

ANJANERI PLATEAU, Nashik District

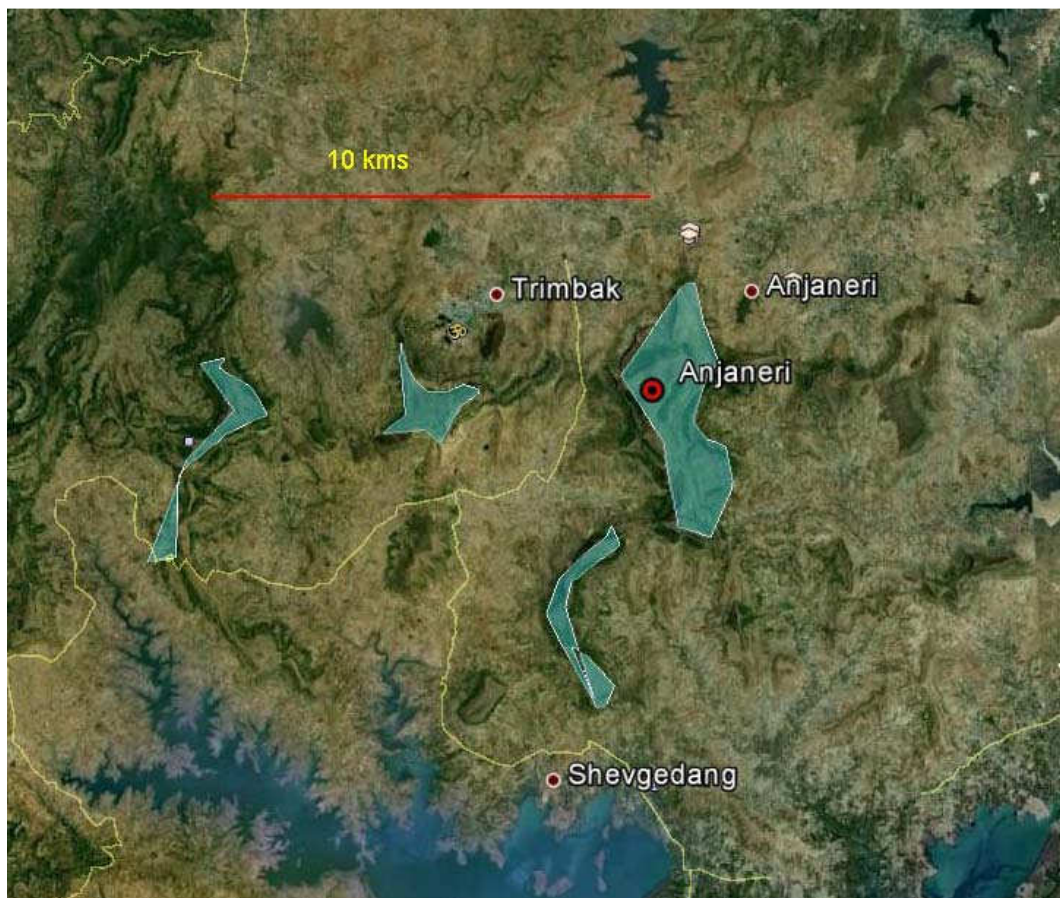
Anjaneri plateau is one of the important hill fort in the mountain range of Nasik-Tryambakeshwar. It is located 20 km away from Nasik by Tryambak Road. The rocky hills of Tryambak (famous Jyotirling), Brahmagiri and Anjaneri are well known sacred places and part of religious pilgrimage circuit for devotees. The plateau top can be reached after a steep climb from Anjaneri village. It is believed to be the birthplace of Hanuman, son of Anjani, and a temple dedicated to Anjani Mata is built on the plateau top.

The hill top is an exposed basalt plateau located between 19°56'39.12"N, 73°34'48.20"E to 19°56'19.02"N, 73°34'28.56"E. The highest point is around 1300 MSL. The fort has 3 extensive plateaus at the elevation of 800MSL, 1100 MSL and 1280-1300 MSL respectively

Anjaneri	Area (sq. kms)	Disturbance
Plateau 1		local grazing, fires, trampling and wasteful picking by tourists, plant collection Illegal extraction for sale.
Plateau 2	6.3821	
Plateau 3	1.6491	
Total	8.0312	

The mesa has steep cliff edges which descend into gently sloping hillslopes. The plateau and its surrounding steep slopes have forest patches affected by biotic pressures. Dense forests are seen only in less accessible areas.

With an exception of a few hectares land under private ownership, the entire area is under RF category. Forest of the fort is divided



into four Gram-Panchayats namely, Anjaneri, Mulegaon, Pegalwadi and Pahine. There are Joint Forest Management committee in all the 4 GPs.

2 International schools/ private colleges have mushroomed on the foot hills of the fort. They have been constructing huge structures around the hill-fort. These educational institutes have drastically changed the economic scenario of the villages especially, Anjaneri and Pegalwadi. Vicinity of city has also resulted in selling off of large percentage of privately owned land to urban investors.

Ecosystem services: The steep hill slopes give rise to many cascades and streams that supply two major dams (Upper Vaitarna Dam) and three minor reservoirs. At the end of monsoon, the plateau has tall grass cover providing sustenance for local cattle and sheep. Natural and manmade ponds are also present on the plateau.

Gregarious numbers of seasonal flowering plants on the three different plateaus including *Heracleum*, *Tricholepis*, *Blumea*, *Celosia*, *Smithia*, *Senecio*, etc. provide food material to the different pollinating insects of families including Lepidoptera, Diptera, Coeloptera, etc. (pic *Tricholepis*)

Honey bees nest on the cliffs and forest trees are a source of nourishment and subsidiary income to locals.

The area has several medicinal plant species, and Vaidus from surrounding areas regularly collect medicinal species from this area. It has been declared as a medicinal plant conservation area (MPCA) by the forest department and special protection has been provided against exploitation.

Biodiversity Profile:

The area is well known owing to its great diversity of medicinal and endemic species. Floristic surveys were carried out for the Flora of Nashik district work by BSI. Dr. M. R. Almeida has also published a checklist of species from this locality. Most recent work is started by Jui Pethe (2012 onwards), who is making a digital herbarium of the area with

funding and local support by the Territorial Forest Department of Nashik circle.

