure-I c

### List of bamboo and canes

S. No	Species (Scientific name)	Local name
1	<i>Babusa arundinacea</i>	Dougi, Bidrugala
2	<i>Dendracalamus strictus</i>	Malebamboo, Shib, Basa, Bans, Medar, Mace, Udha
3	<i>Oxylenanthera monostigma</i>	Choua, Chiwa
4	<i>Ochlandra talboti</i>	Wonte-nulge, Hooda
5	<i>Calamus pseudo-tenuis</i>	Halbettha
6	<i>Calamus rheedii</i>	Jadhubettha
7	<i>Calamus rotang</i>	Sanna bettha, Handi Bettha

(Source: Draft Management Plan for Dandeli WLS, 1996-2001, Kamataka Forest Dept.)

## Annexure-II

### List of major flora from the study area

Sl No.	Common Name	Botanical name
1	Jamba	<i>Xylia xylocarpa</i>
2	Kindal	<i>Terminalia paniculata</i>
3	Karambal	<i>Dillenia pentagyna</i>
4	Kawal	<i>Careya arborea</i>
5	Matti	<i>Terminalia tomentosa</i>
6	Nelli	<i>Emblica officinalis</i>
7	Daman	<i>Grewia tilifolia</i>
8	Nandi	<i>Lag erstroemia lanceolata</i>
9	Teak	<i>Tectona grandies</i>
10	Shisham	<i>Dalbergia latifolia</i>
11	Kajra	<i>Strychnos nux-vomica</i>
12	Bellate	<i>Albezzia procera</i>
13	Haiga	<i>Hopea wightiana</i>
14	Kakke	<i>Cassia fistula</i>
15	Banni	<i>Bauhinia racemosa</i>

(Source: TERI study, 2001)

### List of major shrubs and grasses

Sl. No.	Common name	Scientific name
1	Chirkal	
2	Kadu	<i>Dioscorea spp.</i>
3	Bidrugala	<i>Bambusa arundinacea</i>
4	Bamboo	<i>Dendrocalamus strictus</i>
5	Danti	<i>Baliospermum axilare</i>
6	Shige	<i>Acacia coincinna</i>

(Source: TERI study, 2001)

## Annexure-III

### List of animals found in Dandeli WLS.

SNo	Common name	Scientific name
1	Rhesus macaque	<i>Macaca mulatta</i>
2	Bonnet macaque	<i>Macaca radiata</i>
3	Slow loris	<i>Nycticebus coucang</i>
4	Common langur	<i>Semnopithecus entellus</i>
5	Tiger	<i>Panthera tigris</i>
6	Leopard	<i>Panthera pardus</i>
7	Golden cat	<i>Felis chaus</i>
8	Leopard cat	<i>Felis bengalensis</i>
9	Jungle cat	<i>Felis chaus</i>
10	Toddy cat	<i>Paradoxurus hermaphroditus</i>
11	Small Indian civet	<i>Viverriculla indica</i>
12	Hyena	<i>Hyaena hyaena</i>
13	Small Indian mongoose	<i>Herpestes auropunctuatus</i>
14	Jackal	<i>Canis aureus</i>
15	Indian Fox	<i>Vulpes bengalensis</i>
16	Indian wild dog	<i>Cuon alpinus</i>
17	Sloth bear	<i>Melursus ursinus</i>
18	Malabar giant squirrel	<i>Ratufa bicolor</i>
19	Indian Giant Squirrel	<i>Ratufa indica</i>
20	Common Giant Flying Squirrel	<i>Petaurista petaurista</i>
21	Gaur	<i>Bos gaurus</i>
22	Indian porcupine	<i>Hystrix indica</i>
23	Hare	<i>Lepus nigricollis</i>
24	Elephant	<i>Elephas maximus</i>
25	Sambar	<i>Cervus unicolor</i>
26	Chital	<i>Axis axis</i>
27	Indian pangolian	<i>Manis crassicaudata</i>
28	Indian chevrotain (Mouse deer)	<i>Tragulus mervillii</i>
29	Indian wild Boar	<i>Sus scrofa</i>

(Source: Draft Management Plan for Dandeli WLS, 1996-2001, Karnataka Forest Dept.)

## Annexure-IV

List of animals observed through direct/indirect evidences in the study area during the rapid survey

Sl No.	Common name	Scientific name
1	Common langur	<i>Semnopithecus entellus</i>
2	Rhesus macaque	<i>Macaca mulatta</i>
3	Bonnet macaque	<i>Macaca radiata</i>
4	Indian pangolin	<i>Manis crassicaudata</i>
5	Wild boar	<i>Sus scrofa</i>
6	Sambar	<i>Cervus unicolor</i>
7	Spotted deer	<i>Axis axis</i>
8	Barking deer	<i>Muntiacus muntjak</i>
9	Civet cat	<i>Felis caracal</i>
10	Jungle cat	<i>Felis chaus</i>
11	Small Indian mongoose	<i>Herpestes auropunctatus</i>
12	Indian giant squirrel	<i>Ratufa indica</i>
13	Malayan flying squirrel	<i>Ratufa bicolor</i>
14	Indian fox	<i>Vulpes bengalensis</i>
15	Indian hare	<i>Lepus nigricollis</i>
16	Sloth bear	<i>Melursus ursinus</i>
17	Porcupine	<i>Hystrix indica</i>
18	Leopard	<i>Panthera pardus</i>
19	Tiger	<i>Panthera tigris</i>
20	Gaur	<i>Bos gaurus</i>
21	Jackal	<i>Canis aureus</i>

(Source: TERI study, 2001)

## Annexure-V

### List of Birds found in Dandeli WLS

S.N	Common	Scientific name
1	Little Grebe	<i>Podiceps ruficollis</i>
2	Little Cormorant	<i>Phalacrocorax niger</i>
3	Purple Heron	<i>Ardea purpurea</i>
4	Pond Heron	<i>Ardeola grayii</i>
5	Cattle egret	<i>Bubulcus ibis</i>
6	Little egret	<i>Egretta garzetta</i>
7	Large egret	<i>Egretta alba</i>
8	Intermediate egret	<i>Egretta intermedia</i>
9	Adjutant stork	<i>Leptoptilos dubius</i>
10	White necked stork	<i>Ciconia episcopus</i>
11	Lesser Adjutant	<i>Leptoptilos javanicus</i>
12	Lesser whistling teal	<i>Dendrocygna javanica</i>
13	Common teal	<i>Anas crecca</i>
14	Crested honey buzzard	<i>Pernis ptilorhynchus</i>
15	Black kite	<i>Milvus migrans</i>
16	Brahmini Kite	<i>Haliastur indus</i>
17	Shikra	<i>Accipiter badius</i>
18	Crested hawk eagle	<i>Spizeatus cirrhatus</i>
19	Black eagle	<i>Ictineatus malayensis</i>
20	Greyheaded fishing eagle	<i>Ichthyophaga ichhyaetus</i>
21	White rumped vulture	<i>Gyps bengalensis</i>
22	Scavenger vulture	<i>Neophom perchopterus</i>
23	Crested serpent eagle	<i>Spilomis cheela</i>
24	Tawny eagle	<i>Aquila rapax</i>
25	Peregrino falcon	<i>Falco peregrinus japonensis</i>
26	Eurasian Hobby	<i>Falco subbuteo</i>
27	Grey jungle fowl	<i>Gallus sonneratti</i>
28	Common peafowl	<i>Pavo cristatus</i>
29	Whitebreasted waterhen	<i>Amauromis pheonicurus</i>
30	Purple moorhen	<i>Porphyrio porphyrio</i>
31	Red wattled lapwing	<i>Vanellus indicus</i>
32	River tern	<i>Sterna aurantia</i>
33	Greyfronted Green pigeon	<i>Treron pompadora</i>
34	Common green pigeon	<i>Treron phoenicoptera</i>
35	Jerdon's Imperial pigeon	<i>Ducula badia</i>
36	Blue rock pigeon	<i>Columba livia</i>
37	Spotted dove	<i>Streptopelia chinensis</i>
38	Emerald dove	<i>Chalcophas indica</i>
39	Yellow legged green pigeon	<i>Treron phoenicoptera</i>
40	Nilgiri wood pigeon	<i>Columba elphinstonii</i>

