

This survey was undertaken by the Ecological Society under the guidance of Prof. P. Gore

LAND-USE AND BIODIVERSITY AROUND WAI TOWNSHIP

Surrounded by hills on three sides the Wai township nestles in the catchment of the Krishna river. Wai is the headquarters of the tehsil (Taluka) (Lat. 17 55 - 18 N and Long. 73 50 - 73 55 N) of the same name in Satara district of Maharashtra. An area within a radius of approximately 5 kms from the township was selected for a preliminary study of biodiversity. Field-work was carried out during a stretch of four days in March 2002.

Hills, steep slopes, ravines, rocky outcrops, a gorge carved out by the river in rocks present a picture of rugged topography in Wai's environs. At a few places such as Menavali the river runs through a broader plain where it has succeeded in forming a narrow flood plain. The study area is bounded to the north by the slopes of Pandavgad, a towering massif of exposed basalt with an altitude of 1259 metres. To the west and south are the radiating spurs of the Mahabaleshwar-Panchgani plateau whose slopes run down to the valley of the Krishna. The general aspect of the region is steep slopes that turn gentle to form a broad valley base through which the river flows. The river is still in its upper reaches pushing its way through rocks and boulders. The Krishna valley is V-shaped to the west and opens out to the east as the river emerges from steep hills and enters a broader plain.

Between hill slopes and the river channel is a unique geomorphic feature called the Pediment where loose material transported from hills and slopes has been deposited over several centuries. Another interesting geomorphic feature are the ravines in this loose material carved by streams flowing down the slopes. They are spectacularly seen between Pasrani Ghat and the township to the south of Wai.

The river Krishna rises to the NE of Mahabaleshwar plateau at an elevation of 1371 metres and flows eastwards. In the study area a number of streams draining the surrounding slopes come to meet the river. The largest of them is the Kivra Nala which drains the hill slopes north of Wai. Accumulation of large alluvial deposits on both sides of this nalla shows that at one time this was a very substantial stream with a large volume of water. Streams that meet the river from the south show a dendritic pattern while those coming from the north display a parallel pattern. The actual channel width of the streams ranges between 2 and 6 metres though at places some of the streams meander though a broader plain formed by deposits of alluvium carried by them. Both the streams and the river flow through ravines though at places the river channel is up to 50 metres in width. The streams are non-perennial retaining some water till the end of the cold season (January-February) and running dry till the commencement of the monsoon in June. Seepage from the right and left bank canals of the Dhom dam drains through some of the streams.

The climate of the Wai region is generally dry with moderate temperatures during winter and summer and an average annual rainfall of 1000 mm. The region has "Regur soil" which results from a weathering of basalt. Soil cover on the slopes is thin but grows thicker towards the river channel as it is enriched by the eroded material from the hills and sediments brought by the river. The river however, has been dammed in its upper reaches to the west of Wai town forming two large reservoirs which control the flows of water and sediment. The volume of water that flows

through the river channel today contains mainly the return flows from agriculture and human settlements (including some industry) and is contaminated by sewage, agricultural run-off containing pesticides and fertilisers and industrial effluents. The stream flows also show similar compositions.

Land-use Pattern

Agriculture and small human settlements occupy most of the study area. Flood plain area near the river channel is mostly farmed which activity gradually thins out away from the river and on to the pediment. As one moves away from the river, settlement and villages occupy a larger space. Agriculture extends right up to the stream banks though at certain places a buffer of stream vegetation exists. Most of the streams are well-shaded with vegetation, the river also is not an exception to this rule except in the central part of the town. Floral and faunal diversity is concentrated mainly around riverine and stream-bank vegetation. Such areas may be designated as wilderness areas.

The pattern of land-use can therefore, be described as follows: a large area occupied by farming and human settlement including some industry mainly along the river and nearby areas; rainfed and seasonal farming on parts of the pediment and wilderness areas along streams and ravines in the pediment. The rest of the study area is occupied by roads and canals which emanate from the Dhom dam.