Ecological surveys of the area have not been undertaken. But observations have been made during monsoon periods. The steep hill slopes of the area have typical cliff vegetation dominated by *Tripogon* spp. Small clumps of succulent *Euphorbia* are also seen *Eriocaulon-Utricularia* dominated Ephemeral Flush Vegetation is seen on gently sloping rocky areas. *Pogostemon deccanensis* forms dense patches in the water logged areas.

Typical basalt plateau endemics such as *Cyathocline lutea*, *Senecio dalzellii*, *Smithia purpurea* entirely cover the rocky plateau top. Several grasses (*Heteropogon*, *Dichanthium*, *Ischaemum*, *Themeda*) form dense growth during late monsoon period.

The place has become well known as the type locality of *Ceropegia anjanerica*. It is not reported from any other hill in the surrounding area. There is a great need of conservation of this locality as the only site of existence of the species. *Ceropegia anjanerica* is found in large numbers in association with clumps of *Senecio dalzellii*, *Celosia argentea*, *Lepidagathis* sp. and *Justicia betonica*. Other western plant specialists found on the plateau are *Tricholepis amplexicaulis*, *Pesmodium alysicarpoides*, *Heracleum* sp, *Pinda deccanensis*, *Paracaryum malabaricum*, etc.

Along with this, other endemic and threatened species like *Sida indica*, *Ceropegia* spp. *Habenaria* sp, *Dendrobium microbulbon*, etc are commonly seen here.

The 10-12m high vertical cliffs are ideal and safe nesting sites for long billed vultures (*Gyps indicus*). The critically endangered scavenging species is seen in healthy numbers on the fort. Many other raptors have been reported. Shri. Vishwarup Raha of Nashik has maintained detailed records of the birds of this region reported more than two hundred species from the area. Detailed surveys of herpetofauna, invertebrates etc. have not been conducted so far. But observations during monsoon indicate potentially rich snake, gecko and amphibian fauna including *Trimeresurus gramineus* and geckos like *Hemidactylus* spp., *Geckoella deccanensis*. The rocky cliffs are ideal habitat

for many cliff dwelling and stream dwelling species of animals.



Ceropogia anjanerica

© Sanjay Thakur

Some documentation on lichens and other cryptogamic fauna is available, however, very little has been published so far. Endemic lichen, *Graphis maharashtra*, is reported from Anjaneri area.

Current and potential threats

The pressures on the plateau vegetation are currently low. Local grazing and putting of fires by the villagers does have some impact. The annual fair where reportedly a lakh of pilgrims visit the temples is a major cause of trampling, littering. There is high degree of illegal extraction of medicinal and religiously important plants like *Heracleum grande*, *Terminalia chebula*, *T. Bellarica*, *Embelia base*, *Desmodium sp*, *Curcuma pseudomontana*, *Eriolaena quinquilocularis*, *Neuracanthus sphareostachys* etc. which are in huge demand in Nashik and surrounding markets like Ghoti, Igatpuri, Tryambakeshwar, etc.

There is serious overexploitation of plants by local communities. Tubers of *Ceropogia* spp. are collected and eaten in large numbers.

Threatened plants are collected by the botanists.

Browsing tourists pick gregariously flowering wild plants like *Adelocaryum malabaricum*, *Pinda cocanensis*, *Cyanoglossum zeylanicum*, *Smithia purpurea*, *S. bigemina*, etc.

To prevent this, awareness creation activities are being conducted by local researchers, JFM committee and forest department. Special protection has now been given to the Medicinal Plants in Conservation Area. Sensitization of tourists has been started by the JFM members who are allowed to run parking facility and collect toll from the local villagers.



Hanuman carved on rocks

© Sanjay Thakur

Suggestions for conservation:

- Increased protection of the Medicinal Plant Conservation Area
- Continued awareness generation for all the surrounding villages to reduce overexploitation of plant resources
- Prevention of accidental fires
- Special protection of bird habitats, especially of the vultures

- Complete documentation of faunal and cryptogam diversity and regular monitoring of flora and fauna
- Visitor sensitization regarding religious, cultural, historical and aesthetic importance of the area
- Protection of natural drainage and micro-planning for water and ecological conservation
- Capacity building of JFM committees to design a sustainable harvesting policy for any commercially important wild plant.
- Eco-friendly enterprises can be promoted to give locals added income sources.

- Management of existing tourism to avoid problems of garbage, nuisance to wilderness etc.
- Planning conservation oriented low-impact tourism

Based upon information provided by :

Jui Pethe, Amit Tillu, Kiran Rahalkar, Ketan Patwardhan, Vishwarup Raha, Nature Conservation Society, Nashik; Sanjay Thakur, Biome Conservation Foundation Pune; Joint Forest Management Committee, Anjaneri, Office of CCF (Territorial) Nashik Division.



© Jui Pethe

Anjaneri hill top



© Aparna Watve

Anjaneri JFM committee members, forest department staff with Jui Pethe and Amit Tillu



© Jui Pethe

Anjaneri JFM committee meeting

JUNNAR PLATEAUS, Pune District

The basalt plateau of Ambe-Hatvij is one of the largest and floristically rich rocky plateau in the Pune district. It is located 60 kms away from Junnar town. The plateau top can be reached after a steep climb from Inglun village. The road passes through villages of ambe-hatvij and Kathewadi and ends at the sacred grove of Durguwadi, which overlooks the Konkan area. Adjacent to it is the plateau of Warsubai temple.

The plateau is located between 19°11'37.99"N, 73°41'42.57"E to 19°13'3.59"N & 73°38'33.92"E. The highest point is around 1200m ASL.