S.N	Common	Scientific name
41	Blossomheaded Parakeet	<i>Psittacula cyanocephala</i>
42	Bluewinged parakeet	<i>Psittacula columboides</i>
43	Rose ringed parakeet	<i>Psittacula krameri</i>
44	Indian Lorikeet	<i>Loriculus vernalis</i>
45	Common hawk cuckoo	<i>Cuculus varius</i>
46	Indian cuckoo	<i>Cuculus micropterus</i>
47	Bay banded cuckoo	<i>Cacomantis sonneratii</i>
48	Plaintive cuckoo	<i>Cacomantis passerinus</i>
49	Sirkeer cuckoo	<i>Taccocua leschenaultii</i>
50	Koel	<i>Eudynamys scolopacea</i>
51	Coucal	<i>Centropus sinensis</i>
52	Collared Scops owl	<i>Otus bakkamoena</i>
53	Forest eagle owl	<i>Bubo nipalensis</i>
54	Barred jungle owlet	<i>Glaucidium radiatum</i>
55	Spotted owlet	<i>Athene brama</i>
56	Indian scops owl	<i>Otus scops</i>
57	Jungle Nightjar	<i>Caprimulgus indicus</i>
58	Longtailed nightjar	<i>Caprimulgus macrurus</i>
59	Whiterumped spinetail swift	<i>Chaetura sylvatica</i>
60	House swift	<i>Appus affinis</i>
61	Crested Tree swift	<i>Hemiprocne coronata</i>
62	Stork billed kingfisher	<i>Pelargopsis capensis</i>
63	Pied kingfisher	<i>Ceryle rudis</i>
64	Small blue kingfisher	<i>Alcedo atthis</i>
65	Whitebreasted kingfisher	<i>Halcyon smyrnensis</i>
66	Chestnutheaded Bee-eater	<i>Merops leschenaulti</i>
67	Green Bee-eater	<i>Merops orientalis</i>
68	Bluebearded Bee-eater	<i>Nyctyornis athertoni</i>
69	Indian roller	<i>Coracias benghalensis</i>
70	Hoope	<i>Upupa epops</i>
71	Common Grey Hornbill	<i>Trochus birostris</i>
72	Malabar Grey Hornbill	<i>Trochus griseus</i>
73	Malabar Pied Hornbill	<i>Anthracoscerus cornatus</i>
74	Great Pied Hornbill	<i>Buceros bicornis</i>
75	Small Green Barbet	<i>Megalaima viridis</i>
76	Crimsonthroated barbet	<i>Megalaima rubricapilla</i>
77	Crimsonbreasted barbet	<i>Megalaima haemacephala</i>
78	Large Green barbet	<i>Megalaima zeylanica</i>
79	Bluethroated barbet	<i>Megalaima asiatica</i>
80	Large goldenbacked woodpecker	<i>Chrysocolaptes lucidus</i>
81	Rufous woodpecker	<i>Micropternus brachyurus</i>
82	Lesser yellownaped woodpecker	<i>Picus chlorolophus</i>
83	Lesser goldenbacked woodpecker	<i>Dinopium benghalense</i>
84	Great black woodpecker	<i>Dryocopus javensis</i>
85	Heartspotted woodpecker	<i>Hemicircus canente</i>

S.N	Common	Scientific name
86	Mahratta woodpecker	<i>Picoides mahrattensis</i>
87	Pigmy woodpecker	<i>Picoides nanus</i>
88	Indian pitta	<i>Pitta brachyura</i>
89	Ashycrowned finch lark	<i>Eremopterix grisea</i>
90	Dusky crag martin	<i>Hirundo concolor</i>
91	Common swallow	<i>Hirundo rustica</i>
92	Wiretailed swallow	<i>Hirundo smithii</i>
93	Redrumped swallow	<i>Hirundo daurica</i>
94	Ashy swallow shrike	<i>Artamus fuscus</i>
95	Grey shrike	<i>Lanius excubitor</i>
96	Rufousbacked shrike	<i>Lanius schach</i>
97	Brown shrike	<i>Lanius cristatus</i>
98	Golden oriole	<i>Oriolus oriolus</i>
99	Black headed oriole	<i>Oriolus xanthornus</i>
100	Blacknaped oriole	<i>Oriolus chinensis</i>
101	Black Drongo	<i>Dicrurus adsimilis</i>
102	Grey Drongo	<i>Dicrurus leucophaeus</i>
103	Whitebellied drongo	<i>Dicrurus caeruleus</i>
104	Bronzed drongo	<i>Dicrurus aeneus</i>
105	Haircrested drongo	<i>Dicrurus hottentottus</i>
106	Racket tailed drongo	<i>Dicrurus paradiseus</i>
107	Blyth's myna	<i>Sturnus malabaricus blythii</i>
108	Blackheaded myna	<i>Sturnus pagodarum</i>
109	Common myna	<i>Acridotheres tristis</i>
110	Jungle myna	<i>Acridotheres fuscus</i>
111	Hill myna	<i>Gracula religiosa</i>
112	Common treepie	<i>Dendrocitta vagabunda</i>
113	House crow	<i>Corvus splendens</i>
114	Jungle crow	<i>Corvus macrorhynchos</i>
115	Pied flycatcher shrike	<i>Hemipus picatus</i>
116	Large wood shrike	<i>Tephrodornis vigratus</i>
117	Common wood shrike	<i>Tephrodornis pondicerianus</i>
118	Large cuckoo shrike	<i>Coracina novaehollandiae</i>
119	Blackheaded cuckoo shrike	<i>Coracina melanoptera</i>
120	Scarlet minivet	<i>Pericrocotus flammeus</i>
121	Small minivet	<i>Pericrocotus cinnamomeus</i>
122	Common iora	<i>Aegithina tiphia</i>
123	Goldfronted chloropsis	<i>Chloropsis auriformis</i>
124	Goldmantled chloropsis	<i>Chloropsis cochinchinensis</i>
125	Fairy bluebird	<i>Irena puella</i>
126	White cheeked bulbul	<i>Pycnonotus leucogenys</i>
127	Black bulbul	<i>Hypsipetes madagascariensis</i>
128	Ruby throated yellow bulbul	<i>Pycnonotus melanicterus gularis</i>
129	Red whiskered bulbul	<i>Pycnonotus jocosus</i>
130	Redvented bulbul	<i>Pycnonotus cafer</i>