Agriculture and Human Settlements

Grains such as wheat and jowar, vegetables, leafy vegetables and corn, fruit such as banana and pomegranate and cash crops such as sugarcane and turmeric are grown in the study area. Irrigation to these is provided by wells or canals. Some crops are rainfed. Floriculture, vermiculture and organic farming are also practised to some extent. Inorganic fertilisers such as urea, DAP, 1870, Sufala are used together with pesticides such as BHC and organochlorines. In small villages such as Bopardi, Lohare, domestic waste is channelled into farms.

As the valley is well-watered, with a perennial river and many streams, shortage of water for agriculture and drinking is not generally felt. Canals provide additional benefits. Number of wells in the study area may exceed a few hundreds. Livestock can be maintained on agricultural residue and forage picked up from the surrounding vegetation. Fertilisers and pesticides are required mainly for cash crops and vegetables respectively.

Human settlements are scattered throughout the study area including parts of certain villages. Many of the houses lack sanitation facilities. Disposal of waste is hardly organised either, which results in polluting the surroundings of farms, roads and tracks and stream basins.

The study area borders the industrial area of the Wai township. The area harbours some small scale units which lack facilities for proper treatment of the waste. As such solid waste is mostly dumped in the surroundings and effluents flow by gravity towards the stream basins. No attempt was made to estimate the volume of either liquid or solid waste.

Wilderness Areas including Fallows and Barren Lands

In the study area both the banks of the Krishna river were found to be covered with vegetation at most places. The vegetation is of mixed type representing evergreens (*Salix*, *Mangifera*, *Syzygium* sp.), semi-evergreens (*Pongamia*, *Ficus*, *Bridelia* sp.), moist deciduous (*Amoora*, *Thespesia*, *Terminalia* spp) and deciduous (*Tectona*, *Albizia*, *Anogeissus* spp.). Height of these trees varies between 15 and 20 metres. Some of the trees such *Samanea saman*, *Adenonia digitata*, *Ficus bengalensis* are of giant stature and must be quite old. Riverine vegetation, though maintained, represents a narrow band along the river. This band needs to be widened to provide adequate habitat for riverine fauna and act as a filter checking contamination of the river flow.

The band of vegetation along the streams is wider at least at some places than the one along the river though most of the trees lack stature and foliage of the former. The vegetation must be carrying out its ecological functions of providing shade to the river flow, bringing down the ambient temperature, checking erosion and filtering pollutants that otherwise would have entered the channels en masse. Here, along the streams, one can still find lianas looping around the large trees and providing evidence of the more or less undisturbed character of the stretch of vegetation.

The canal banks show vegetation in poor health, though plants such as *Gliricidea*, *Cassia*, *Eucalyptus* and *Dalbergia sissoo* have been planted. *Acacia nilotica*, *Woodfordia fruticosa* etc. have regenerated where plantation does not exist. The canal slopes are mostly uncovered with vegetation and therefore, are prone to erosion. Tracks along the canals show soft, loose soil which can very well be blown away.

A list of plants grouped according to their character appears at the end.

Birds of the Study Area

Agriculture, human settlements, river and streams and even fallow and barren areas provide habitats for different bird species. Though no endangered or threatened species could be recorded in the study area, some of the birds that have disappeared from most of the urban areas of Maharashtra, could still be seen around Wai. Examples are the Little green heron and the Tickell's blue flycatcher. Birds which are normally found in the hills such as Mahabaleshwar and Panchgani, were also noted; for example, Rufousbellied and Spotted babblers. Migratory birds such as Blackheaded bunting wintering in drier areas but of late rare in western Maharashtra, were also noted. A list of birds recorded during the investigation can be found at the end.

ECOLOGICALLY IMPORTANT LOCATIONS THAT NEED TO BE PRESERVED

River Course near Menavali

Here the river flows gently through a wide enough basin. Both the banks have tall, spreading trees providing canopy cover, shade and tranquillity. Sands, mud banks, sand bars provide a mosaic of habitats with corresponding vegetation. The Baobab tree near the Phadnis mansion is a veritable natural monument.