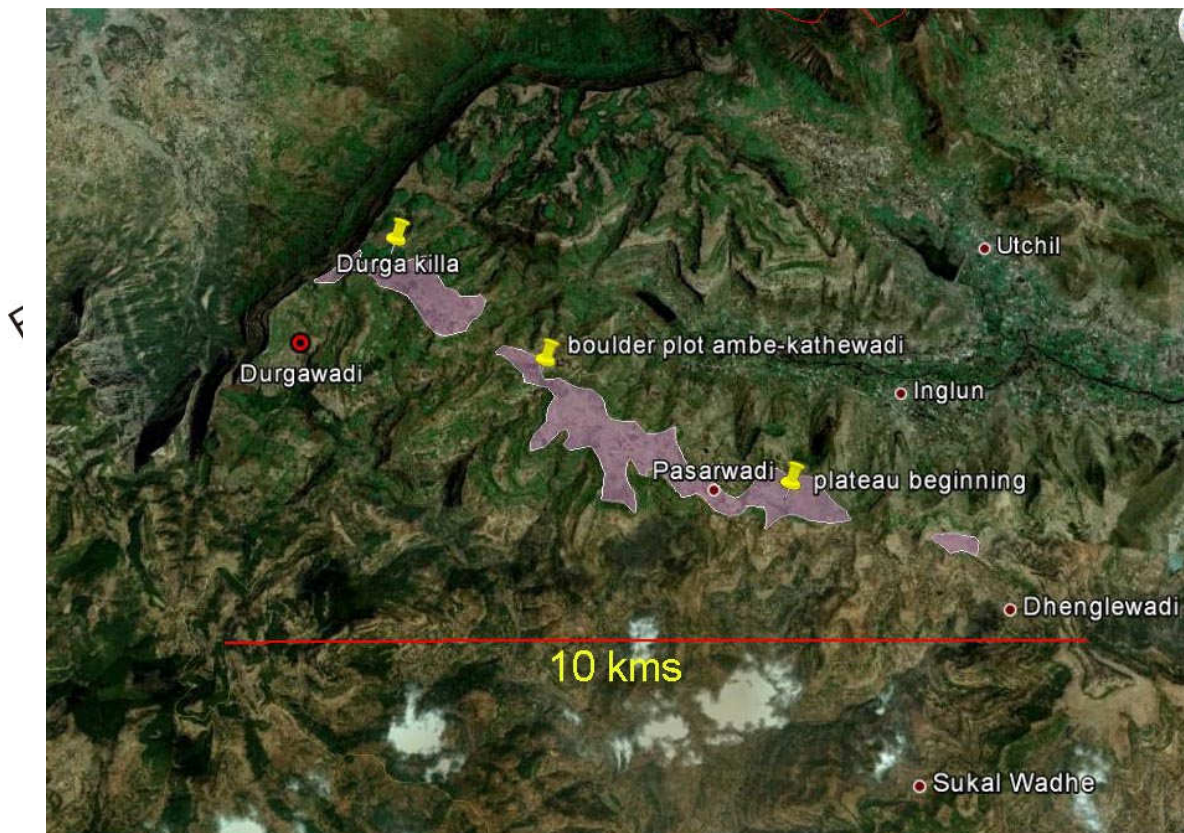
The mesa has steep cliff edges on south side which descend into gently sloping hill slopes. The plateau and its surrounding steep slopes have small patches of forest, but are mostly private lands extensively cultivated for rice and Nachli. The sacred grove and surroundings are reserve forest.

Durgawadi killa (fort) is a name given to a rocky hill top above the sacred grove. It is entirely made of boulders and holds many endemic and threatened species of plants.

JUNNAR	Area (sq. kms)	Disturbance
Warsubai	0.0977	local grazing, fires, trampling by tourists, plant collection proposed windfarms
Hatvij	2.0299	
Durgwadi	0.7517	
Total	2.8793	

Ecosystem services

The steep hill slopes give rise to many cascades and streams that supply Dimbhe dam. One small reservoir is also present to the north of the area. The entire plateau has many natural ephemeral ponds supplying villages. Wells with perennial water supply are present on the plateau top. At the end of monsoon, the plateau has tall grass cover



providing sustenance for local cattle. Some artificial ponds have also been created to take advantage of the impervious basalt strata for water storage.



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Biodiversity Profile:

The area has been extensively studied floristically. Flora of Junnar was written by K. Hemadri in 1970. Most recent work is by Dr. Savita Rahangadale and Dr. Sanjay Rahangadale who studied the impacts of development on the Junnar area. They have reported many endemic, threatened and new species from this region.

The vegetation of this plateau was quantitatively studied during 2004-2006 as a part of Department of Science and Technology funded project on plant communities of rocky plateaus. In a sampling area of 25 sq.m, $H' = 4.417$ and 44 herbaceous species were reported in September 2004, followed by $H' = 4.404$ and 47 herbaceous species in September 2005. This had the highest diversity amongst the six plateaus studied in the NW Ghats.

The steep hill slopes of the area have typical cliff vegetation dominated by *Tripogon* spp. Small clumps of succulent *Euphorbia* are also seen. *Eriocaulon-Utricularia* dominated Ephemeral Flush Vegetation is seen on gently sloping rocky areas. *Pogostemon deccanensis* forms dense patches in the water logged areas. *Drosera indica* is very common in the vegetation.

Typical basalt plateau endemics such as *Cyathocline lutea*, *Senecio dalzellii*, *Smithia purpurea* entirely cover the rocky plateau top. Several grasses (*Heteropogon*, *Dichanthium*, *Ischaemum*, *Glyphochloa*) form dense growth during late monsoon period.

The area is especially rich in lithophytic and epiphytic orchids and *Ceropegia* species. *Ceropegia mahabalei* is reported from this area.

Faunal surveys of the area have not been undertaken so far. But incidental observations indicate rich herpetofaunal diversity. *Hemidactylus* spp., are commonly seen. The ponds are good breeding grounds for aquatic fauna especially amphibians. The rocky boulders are ideal habitat for many scorpions and other rocky area fauna.

Lichens of the area have been extensively documented by the Lichenology department of Agharkar Research Institute. Many species of microlichens have been reported. Many large boulders on this plateau are completely covered with dense and healthy growth of lichens such as *Parmelia*, *Graphis* etc. and mosses.



Lichens © Sanjay Thakur

This area is type locality of a newly described species, *Mucuna sanjappae*

Current and potential threats

In the past, the pressures on the plateau were mainly due to local villages. Extensive grazing, fires are common. Much of the previously rocky area has been claimed for agriculture. Boulders have been used for construction locally. At present, the Durguwadi temple inside the sacred grove attracts many tourists and slowly garbage and disturbance has increased. The renovation of the temple has caused much disturbance to the forest. Grazing and fuelwood collection inside the grove is also common. Outside the grove large area has been used for contour trenching for

plantation, which has not survived. Blasting was done on plateau to create ponds.

Local people have recently reported proposal of windfarm at the area. So far the work has not started and it is difficult to know its impacts as the locations are yet to be announced.