S.N	Common	Scientific name
131	Yellow browed bulbul	<i>Hypsipetes indicus</i>
132	Rufous babbler	<i>Turdoides subrufus</i>
133	Spotted Babbler	<i>Pellorneum ruficeps</i>
134	Slatyheaded scimitar babbler	<i>Pomatorhinus horsfieldii</i>
135	Black headed babbler	<i>Rhophochla atriceps</i>
136	Jungle babbler	<i>Turdoides striatus</i>
137	Quaker babbler	<i>Alcippe poioicephala</i>
138	Brown flycatcher	<i>Muscicapa latirostris</i>
139	Redbreasted flycatcher	<i>Muscicapa parva</i>
140	Tickell's blue flycatcher	<i>Muscicapa tickelliae</i>
141	Verditer flycatcher	<i>Muscicapa thalassina</i>
142	Whitebrowed fantail flycatcher	<i>Rhipidura aureola</i>
143	Whitespotted fantail flycatcher	<i>Rhipidura albicollis</i>
144	Paradise flycatcher	<i>Terpsiphone paradisi</i>
145	Monarch flycatcher	<i>Hypothymis azurea</i>
146	Streaked fantail warbler	<i>Cisticola juncidis</i>
147	Franklin's wren warbler	<i>Prinia hodgsonii</i>
148	Jungle wren warbler	<i>Prinia sylvatica</i>
149	Tailor bird	<i>Orthomotus sutorius</i>
150	Blyth's reed warbler	<i>Acrocephalus dumetorum</i>
151	Greenish leaf warbler	<i>Phylloscopus trochiloides</i>
152	Magpie robin	<i>Copsychus saularis</i>
153	Shama	<i>Copsychus malabaricus</i>
154	Pied bush chat	<i>Saxicola caprata</i>
155	Indian robin	<i>Saxicoloides fulicata</i>
156	Blueheaded rock thrush	<i>Monticola cinclorhynchus</i>
157	Blue rock thrush	<i>Monticola solitarius</i>
158	Malabar whistling thrush	<i>Myiophonus horsfieldii</i>
159	Whitethroated ground thrush	<i>Zoothera citrina cyanotus</i>
160	Whitebreasted laughing thrush	<i>Garrulax jerdoni</i>
161	Grey tit	<i>Parus major</i>
162	Yellowcheeked tit	<i>Parus xanthogenys</i>
163	Velvet fronted nuthatch	<i>Sitta frontalis</i>
164	Tree pipit	<i>Anthus spp.</i>
165	Grey wagtail	<i>Motacilla caspica</i>
166	Large pied wagtail	<i>Motacilla maderaspatensis</i>
167	Forest wagtail	<i>Motacilla indica</i>
168	White wagtail	<i>Motacilla alba</i>
169	Tickell's flowerpecker	<i>Dicaeum erythrorhynchos</i>
170	Nilgiri flowerpecker	<i>Dicaeum concolor</i>
171	Thickbilled flowerpecker	<i>Dicaeum agile</i>
172	Purple rumped sunbird	<i>Nectarinia zeylonica</i>
173	Small sunbird	<i>Nectarinia minima</i>
174	Loten's sunbird	<i>Nectarinia lotenia</i>
175	Purple sunbird	<i>Nectarinia asiatica</i>

S.N	Common	Scientific name
176	Yellow backed sunbird	<i>Aethopyga siparaja</i>
177	Little spider hunter	<i>Arachnothera longirostris</i>
178	White-eye	<i>Zosterops palaperbrosa</i>
179	House sparrow	<i>Passer domesticus</i>
180	Yellowthroated sparrow	<i>Petronia xanthocollis</i>
181	Baya	<i>Ploceus philippinus</i>
182	Whitebacked munia	<i>Lonchura stnata</i>
183	Spotted munia	<i>Loncura punctulata</i>
184	Green sand piper	<i>Tringa ochropus</i>
185	Common sand piper	<i>Tringa hypoleucos</i>
186	White ibis	<i>Threskiornis aethiopica</i>
187	Pheasant tailed jacana	<i>Hydrophasianus chirurgus</i>
188	Bronze winged jacana	<i>Metopidius indicus</i>
189	Darter	<i>Anhinga rufa</i>
190	Pintail	<i>Anas acuta</i>
191	Black winged stilt	<i>Himantopus himantopus</i>
192	Marsh Harrier	<i>Circus macrorus</i>
193	Small Greenbilled Malkoha	<i>Rhopodytes viridirostris</i>
194	Ceylon frogmouth	<i>Batrachostomus moniliger</i>
195	Spotted grey creeper	<i>Salapornis spilonotus</i>
196	Coot	<i>Fulica atra</i>

(Source: Draft Management Plan, Dandeli WLS KFD, 1996-2001)

## Annexure-VI

### List of birds seen during the rapid survey in the study area

Sl No.	Common name	Scientific name
1	Little grebe	<i>Podiceps ruficollis</i>
2	Little egret	<i>Egretta garzetta</i>
3	Median egret	<i>Egretta intermedia</i>
4	Cattle egret	<i>Bubulcus ibis</i>
5	Little cormorant	<i>Phalacrocorax niger</i>
6	Darter	<i>Anhinga rufa</i>
7	Purple heron	<i>Ardea purpurea</i>
8	Pond heron	<i>Ardeola grayii</i>
9	White breasted water hen	<i>Amaurionis phoenicurus</i>
10	Purple moorhen	<i>Porphyrio porphyrio</i>
11	Common moorhen	<i>Gallinula chloropus</i>
12	Brahminy kite	<i>Haliastur indus</i>
13	Panah kite	<i>Milvus migrans</i>
14	Grey headed fishing eagle	<i>Ichthyophaga icthyaetus</i>
15	White backed vulture	<i>Gyps bengalensis</i>
16	Common myna	<i>Acridotheres tristis</i>
17	Shikra	<i>Accipiter badius</i>
18	Jungle crow	<i>Corvus macrorhynchos</i>
19	House crow	<i>Corvus splendens</i>
20	Magpie robin	<i>Copsychus saularis</i>
21	Indian robin	<i>Saxicoloides fulicata</i>
22	Jungle babbler	<i>Turdoides striatus</i>
23	Red wattled lapwing	<i>Vanellus indicus</i>
24	Grey partridge	<i>Francolinus pondicerianus</i>
25	Jungle bush quail	<i>Perdica asiatica</i>
26	Grey jungle fowl	<i>Gallus sonneratti</i>
27	Pea fowl	<i>Pavo cristatus</i>
28	Pigmy wood pecker	<i>Dendrocopus nanus</i>
29	Mahratta wood pecker	<i>Dendrocopus mahrattensis</i>
30	Green barbet	<i>Megalaima virides</i>
31	Crimson breasted barbet	<i>Megalaima haemacephala</i>
32	Malabar Grey hornbill	<i>Ocyrceros griseus</i>
33	Malabar pied hornbill	<i>Anthracoceros coronatus</i>
34	Hoopoe	<i>Upupa epops</i>
35	Indian roller	<i>Coracias benghalensis</i>
36	Small blue kingfisher	<i>Alcedo atthis</i>
37	White breasted kingfisher	<i>Halcyon smyrenensis</i>
38	Pied kingfisher	<i>Ceryle rudis</i>
39	Stork billed kingfisher	<i>Pelargopsis capensis</i>
40	Chest nut headed bee eater	<i>Merops leschenaulti</i>
41	Green bee eater	<i>Merops orientalis</i>
42	Common hawk cuckoo	<i>Cuculus vanus</i>