A Stretch of the Pasarni Stream

This stream, as it flows out of the Pasarni village follows a meandering course through a broad river channel. Meanders show a substantial deposition of silt on one side, a riverine terrace which is now under cultivation. Vegetation around the stream has Salix and lianas which go to prove that the stream at one time must have a substantial flow and a temperature-humidity regime favouring evergreen vegetation. This location with its canopy cover is a good habitat for birds such as the Paradise flycatcher, White-spotted fantail flycatcher etc. Small bunds across the stream built for irrigation, also provide habitat for fish and birds. Such stream stretches need to be preserved.

Kivra Nalla Downstream of Sultanpur

This ancient stream, now much reduced, shows accumulation of sediment deposits on both banks which are several metres tall. The present stream has carved out a channel through them which is deep and V-shaped. The channel today is contaminated by sewage, agricultural outflows and dumping of garbage but should be cleaned and maintained as a site special scientific interest.

Ravines Down the Slopes of Pasarni Ghat

These deep ravines also show the work of gushing water from the slopes. Erosive forces that act on bare, steep slopes have transported material by gravity through which the streams have etched out these ravines. They are a subject of geomorphic study and display peculiar vegetation. These ravines should also be preserved as sites of special scientific interest.

Threats to Biodiversity

No evidence of large scale cutting and burning of vegetation was recorded during the investigation. However, regeneration of vegetation even near the banks of the river and streams is scant due probably to trampling, browsing and collection of fuel wood. When regeneration is threatened, replacement of present vegetation will be impossible and weeds will take over as the present trees die or are destroyed. With it will disappear most of the habitats used by insects, reptiles and birds.

Contamination of soil and water through dumping of solid and liquid wastes including human excreta and agricultural run-off appears to be the major threat to biodiversity in the study area. No measurement of nitrate and sulphate loadings in the streams was available, neither such investigation carried out. But the outflows of sewage from human settlements and Wai town look quite substantial. They will wipe out dissolved oxygen through eutrophication, leading to death of aquatic organisms such as fish, will lead to poisoning of the soil through leaching and give rise to pathogens dangerous to human health. Spread of weeds harbouring mosquitos, choking natural drainage channels by plastic and non-degradable waste will further contaminate the surroundings. Brick kilns, burning of non-biodegradable garbage and of industrial waste will add to air pollution.

THE ONE SINGLE MEASURE THAT CAN BE SUGGESTED TO PREVENT POLLUTION OF VARIOUS SORTS, IMPROVE PUBLIC HEALTH AND ENHNACE BIODIVERSITY AROUND WAI TOWN, IS ORGANISED AND PROPER DISPOSAL OF SOLID AND LIQUID WASTE IN ALL ITS MANIFESTATIONS.

LIST OF PLANTS RECORDED DURING THE INVESTIGATION

Large Trees

| | |
|----------------------------|-----------|
| <i>Pongamia pinnata</i> | Karanj |
| <i>Eugenia jambolana</i> | Jambhul |
| <i>Bombax malabaricum</i> | Katesawar |
| <i>Ficus racemosa</i> | Umbar |
| <i>Mangifera indica</i> | Amba |
| <i>Tamarindus indicus</i> | Chinch |
| <i>Salix tetrasperma</i> | Walunj |
| <i>Ficus religiosa</i> | Pimpal |
| <i>Cocos nucifera</i> | Naral |
| <i>Ficus benghalensis</i> | Vad |
| <i>Cassia siamea</i> | Kashid |
| <i>Samania saman</i> | Rain tree |
| <i>Eucalyptus globulus</i> | Nilgiri |
| <i>Terminalia arjuna</i> | Arjun |
| <i>Azadirachta indica</i> | Kadulimb |
| <i>Ailanthus excelsa</i> | Maharukh |
| <i>Adansonia digitata</i> | Baobab |
| <i>Albizia lebbek</i> | Shirish |
| <i>Aegle marmelos</i> | |