Suggestions for Conservation

- DCF, Ghod Project Forest Division, Junnar has submitted a proposal of Eco-Sensitive Zone around Bhimashankar WLS to the Ministry of Environment and Forest. This includes some of the plateau areas, but details are not yet available and it is in process
- Developing an appropriate management plan for the ESZ will greatly help in the conservation of biodiversity on the plateau areas
- Identification of the basalt plateaus, other outcrops, streams, cascades, natural ponds of the region as natural heritage sites, with detailed measures for conservation of biodiversity on the sites needs to be created.
- Continued inventorying of the region for lesser-known taxa and regular monitoring will help in the management.
- Prevention of fires, overgrazing, garbage are of utmost importance

- Plantation, water conservation or soil conservation measures should be undertaken only after defining a biodiversity conservation master plan.

Based upon information provided by :

Dr. Savita Rahangadale , BJ College Ale, Dr. Sanjay Rahangadale, PDEA's A. W. College, Otur, Atulkumar Kale, Kusum Karnik, Shashwat, Dr. Gargee Pandit, Agharkar Research Institute, Pune, Office of CCF (Territorial) Pune Division, Sanjay Thakur, Aparna Watve Biome Conservation Foundation Pune



Cyathocline lutea © Aparna Watve

Durgawadi rocky plateaus

© Sanjay Thakur



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Durgawadi sacred grove

© Sanjay Thakur

NANEGHAT PLATEAU, Pune District

Naneghat plateau is one of the most famous locations in the Junnar area of Pune district. It is located 26 km away from Junnar. The rocky hills of this region are well known forts. There is a tar road from Junnar to Naneghat (Ghatghar village).

Kukadeshwar temple near this area is famous for basalt carvings from 12th century. Naneghat is famous as an ancient mountain pass, for more than 2000 years. A steep climb from Konkan through a mountain pass has been used by centuries of traders and later by trekkers. Two large caves of Naneghat are famous archaeological sites owing to stone writings and have been studied by many indologists. These caves and inscriptions date back to the period of Satvahan kings (about 200 BCE–190 CE).

The area has many exposures of basalt on the plateau located between 19°16'15.63"N, 73°43'14.45"E to 19°17'53.29"N, 73°40'22.37"E. The highest point is around 700m ASL. The hill forts of Chavand and Jeevdhan rise steeply to 800 m above this plain area.

This area differs from others owing to basalt being exposed as a broad expanse at low altitude. The outcrops and its surroundings

have rice fields and small forest patches maintained as sacred groves or RF. Entire area has grazing, some amount of burning and trampling.

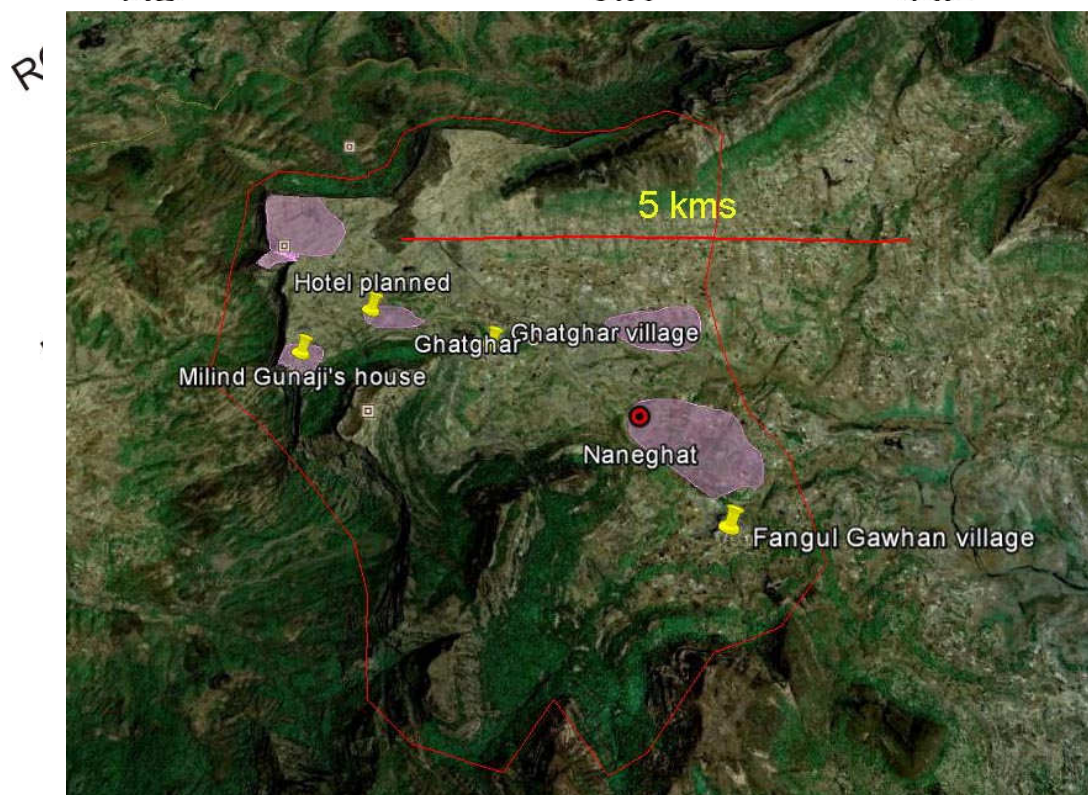
With an exception of a few hectares land under RF, the area is privately owned, part of Gaothan.

Ecosystem services

The plains give rise to many streams that supply Kukdi river, and ultimately Manikdoh reservoir. Three ponds have been constructed near rocky areas and two more are being constructed. In addition, many natural pools form on the outcrops and supply local cattle. At the end of monsoon, the area has tall grass cover providing sustenance for local cattle.

Naneghat	Area (sq kms)	Disturbance
Area 1	0.7524	Grazing, trampling,
Area 2	0.1131	quarrying,
Area 3	0.1126	ponds, littering,
Area 4	0.4939	conversion
Area 5	1.472	
Total	0.7524	

Most of the area is under private ownership. The land primarily owned by tribals and hence



land dealings have been very few in the past. The mountain pass and some surrounding portion and patches of land belong to RF category.