Sl No.	Common name	Scientific name
43	Indian plaintive cuckoo	<i>Cacomantis passerinus</i>
44	Koel	<i>Eudynamys scolopacea</i>
45	Crow pheasant	<i>Centropus sinensis</i>
46	Rose ringed parakeet	<i>Psittacula krameri</i>
47	Blossom headed parakeet	<i>Psittacula cyanocephala</i>
48	Palm swift	<i>Cypsiurus parvus</i>
49	House swift	<i>Apus affinis</i>
50	Spotted owlet	<i>Athene brama</i>
51	Indian Jungle nightjar	<i>Caprimulgus indicus</i>
52	Blue rock pigeon	<i>Columba livia</i>
53	Little brown dove	<i>Stroptopelia senegalensis</i>
54	Red turtle dove	<i>Stroptopelia tranquebirica</i>
55	Ring dove	<i>Stroptopelia decaocto</i>
56	Spotted dove	<i>Stroptopelia chinensis</i>
57	Green pigeon	<i>Treron phoenicoptera</i>
58	Common wood shrike	<i>Tephrodornis pondicerianus</i>
59	Pied bush chat	<i>Saxicola caprata</i>
60	Ashy wren warbler	<i>Prinia socialis</i>
61	Blyth's reed warbler	<i>Acrocephalus dumetorum</i>
62	Red vented bulbul	<i>Pycnonotus cafer</i>
63	Red whiskered bulbul	<i>Pycnonotus jocosus</i>
64	Tailor bird	<i>Orthotomus sutorious</i>
65	Tickell's Blue flycatcher	<i>Cyornis tickelliae</i>
66	White browed fantail fly catcher	<i>Rhipidura aureola</i>
67	Paradise flycatcher	<i>Terpsiphone paradisi</i>
68	Purple sunbird	<i>Nectarinia asiatica</i>
69	Purple rumped sunbird	<i>Nectarinia zeylonica</i>
70	Black Drongo	<i>Dicrurus adsimilis</i>
71	Tree pie	<i>Dendrocitta vagabunda</i>
72	Tickell's Flower pecker	<i>Dicaeum erythrorhynchos</i>
73	Common sand piper	<i>Tringa ochropus</i>
74	Common babbler	<i>Turdoides caudatus</i>
75	House sparrow	<i>Passer domesticus</i>
76	Large pied wagtail	<i>Motacilla maderaspatensis</i>
77	Black red start	<i>Phoenicurus ochrurus</i>

(Source: TERI study, 2001)

## Annexure VII

### List of Fishes as observed in Kali River

S. No	Common Name	Scientific Name
1	Rohu	<i>Labeo rohita</i>
2	Katia	<i>Catla catla</i>
3	Sol or Murrel	<i>Cirrhinus mrigala</i>
4	Panela	
5	Lavni	
6	Balchi	
7	Ouwaal	
8	Gorchi	
9	Dok	
10	Kadas	
11	Sampmachi	Eel ?
12	Jabb	<i>Chela spp.</i>
13	Toli	<i>Danio spp.</i>
14	Gojali	<i>Heteropneustis spp.</i>
15	Morgud	Catfish ?
16	Calmino	Stone fish?
17	Pirtod	
18	Kainedi	
19	Malga	Large Eel like ?
20	Malwa	
21	Katwa	
22	Bobbari	

(Source: TERI study, Dec 2001).

## Annexure-VIII

### List of phytoplanktons found in Kali River (Birsal 1989)

I. Cyanophyceae	II. Chlorophyceae	III. Bacillariophyceae	IV. Englenophyceae
<i>Microcystis aeruginosa</i>	<i>Chlorella vulgaris</i>	<i>Melosira granulata</i>	<i>Euglona elongata</i>
<i>M. robusta</i>	<i>Ankistrodesmus sigmoides</i>	<i>M. islandica</i>	<i>E. Polymorpha</i>
<i>M. viridis</i>	<i>A. spiralis</i>	<i>Cyclotella glomerata</i>	<i>E. Sanguinea</i>
<i>Chroococcus minutus</i>	<i>Pediastrum araneosum</i>	<i>C. Stelligere</i>	<i>Phacus caudatus</i>
<i>C. tenax</i>	<i>P. duplex</i>	<i>Fragilaria brevisiraia</i>	<i>P. indicus</i>
<i>C. turgidus</i>	<i>P. simplex</i>	<i>F. rumpens</i>	<i>P. longicauda</i>
<i>Gloocapsa decorticans</i>	<i>P. tetras</i>	<i>F. rumpens</i>	<i>P. nordstodtil</i>
<i>G. golatinosa</i>	<i>Spirogyra pratensis</i>	<i>Synedra ulna</i>	<i>P. nordstodtii</i>
<i>Aphanocapsa biformis</i>	<i>S. subsalsa</i>	<i>S. ulna var. amphirhynchus</i>	<i>Lepocinclis acuta</i>
<i>A. stagnina</i>	<i>S. varians</i>	<i>S. ulna var. danica</i>	<i>L. fusiformis</i>
<i>Synechococcus aeruginosus</i>	<i>Closterium acerosum</i>	<i>Gyrosigma baikalensis</i>	<i>L. ovum</i>
<i>S. cedrorum</i>	<i>C. gracile var. tenue</i>	<i>G. scalprodes</i>	
<i>Coelosphaerum naegelianum</i>	<i>Cosmarium contractum</i>	<i>G. scalproides var. eximia</i>	
<i>Merismopedia convoluta</i>	<i>C. granatum</i>	<i>Pleurosigma angulatum</i>	
<i>M. punctata</i>	<i>C. lundellii</i>	<i>P. elongatum</i>	
<i>M. tenuissima</i>	<i>C. portianum</i>	<i>P. salinarum</i>	
<i>Arthrospira platensis</i>	<i>C. punctulum</i>	<i>Navicula cari var. angusta</i>	
<i>Spirulina gigatia</i>	<i>Staurastrum arnellii</i>	<i>N. cocconeiformis</i>	
<i>S. major</i>	<i>S. gracile</i>	<i>N. cryptocephala</i>	
<i>S. Moneghiniana</i>	<i>S. lotanum</i>	<i>N. cuspidata</i>	
<i>S. princeps</i>		<i>N. pupula</i>	
<i>Oscillatoria acuta</i>		<i>N. rostellata</i>	
<i>O. agardhii</i>		<i>Nitzschia closterium</i>	
<i>Lynghya aerugineo-coerulea</i>		<i>N. ignorata</i>	
<i>L. allorgei</i>			
<i>Phormidium bohneri</i>			
<i>P. purpurascens</i>			
<i>Cylindrospermum sphaerica</i>			
<i>Anabaena lyngarii</i>			
<i>A. orientalis</i>			
<i>A. sphaerica</i>			
<i>A. unisporea</i>			
<i>Gloeotrichia ghosel</i>			
<i>G. pilgeri</i>			
<i>G. raciborskii</i>			