Medium-size Trees

| | |
|-------------------------------|-----------|
| <i>Leucaena glauca</i> | Subabhul |
| <i>Acacia nilotica</i> | Babhul |
| <i>Erythrina indica</i> | Pangara |
| <i>Cordia latifolia</i> | Bhokar |
| <i>Santalum album</i> | Chnadan |
| <i>Carica papaya</i> | Papai |
| <i>Trema orientalis</i> | Gole |
| <i>Bauhinia acuminata</i> | Kanchan |
| <i>Butea monosperma</i> | Palas |
| <i>Thespesia populnea</i> | Bhend |
| <i>Psidium guajava</i> | Peru |
| <i>Bridelia retusa</i> | Asana |
| <i>Mallotus phillippensis</i> | Shendri |
| <i>Anona squamosa</i> | Sitaphul |
| <i>Dalbergia sp.</i> | Shisvi |
| <i>Glirisidea sepium</i> | Giripushp |
| <i>Tectona grandis</i> | Sagwan |
| <i>Anogeissus latifolia</i> | Dhavda |
| <i>Gmelina arborea</i> | Shivan |
| <i>Albizzia procera</i> | Kinhai |
| <i>Boswellia serrata</i> | Salai |
| <i>Anona reticulata</i> | Ramphal |
| <i>Phyllanthus emblica</i> | Avala |
| <i>Heterophrgma sp.</i> | Waras |

Acacia suma Sonkhairi

Acacia leucophloea Hivar

Shrubs and Climbers

Euphorbia sp.

Tinospora cordifolia Gulvel

Bambusa sp. Bambusa

Jatropha sp. Mogli-erand

Vitex negundo Nirgudi

Calotropis gigantea Rui

Asclepias curassova Haldi-kunku

Woodfordia fruticosa Dhayati

Cryptolepis buchanani Chabukvel

Duranta pulmieri

Lantana camara Ghaneri

Jasminum sp. Kusar

Argemone mexicana Pivla dhotra

Celastrus paniculata Malkangoni

Achyranthus aspera Aghada

Eclipta alba Maka

Plumbago zeylanica Chitrak

Amaranthus sp. Rajgira

Pogostemon parviflorus Pangli

Acacia concinna Shikekai

Clematis gauriana Morvel

Caesalpinia sp. Chilhar

Dodonaea viscosa

Grasses, Herbs and Aquatic Plants

Cyperus sp. Lavhaley

Ipomoea aquatica

Urena lobata Vanbhendi

Malva sp.

Birds recorded around Wai

Little cormorant (*Phalacrocorax niger*)

Little grebe (*Tachybaptus ruficollis*)

Little green heron (*Ardeola striatus*)

Pond heron (*Ardeola grayii*)

Cattle egret (*Bubulcus ibis*)

Intermediate egret (*Egretta intermedia*)

Pariah kite (*Milvus migrans govinda*)

Black-winged kite (*Elanus caeruleus*)

White-eyed buzzard (*Butastur teesa*)

Brahminy kite (*Haliastur indus*)

Short-toed snake eagle (*Circaetus gallicus*)

Crested serpent eagle (*Spilornis cheela*)

Crested hawk eagle (*Spizaetus cirrhatus cirrhatus*)

Shikra (*Accipter badius*)

Pale harrier (*Circus macrourus*)

Indian longbilled vulture (*Gyps indicus*)

Jungle bush quail (*Perdica asiatica*)
Rain quail (*Coturnix coromandelica*)
Rock bush quail (*Perdica argoondah*)
Grey partridge (*Francolinus pondicerianus*)
Painted partridge (*Francolinus pictus*)
Common Peafowl (*Pavo cristatus*)
Whitebreasted waterhen (*Amoraurnis phoenicurus*)
Redwattled lapwing (*Vanellus indicus*)
Yellow-wattled lapwing (*Vanellus malabaricus*)
Blue rock pigeon (*Columba livia*)
Little brown dove (*Streptopelia senegalensis*)
Spotted dove (*Streptopelia chinensis*)
Collared dove (*Streptopelia decaocto*)
Yellow-footed green pigeon (*Treron phoenicoptera*)
Roseringed parakeet (*Psittacula krameri*)
Plum-headed parakeet (*Psittacula cyanocephala*)
Koel (*Eudynamys scolopacea*)
Crow Pheasant (*Centropus sinensis*)
Plaintive cuckoo (*Cacomantis passerinus*)
Common hawk-cuckoo (*Cuculus varius*)
Common Indian nightjar (*Caprimulgus asiaticus*)
House swift (*Apus affinis*)
Whitebreasted kingfisher (*Halcyon smyrnensis*)
Small blue kingfisher (*Alcedo atthis*)