Biodiversity Profile:

Naneghat is better known for its archaeological significance. The area was studied as a part of flora of Junnar by BSI scientists. Most recent work on the regional floristics is by Dr. Sanjay Rahangadale of Alephata College and Dr. Sanjay Rahangadale of Otur College. The sacred groves around this area, have been extensively studied by Botany department of Agharkar Research Institute, Pune.

Vegetation wise the area is similar to other basaltic outcroppings in the region. *Elaeagnus-Utricularia* dominated vegetation along with grasses (*Glyphochloa*, *Indopoa*, *Bhidea*, *Dimeria*, *Arthraxon* etc) is abundant. *Isoetes* spp., *Ophioglossum* spp. are seen in moist soil. Ephemeral pools here are specially rich in *Rotala*, Cyperaceae and other aquatics.

Lepidagathis mitis, *Smithia purpurea*, *S. pycnantha*, *Cyathocline lutea* are some of the common endemic species seen here.

Although faunal diversity has not been surveyed in detail, a number of birds, small mammals and snakes have been reported from the area.

Endemic *Uroperis bicatenata* is reported from the forests of Fangul Gawhan village on way to Naneghat. This is one of the two areas (other being Bhimashankar WLS) where this species is present.



© Aparna Watve

Naneghat is also type locality of a little known species *Hemidactylus aaronbauri*. This gecko is restricted to the steep basalt cliffs and

crevices in the region. It has not been reported from elsewhere, and thus the site qualifies for highest protection to the habitat and species.



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Current and potential threats:

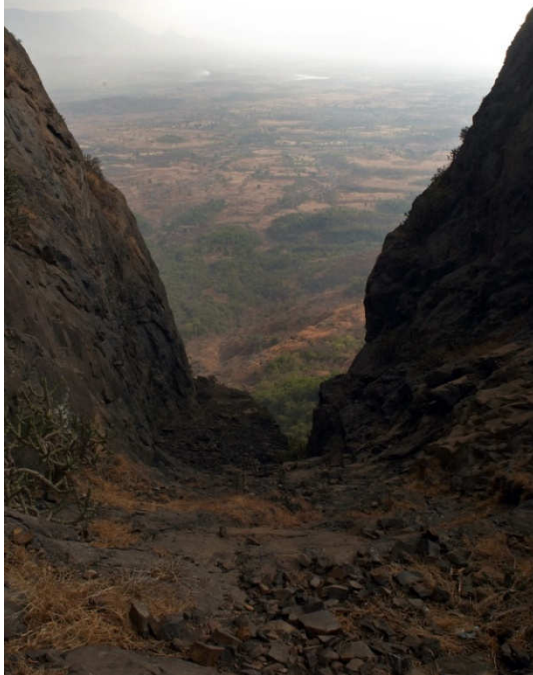
The rocky patches are very small in extent and hence quite vulnerable to even the smallest disturbance. Grazing, trampling and fires have led to deterioration of lichen and moss flora of the ground. The ephemeral pools are quite impoverished in terms of aquatic life. Eutrophication caused by dung, washing of utensils, clothes affects such small areas. Ferns, orchids, lithophytic grass flora is quite poor on these outcrops. However, intact vegetation is seen towards the western edge, away from the villages.

Growing tourism in this area especially the recreational kind is a serious concern. In the past only the trekkers and historically oriented tourists frequented this region. But recently many tourists come here mainly to drink and enjoy in the monsoon. The number of hotels is slowly growing. Although at present only villagers of the area have started it, in future this might grow and create pressure due to increased use of fuelwood and littering.

A noted actor has bought land and built house just next to a large outcrop and cliff. An Italian group of companies has bought land in the Ghatghar village area to build resorts. The threat of land conversion is thus very high. This will lead to increased disturbance to the fragile habitat and ground fauna.

Archeological Survey of India has now kept watchmen and shut off one of the caves by making a gate. This was to protect the ancient stone inscriptions from vandalism.

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aesthetic importance, all of which will be threatened if insensitive tourism and land-use changes of present go unchecked

- Diversity of habitat types, forests, cliffs, scrub, outcrops together support endemic species diversity. It falls in the corridor region between the Bhimashankar and Harishchandragad WLS and has intact wilderness so far.
- The entire area marked by red line **should be declared as eco-sensitive zone** (See: google image)
- Special management plan for preserving this site of natural, cultural, historical heritage should be drafted.
- Research and monitoring of biodiversity and ecological processes should be undertaken.
- Once the legal protection is in place, ecologically and culturally sensitive tourism plan should be drafted.

Based upon information provided by :

Varad Giri, BNHS, Ashok Captain, Yatish Lele, Sanjay Thakur, Aparna Watve, Biome Conservation Foundation Pune

Suggestions for conservation:

- **This area needs urgent legal protection.** It has cultural, historical, ecological and



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Smithia purpurea © Ashok Captain



Lepidaaathis mitis © Ashok Captain

ROCK O

ROCK OUTCROP NETWORK

BHIMASHANKAR OUTCROPS, Pune District

Rocky outcrops are seen scattered throughout the Bhimashankar wildlife sanctuary. They are seen near Kondhwal, Nigdale and Ahupe villages. Bhattiche ran is a well known open rocky area near Ahupe. The area is located between 19°4'38.77"N, 73°34'4.04"E to 19°10'56.63"N, 73°34'19.43"E.

Outcrops are also seen near the Bhorgiri and Terungan area to a smaller extent. In the absence of historical data, it is difficult to say if all these are primary outcrops or secondary ones formed by forest degradation. However, number of endemic herbs seen in these rocky areas increases the biodiversity richness of the sanctuary.