## Annexure-IX

### List of Phytoplankton identified from Kali River (Source: TERI Study, Dec 2001)

#### Diatoms:

- Amphora ovalis* kuetz v. *libyca* (Ehr.) Cleve.  
*Calonies permagna* (Bail) Cleve.  
*Cocconies placentula* Ehr.  
*Cymbella chandolensis* Gandhi  
*C. tumida* (Breb.) V.H. f. *ventricosa* Gandhi  
*C. ventricosa* kuetz. v. *arcuata* Skv.  
*Eunotia praerupta* Ehr. v. *inflata* Grun.  
*E. lunaris* (Ehr.) Grun  
*E. parallela* Ehr.  
*E. pseudoparallela* A. Berg. v. *densestriata* A. Cl.  
*Frustulia saxonica* Rabh.  
*Gomphonema gracile* Ehr. v. *intricatiforme* Mayer  
*G. intricatum* kuetz.  
*G. lanceolatum* Ehr.  
*G. longiceps* Ehr. v. *subclavata* Grun.  
*Gyrosigma kuetzingii* (Grun.) Cleve  
*G. spencerii* (w.smith) Cleve. v. *Nodiferum* (Grun) A.Cl.  
*Melosira granula* (Ehr.) Ralfs.  
*Navicula laeta* A. Mayer  
*N. cuspidata* Kuetz. v. *ambigua* (Ehr.) Cleve  
*N. cari* Ehr. v. *angusta* Grun.  
*N. radiosa* kuetz. v. *acuta* (Breb. ex. kuetz.) Grun.  
*N. viridula* Ehr. v. *intricatiforme* Mayer.  
*N. viridula* kuetz. v. *rostellata* (Cleve) Meister  
*N. vulpina* kuetz.  
*Neidium capitellata* Gandhi  
*N. longiceps* (Greg.) A. Cl. v. *undulatum* (Mayer) A.Cl.  
*Nitzschia obtusa* w. smith v. *scalpelliformis* Grun.  
*N. lorenziana* Grun. v. *subtilis* Grun.  
*Pinnularia divergens* W. Smith v. *capitata* Mills.  
*P. gibba* Ehr.  
*P. kiusiuensis* Skv.  
*P. panhalgarhensis* Gandhi  
*P. platycephala* (Ehr.) Cleve.  
*P. streptoraphe* Cleve.  
*P. vidarbhensis* sp. nov.  
*Stauronies anceps* Ehr. f. *gracilis* (Ehr.) Cleve.  
*S. phoenicenteron* Ehr. v. *intermedia* (Dippel) A.Cl.  
*Suirella robusta* Ehr.  
*Synedra acus* kuetz.  
*S. ulna* (Nitz.) Ehr. v. *danica* (kuetz.) Grun.

## Desmidiaceae:

- Arthrodesmus psilosporus* (Nordst & Lofg.)  
*Cosmarium blyttii* Wille var. *novae-silvae* West & West  
*C. lundelli* Delp.  
*C. pseudoconnatum* Nordst.  
*C. tumidium* Lund.  
*Desmidium baileyi* (Ralfs.) Nordst. fa. *tetragonum* Nordst.  
*Euastrum didelta* Ralfs. var. *bengalicum* Lagerh.  
*E. gnathophorum* West & West var. *bulbosum* var. nov.  
*Netridium digitus* (Ehrbg.) Itzigs. & Rothe  
*Pleurotaenium subcoronulatum* (Tum.) West & West Fa.  
*P. truncatum* (Breb.) Nag. Fa.  
*Staurostrum acanthastrum* West & West  
*S. crenulatum* (Nag.) Delp Fa  
*S. freemanii* West & West var. *nudiceps* Scott & Presc.  
*S. gracile* Ralfs fa. *kriegeri* fa. nov.  
*S. gracile* Ralfs var. *elongatum* Scott & Presc.  
*S. limneticum* Schm. var. *burmense* West & West  
*S. multispiniceps* sp. nov.  
*S. partabgarhensis* Gandhi  
*S. phoenicenteron* Ehr.  
*S. polymorphum* Breb. Fa.  
*S. prionotum* sp. nov.  
*S. raphidacanthum* sp. nov.  
*S. rosei* Playf.  
*S. sebaldi* Reinsch var. *ornatum* Nordst.  
*S. sexangulare* Lund var. *subglabrum* West & West  
*S. tauphorum* West & West  
*S. thienemannii* Krieg. fa. *triradiatum* fa. nov.  
*S. woltereckii* Behre Fa.  
*S. zonatum* Borges. var. *majus* var. nov.  
*Streptonema trilobatum* Wall  
*Xanthidium antilopaeum* (Breb.) Kutz. var. *leave* Schm. fa. *longispinum* fa. nov.

## Cyanophyceae:

- Aphanocapsa rivularis* (Carm) Rabenhorst.  
*Chroococcus limneticus* var. *subsalsus* Lemmermann  
*C. turgidus* (Kuetz.) Naegeli  
*Coelosphaerium dubium* Grunow  
*Microcystis aeruginosa* Kuetz.  
*Oscillatoria anguina* (Borg.) Gomont  
*O. limnosa* (Roth.) C.A. Agardh.

## Chlorococcales:

- Ankistrodesmus falcatus* (Corda) Ralfs

*A. spiralis* (Turner) Lemmermann  
*Eudorina elagans* Ehrenberg  
*Kirchnerilla obesa* (W. West) Schmidle  
*Mougeotia punctata* Wittrock  
*Oocystis submarina* Lagerheim  
*Pandorina morum* (Muell.) Bory  
*Pleodorina californica* Shaw  
*Spirogyra gratiana* Transeau  
*S. rhizobrachialis* Jao  
*Stigeoclonium stagnatile* (Hazen) Collins  
*Zygnema pectinatum* (Vauch.) C.A. Agardh

#### Dinophyceae:

*Ceratium hirundinella* (O. F. Muell) Dujardin  
*Peridinium gatunense* Nygaard

#### Euglenophyceae:

*Phacus orbicularis* var. *caudatus* Skvortzow

## Annexure-X

### List of zooplanktons found in Kali river

#### Cladoceran species

*Daphnia pulex*  
*D. carinata*  
*Simocephalus vetulus*  
*Moinodaphnia macleayi*  
*Bosminopsis dietersi*  
*Euryalona orientalis*  
*Alona monacantha moncantha*  
*A. pulchella*  
*Chydorus sphaerius*  
*Heliodyptomus viduus*  
*Rhinediaptomus indicus*  
*Tropocyclops prasinus*  
*Neodiaptomus schmaekeri*  
*N. handeli*  
*N. diaphorus*  
*Paradiaptomus greeni*  
*Phyllodyptomus annae*  
*Allodyptomus raoi*  
*Brachionus bidentata*  
*B. caudatus var. personatus*  
*B. calyciflorus var. hymani*  
*B. falcatus*  
*B. quadridentatus*  
*Keratella tropica*  
*Macrochaetus serious*  
(Birsal. N. R 1989)

## Annexure-XI

### List of Zooplankton identified from Kali River

#### Cladocera:

- Alona camboua* Gurney & Richard
- A. monacantha* Monacantha Sars
- Bosminopsis dietersi* Richard
- Daphnia carinata* King
- D. pulex* de Geer
- D. cf. longispina* var. *hyalina* f. *mendotae*
- Diaphanosoma excisum* Sars.
- Dunhevedia serrata* Daday
- Echinisca odiosa* Gurney
- E. cf. rosea* Lievin
- Euryalona orientalis* Daday
- Guernella raphaelis* Richard
- Latonopsis australis* Sars
- Macrothrix goeldi* Richard
- M. laticornis* Fischer
- Moina brachiata* Jurine
- Moinodaphnia macleayi* King
- Pleuroxus trigonellus* Muller

#### *Scapholeberis kingi* Sars.

#### Copepoda:

- Heliodiaptomus viduus* Brehn.
- Mesocyclops hyalinus* Rehberg.
- Paracyclops fimbriatus* Fischer
- Rhinediaptomus indicus* Kiefer
- Tropocyclops prasinus* Fischer

#### Ostracoda :

- Cypris subglobosa* Swerby
- Hemicypris fossulate* Vavra
- Stenocypris hislopi* Ferguson

#### Rotifera :

- Asplanchna brighwelli* Gosse
- Brachionus angularis* Gosses
- B. bidentata* Anderson
- B. diversicornis* Daday
- B. quadridentatus* Hermann

*B. rubens* Ehrenberg  
*Conochilus madurai* Michael  
*Dicranophorus cf forcipate* Muller, L.V.  
*Euchlanis dilatata* Ehrenberg  
*Filinia opoliensis* Zacharias  
*Keratella tropica* Apstein  
*Lecane leontina* Turner  
*Platyias quadricornis* Ehrenberg  
*Rotifer tardus* Ehrenberg

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(Source: TERI Study, Dec 2001)



Photo 1: Location of proposed dam site at Full Reservoir Level height (22m from Kali river bed)



Photo 2: Location of proposed dam site on Kali river.