Pied kingfisher (*Ceryle rudis*)
Small green bee-eater (*Merops orientalis*)
Hoopoe (*Upupa epops*)
Indian roller (*Coracias benghalensis*)
Grey hornbill (*Tockus birostris*)
Coppersmith (*Megalaima haemacephala*)
Small green barbet (*Megalaima viridis*)
Mahratta woodpecker (*Picoides mahrattensis*)
Eastern Skylark (*Alauda gulgula*)
Crag Martin (*Hirundo rupestris*)
Dusky crag martin (*Hirundo concolor*)
Red-rumped swallow (*Hirundo daurica*)
Wire-tailed swallow (*Hirundo smithii*)
Barn swallow (*Hirundo rustica*)
Rufousbacked shrike (*Lanius schach*)
Bay-backed shrike (*Lanius vittatus*)
Golden oriole (*Oriolus oriolus*)
Black drongo (*Dicrurus adsimillis*)
Brahminy myna (*Sturnus pagodarum*)
Common myna (*Acridotheres tristis*)
Jungle myna (*Acridotheres fuscus*)
Rosy pastor (*Sturnus roseus*)
House crow (*Corvus splendens*)
Jungle crow (*Corvus macrorhynchos*)
Small minivet (*Pericrocotus cinnamomeus*)

Iora (*Aegithina tiphia*)
Black-headed cuckoo shrike (*Coracina melanoptera*)
Redvented bulbul (*Pycnonotus cafer*)
Red-whiskered bulbul (*Pycnonotus jocosus*)
Spotted babbler (*Pelorneum ruficeps*)
Rufousbellied babbler (*Dumetia hyperithra*)
Large grey babbler (*Turdoides malcolmi*)
Yellow-eyed Babbler (*Chrysomma sinense*)
Tickell's blue flycatcher (*Muscicapa tickelliae*)
Paradise flycatcher (*Terpsiphone paradisi*)
Blacknaped flycatcher (*Hypothymis azurea*)
Whitebrowed fantail flycatcher (*Rhipidura aureola*)
Franklin's wren warbler (*Prinia hodgsonii*)
Plain wren warbler (*Prinia subflava*)
Ashy wren warbler (*Prinia socialis*)
Tailor bird (*Orthotomus sutorius*)
Blyth's reed warbler (*Acrocephalus dumetorum*)
Magpie robin (*Copsychus saularis*)
Pied bush chat (*Saxicola caprata*)
Indian robin (*Saxicoloides fulicata*)
Blackbird (*Turdus merula*)
Grey tit (*Parus major*)
Grey wagtail (*Motacilla cinerea*)
White wagtail (*Motacilla alba*)

Large pied wagtail (*Motacilla maderaspatensis*)
Thickbilled Flowerpecker (*Dicaeum agile*)
Tickell's Flowerpecker (*Dicaeum erythrorhynchos*)
Purple-rumped sunbird (*Nectarinia zeylonica*)
Purple sunbird (*Nectarinia asiatica*)
White-eye (*Zosterops palpebrosa*)
House sparrow (*Passer domesticus*)
Yellow-throated sparrow (*Petronia xanthocollis*)
Baya (*Ploceus philippinus*)
Whitethroated munia (*Lonchura striata*)
Spotted munia (*Lonchura punctulata*)
Common Rosefinch (*Carpodacus erythrinus*)
Blackheaded bunting (*Emberiza melanocephala*)
Crested bunting (*Melophus lathami*)

Butterflies recorded around Wai

Common grass yellow
Common crow
Common jezebel
Common emigrant
Common sailor
Glassy tiger
Lemon pansy
Common rose
Common wanderer

Common grass dart

Chocolate pansy

Brown awl

Common castor

Tailed jay

Yellow pansy

Lime

White orange tip

Pioneer

Common grass jewel

Common mormon

Blue pansy

Common cerulean

Plain's Tiger

Rustic