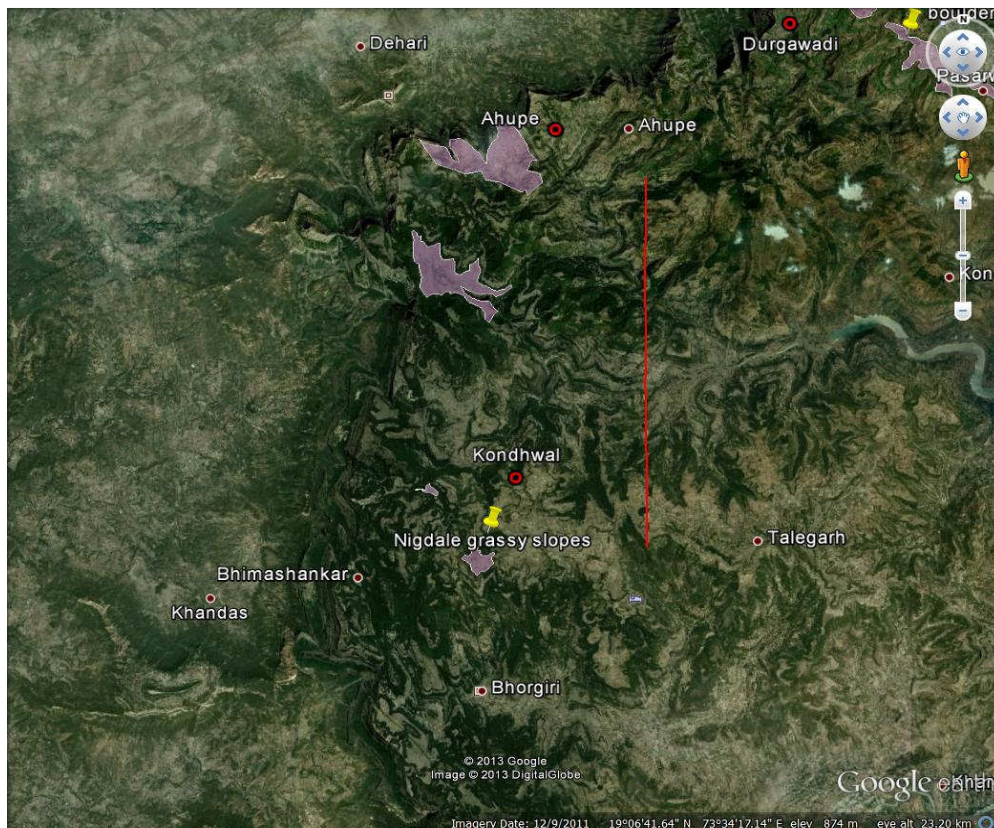
Bhimashankar sanctuary is located about 65kms from Manchar on Pune –Nashik highway. It is famous as a main Jyotirlinga. A footpath also connects Bhimashankar with Konkarn area. The entire area falls under the Pune (Wildlife) forest division.

Ahupe and Bhattiche ran outcrops are located at the crestline almost at the edge of the Western Ghats. Near the Nigdale village, the

area is full of gravel and known as Kharam lands which are not useful for agriculture. This area gets covered by tall grass. Near Kondhwal village, outcropping are adjacent to deep gorge formed by the stream.

The entire area has patches of low semi-evergreen vegetation on the plateaus and dense evergreen forest in the gorges and steep slopes. The outcrops are small in extent but spread throughout the region. The villages and their surrounding have rice fields and some nachni and varal cultivation.

Bhimashankar	Area (sq. kms)	Disturbance
Ahupe1	2.7294	Grazing, trampling,
Bhattiche ran	1.9427	Grazing
Kondhwal road	0.0624	Grazing, trampling,
Nigdale road slopes	0.3414	Parking, littering
Total	5.0759	



Ecosystem services

The Bhimashankar plateau gives rise to many streams that feed into Dimbhe reservoir. All the outcrops have many streams, rivuletes, ephemeral ponds which supply water to domestic cattle. These are also good grazing areas for the cattle and wild herbivores. Fishing is commonly done in the monsoon streams.

Biodiversity Profile:

Bhimashankar WLS has been surveyed by many zoologists and botanists of Pune. The sacred groves around this area have been extensively studied by many researchers. Bhimashankar forests are well known for the giant squirrel. Many birds, invertebrates, reptiles have been reported from the area. The flora of Bhimashankar was made by Botanical Survey of India in 1970s but has not been separately published. Hence it is not possible to understand how far the open grasslands and rocky areas contribute to the overall plant diversity of the sanctuary.

Rock outcrops of this region have never been separately studied. But since 2012, young naturalists of Pune have started recording the biodiversity of the open rocky areas separately. Photodocumentation of lichens, herbs, scorpions etc. is being made.

Outcrops of Ahupe were quantitatively studied during the DST sponsored study (2003-2006). In a sampling area of 20 sq.m, $H' = 3.98$ and 36 herbaceous species were reported in September 2005, followed by $H' = 3.21$ and 32 herbaceous species in September 2006, indicating rich herbaceous diversity.

Vegetation is similar to other basaltic outcroppings in the region. *Eriocaulon-Utricularia* dominated vegetation along with grasses (*Glyphochloa*, *Indopoa*, *Bhidea*, *Dimeria*, *Arthraxon* etc.) is abundant. *Burmanna coelestis* is quite common. Ephemeral pools here are rich in *Rotala*, Cyperaceae and other aquatics.

Smithia purpurea, *S. pycnantha*, *Cyathocline lutea* are some of the common endemic species seen here.

Although faunal diversity has not been documented in detail, a number of amphibians have been reported from the area.

Endemic *Uropeltis bicatenata* is reported from this area and is one of its two known localities. (other being Fangul Gawhan near Naneghat plateau)



Streams in Bhimashankar area are type locality of an endemic and endangered fish *Parapsilomachus elongates* (IUCN, 2012). A scorpion, *Isometrus rigidus* has been described from Bhimashankar area.

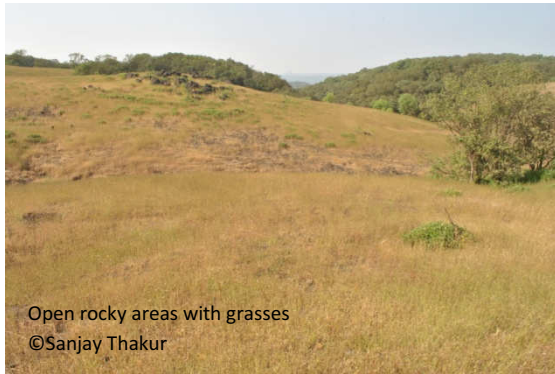
ZSI survey has documented 529 species of animals from this sanctuary. Large number of insects and endemic species are reported. However, specific diversity of open rocky habitats found in the sanctuary has not been separately reported. It is also expected to be high.

Studies on Bhimashankar WLS have mainly concentrated upon forest ecology and mammal behaviour. Prakash Gole and his team conducted a monitoring study of grasslands in the area, by creating an exclusion plot. However, the results are not reported.