Photo 3: Natural forest of Dandeli range in the submergence zone.



Photo 4: Damage caused by wild elephants in the submergence zone.

Photo 5: Huge  
Terminalia tree  
in the impact area  
& the survey team

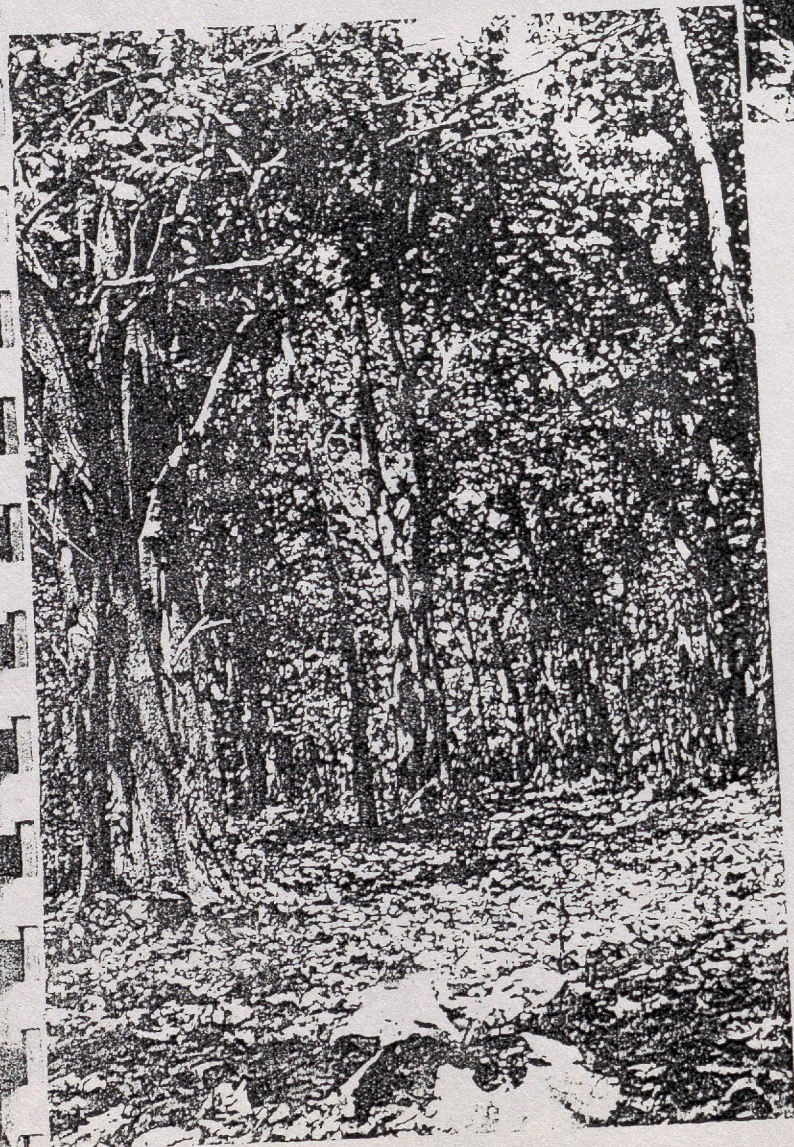
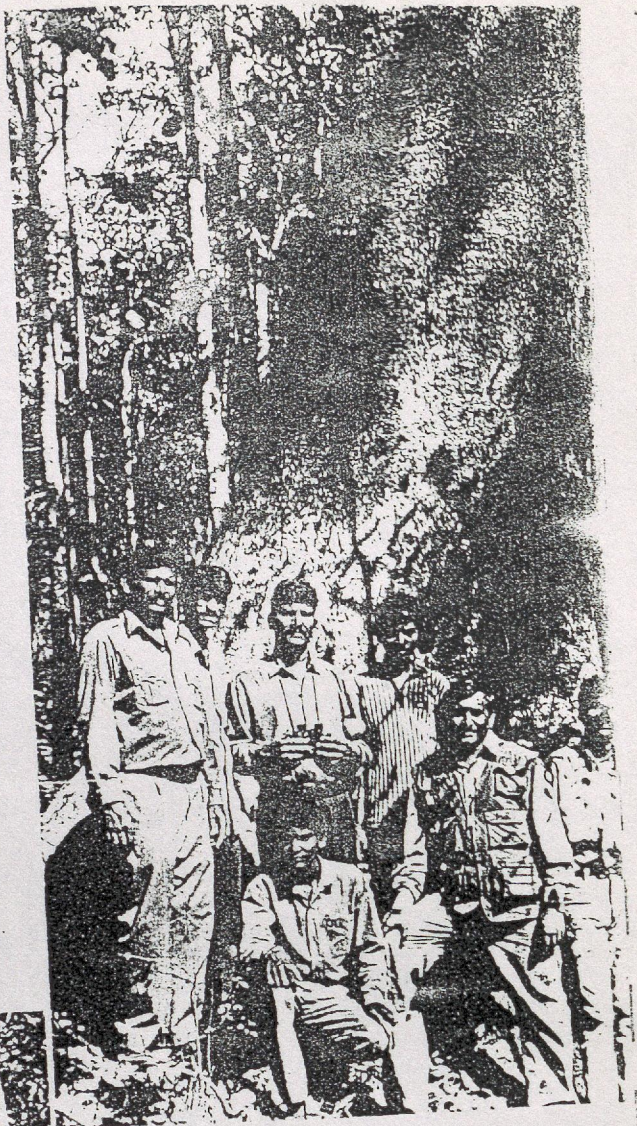


Photo 6: Dense  
Primary forest  
in the submergence  
Zone.