Current and potential threats

All the outcrops have legal protection as part of sanctuary. But in the past plantation of Silver Oaks was carried out on Kondhwal outcrops. More recently, soil and water conservation work has been carried out near Terugnan and digging and trenching has been done on the rocky areas. Near Ahupe boulders

have been used for construction and pond has been made.



Open rocky areas with grasses
©Sanjay Thakur



Garbage burning on with grasslands
©Sanjay Thakur

Medicinal plant collection is a serious issue in this sanctuary as they are sold in local market. Silver ferns common on the rocky areas are also collected and sold in large quantity.

Grazing of domestic cattle is common on all the outcrops. Fires do occur to a small extent. Major disturbance in this entire area is due to the growing number of pilgrims visiting the temple deep in the forest area. On the day of Mahashivratri, around five lakh of people visit the place. They camp out on open areas, cook, litter and severely damage the open lands and surrounding vegetation. Parking of tourist vehicles, littering by tourists is on the rise. The JFM committee has recently started collection of toll and using the money for cleaning of the area. But many times this is collected and burnt on open grasslands.

Although the forest in this area is well protected, there is much pressure on the grasslands and scrub habitats in the sanctuary due to presence of villages and growing pilgrims. It is therefore necessary to undertake a thorough survey of the non-forest habitats and study the biodiversity and current impacts of different activities on the non-forest habitats.

Suggestions for conservation

- The entire area has legal protection but the rocky areas need to be specially managed to protect biodiversity.
 - Complete documentation of faunal and cryptogam diversity and regular monitoring of flora and fauna of the outcrop areas
 - Plantation, soil removal, upheaval should not be undertaken without planning for herbaceous species conservation
 - Effects of grazing, trampling and burning should be studied and appropriate mitigation measures taken.
 - Conversion of open grasslands or rocky areas into parking spaces or camping sites or dumping and disposal of garbage should be prevented.
- They need to be protected as representative areas of basalt plateau diversity within PA network

Based upon information provided by:

Anirudh Chawk (Pugmarks), Ashish Nerlekar, Sanjay Thakur, Aparna Watve, (Biome Conservation Foundation, Pune), Ashok Captain



Burmannia coelestis
©Sanjay Thakur



Smithia pycnantha
©Sanjay Thakur



Kondhwal rocky area ©Sanjay Thakur



Ahupe rocky area ©Sanjay Thakur

PANCHGANI GROUP OF PLATEAUS, Satara District

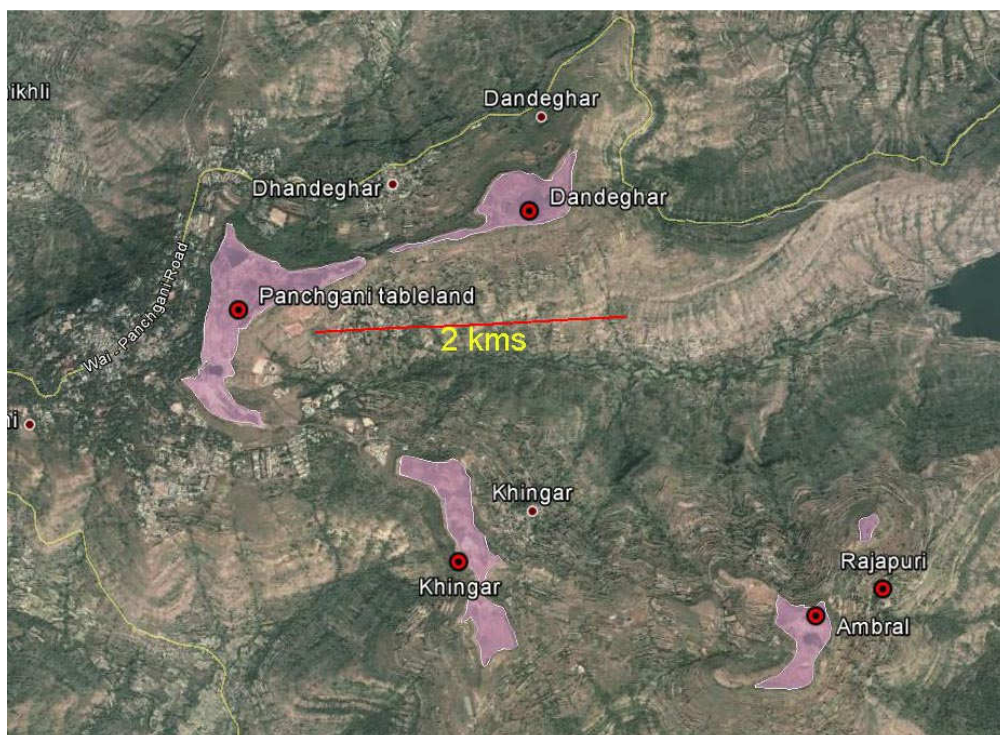
Panchgani group of plateaus includes a group of five distinct plateaus in Satara district, stretching from 17°54'12.08"N, 73°50'45"E to 17°55'29.98"N, 73°48'12.57"E. The elevation varies between 1200-1340m ASL. The most famous among them is the Asia Plateau or Panchgani tableland located in Panchgani hill station, and the nearest town is Wai. Panchgani tableland and Ambral can be accessed by jeepable roads upto the base of the tableland. Footpaths lead to Khingar, Rajapuri and Dandeghar plateaus.

Panchgani is included in the Mahabaleshwar-Panchgani Ecosensitive Zone. All the 5 tablelands around Panchgani are Conservation Zones. Panchgani tableland is a Natural Heritage Site.

Geology, geomorphology, flora and fauna of Panchgani tableland has been studied for more than a century. It was a popular summer tourism spot since British period. Winter tourism and monsoon tourism to this area is a recent phenomenon. The other plateaus although well known are not as famous as the Panchgani tableland.

The hill slopes surrounding the tablelands are gently sloping with mostly scrub vegetation due to excessive grazing and fuelwood collection. Those around Khingar and Ambral are in RF category. Slopes around Rajapuri are cultivated while those around the Panchgani tableland have shanties, bungalows, town market and institutes with large playing grounds. Good regeneration of trees is seen in campus of Moral Rearmament Institute at the northern side of the Tableland. But the eastern and western slopes have degraded scrub which has been planted with *Eucalyptus*, Silver Oak for more than half century.