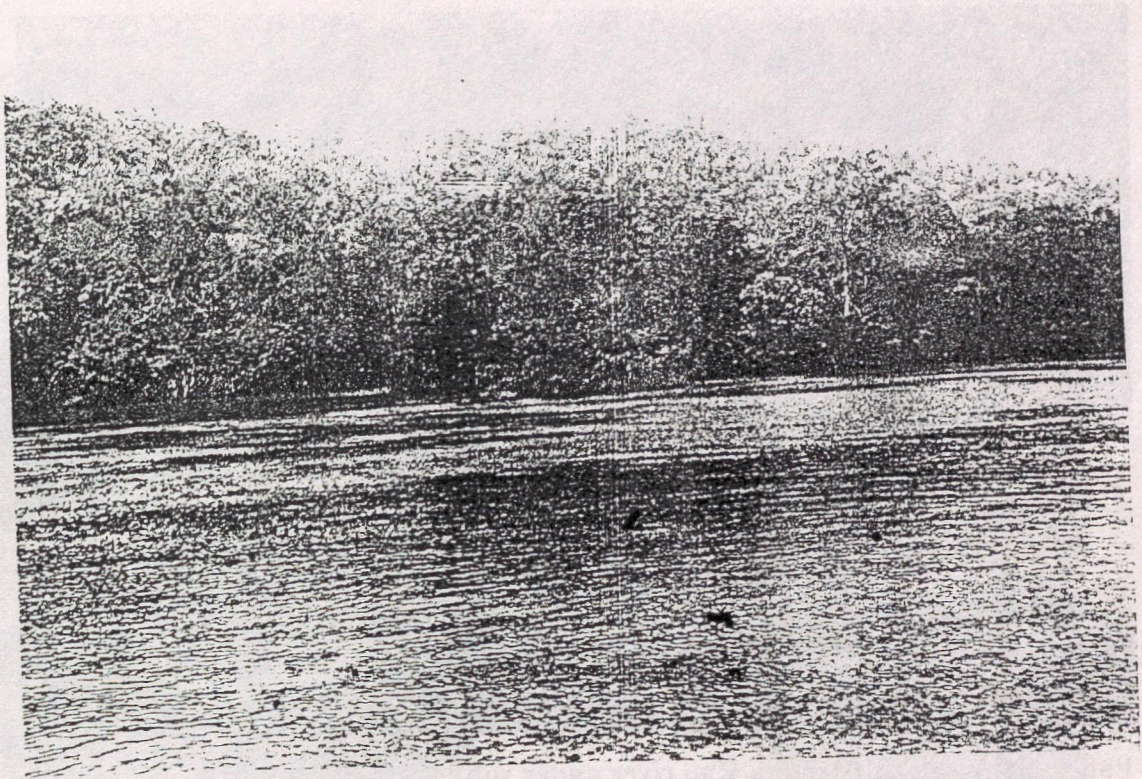


Photo 7: Dense vegetation in the submergence zone in the backdrop of Kali river.

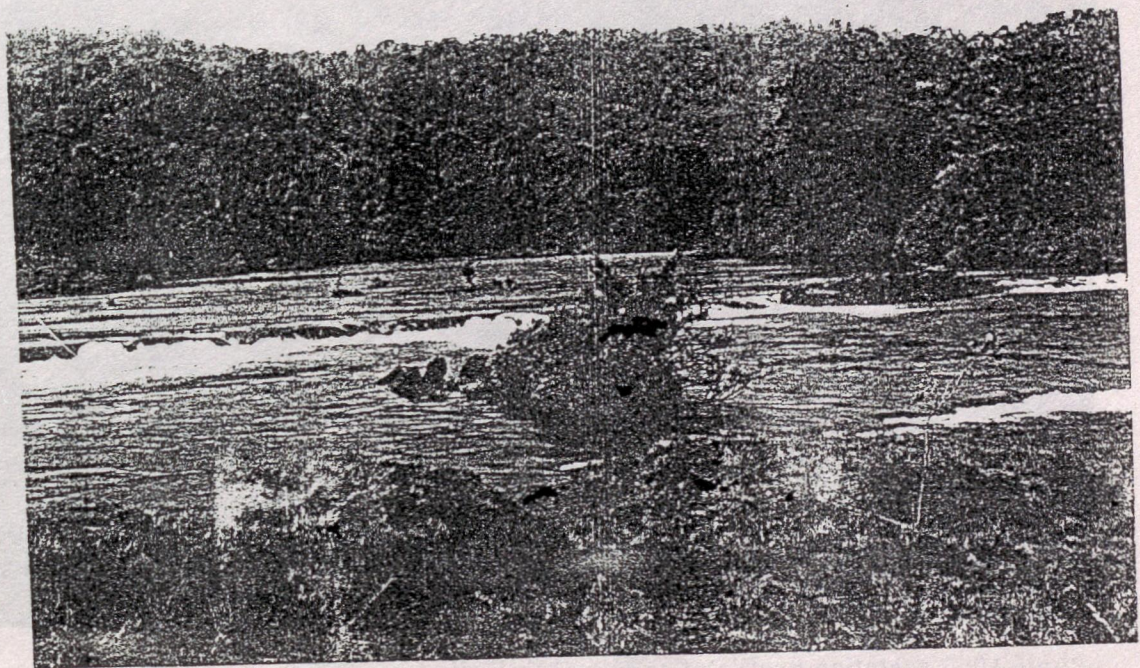


Photo 8: Another view of vegetation in the submergence zone in Dandeli.

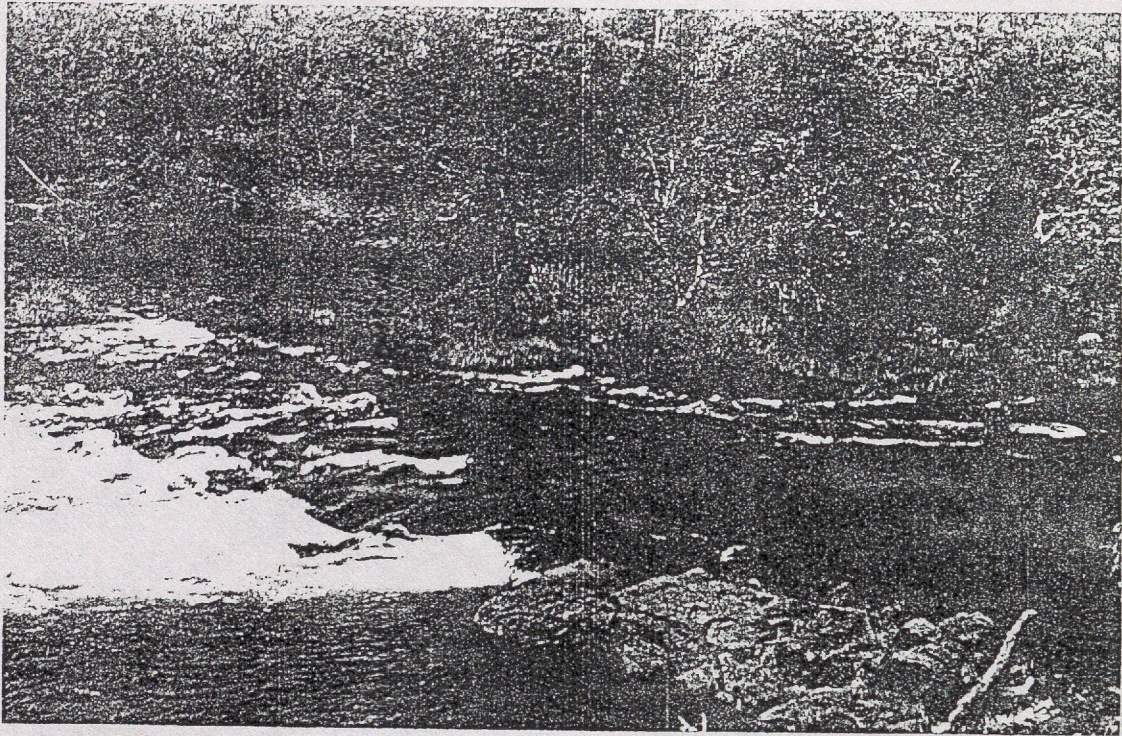


Photo 9: View of an Island in Kali river under submergence zone.



Photo 10: Vegetation profile of an Island in Kali river.

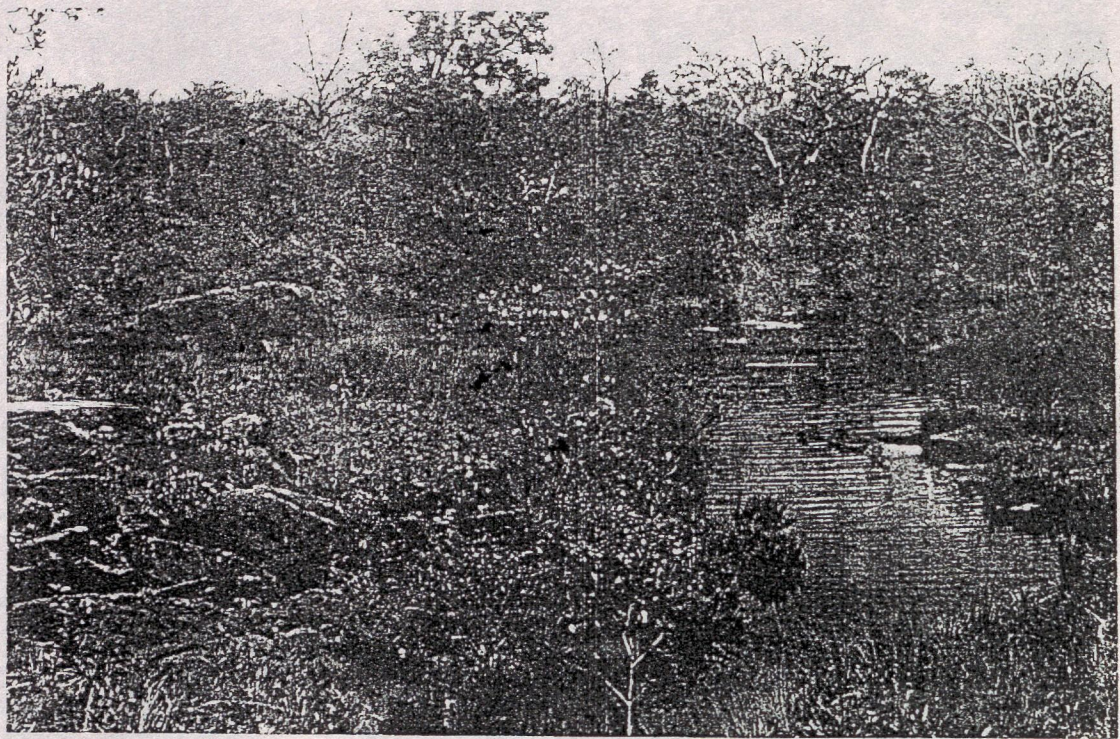


Photo 11: Island ecosystem in submergence zone.

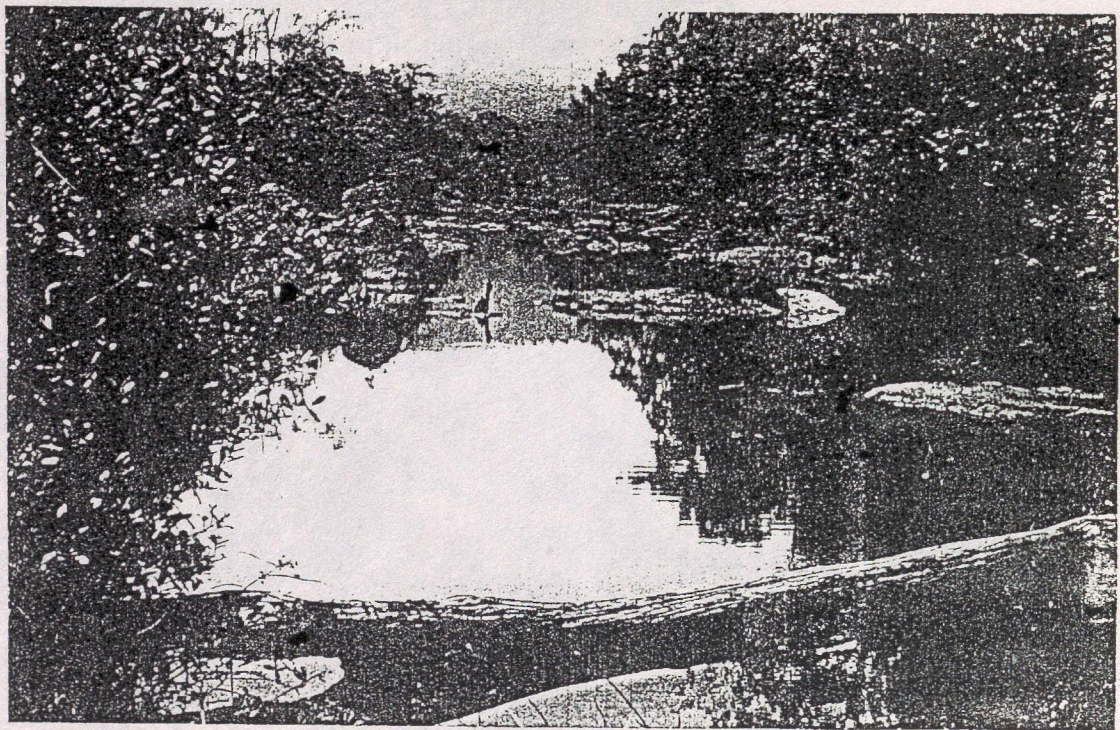


Photo 12: Lagoon on an Island in Kali river.



Photo 13: Rich flora of an Island in submergence zone.



Photo 14: Elephant dung seen on an Island in Kali river.



Photo 15: Malabar pied hornbill – A commonly seen bird species of Dandeli area

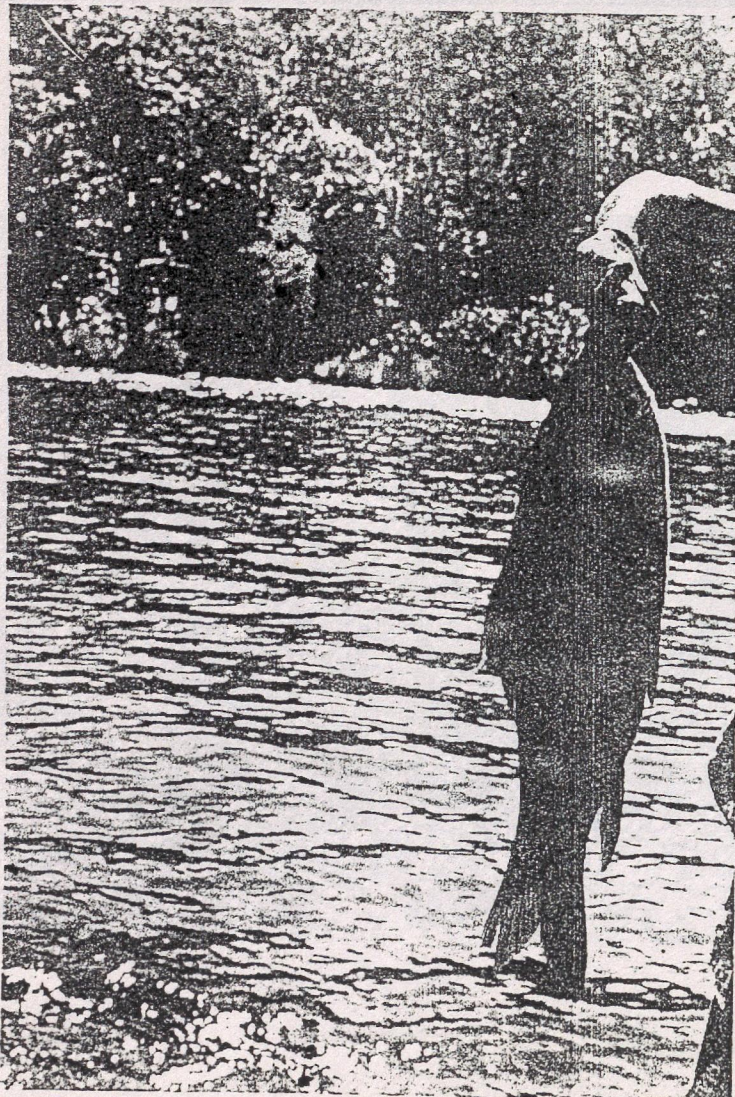


Photo 16:  
Commonly found  
Fish species in  
Kali river.



Photo 17: Leopard scat found in the submergence area.



Photo 18: Sloth Bear faeces found in the submergence area.