Panchgani group	Area (sq. kms)	Disturbance
Panchgani tableland	0.3933	Excessive tourism
Khingar	0.2492	Tourism
Dandeghar	0.1908	local pressures
Ambral	0.1325	Plantation
Rajapuri	0.0157	Tourism
Total	0.9815	



Ecosystem services:

Many hill streams originate from these plateaus. They feed into Dhom and two smaller dams. The Panchgani tableland has large pond which retains water till the beginning of winter. Additionally several small ephemeral pools form during monsoon on all the plateaus. Some amount of grazing by goats and cattle from local villages and dhangars happens on all plateaus.

Biodiversity Profile

The Panchgani tableland has been floristically explored by the botanists for more than a century. It is **type locality** of six flowering plants (of which one is presumed extinct locally) and 2 freshwater fern species (*Isoetes* spp.) all of which are endemic to Western Ghats. It is also **type locality** of a freshwater Ostracode (an invertebrate), but its present status at the locality is unknown. It is also **type locality** of one lichen species and has around 20 lichen species, of which many are Western Ghat endemic. Most recently Lekhak and Yadav (2012) have documented floristic richness of this plateau.

A systematic ecological survey of the tableland has been done since 2003. 47 endemic species angiosperms and ferns are seen here of which 7 are Endangered, 2 are Critically Endangered, 3 are Vulnerable. Malabar Lark an endemic bird is seen but does not nest on the plateau.

Tourism related activities have taken a severe toll on these species. The populations of all the plants are impoverished and healthy growth is limited to the extreme corners and edges where tourists do not visit. The parking, central portion and the viewing points are completely devoid of lichens, mosses and algae due to excessive trampling over the years.

The small ephemeral pools so characteristic of the rocky plateaus have been destroyed by dumping of soil to create flat ground. This has led to loss of most freshwater fauna. The tadpole shrimps are now limited to few undisturbed pools away from the tourism area. Most severely affected is all the ground dwelling fauna. Hardly any amphibians, snakes or geckos are seen on the tableland. Removal of boulders over the years by local

people has led to destruction of a critical microhabitat of ground dwelling fauna.



Tadpole shrimp ©Aparna Watve

In 1909, Rev. E. Blatter one of the greatest botanists of the Western Ghats wrote about the Panchgani tableland:

“The whole is covered with grass into which there are woven the loveliest of tiny flowers. Most of the characteristic plants prefer a gregarious life; there are smaller and bigger patches of a papilionaceous plants (*Smithia hirsuta*) or of the white delicate ‘*Eriocaulon*’, locally called ‘hat-pin’, or again, miniature little forests of the purple ‘*Dysophylla stellata* var. *gracilis*’, and whole carpets of the ‘Blue Bonnets’ (*Utricularia*) . . .”

The beauty described in 1909 has never been seen since 2003, owing to the extreme disturbance of the land. But a glimpse of this was seen during 2012 Monsoon monitoring. After 8 month long restrictions on horse cart riding, the disturbed portions were re-colonized by the endemic vegetation.



© Aparna Watve

The less disturbed areas were dominated by typical lateritic plateau communities with *Utricularia* spp., *Eriocaulon* spp. and *Smithia* spp. in abundance along with *Rotala* spp.

Indigofera dalzellii, *Habenaria panchganiensis*, *H. heyneana*, *Glyphochloa spp.*, *Jansenella griffithiana*.

A grass, *Dichanthium panchganiensis*, an orchid *Habenaria panchganiensis*, a succulent *Euphorbia panchganiensis* and lichen *Diorygma panchganiensis* have been named after Panchgani and have put the tableland on the global biodiversity map.

Underground caves, typical of lateritic plateaus are present on the Panchgani and Wajapuri plateaus. One of the caves on Panchgani tableland was a roosting place of bats. This has been taken over by a restaurant. The disturbance by tourists has driven away the original bat colony of this cave. Now bats are seen only during monsoon when tourism is low. The second cave has dense growth of ferns and lichens and is also visited by tourists.

Current and potential threats

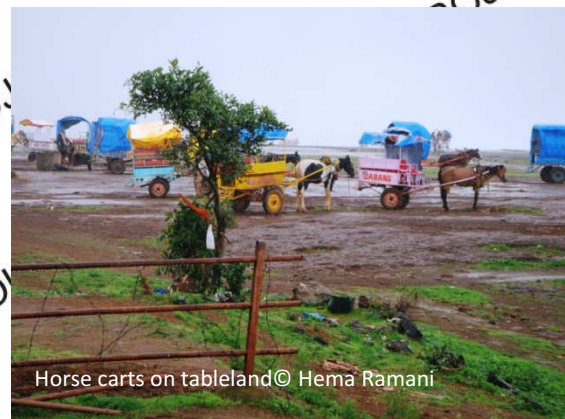
Tourism related activities pose a serious threat to the tableland and surrounding areas since the past. Efforts have been going on to regulate them since the declaration of the MPESZ.

In the past, recreational activities including toy-trains, giant wheels, stalls, horse and horse cart riding, jeep driving, balloon rides were uncontrolled and were going on at the top of the Panchgani tableland. Riding of 2-wheelers and 4-wheelers was allowed till 2006. Parasailing was also allowed from the plateau. An order by the Bombay High Court in 2006 moved many of these activities away from the plateau. The horse and horse cart riding has been banned during the monsoon (June-September). Monsoon tourism is very low allowing some breathing space for the biodiversity. But the disturbance till now, which has been round the year has led to much destruction of a central part of the beautiful plateau. The Panchgani Municipal Council has been ineffective in stopping the horses and horsecart riding on main tableland, despite the Bombay High Court's clear order to do so. It has allowed many other activities under the name of landscape development. A pond has been created and soil upheaval and soil dumping has been carried out. A part of the

tableland has been converted into parking space. A portion traditionally used as a football ground is extremely impoverished.

Panchgani tableland is visited by tourists from all over India. Mahabaleshwar region is one of the most famous hill stations of India, popularized by many Hindi film shootings at this location. The tourism so far is entirely recreational and no effort has been done to promote awareness of nature or ecotourism.

In March 2012, due to an accident where a horsecart fell off the cliff and led to death of a girl and a horse, the High Court Orders were activated and horses and horsecart banned from plying on main tableland. An ecological review of the tableland area was carried out by Dr. Aparna Watve where a vision plan for conservation and eco restoration of the natural biodiversity of the plateau was submitted. The matter is still pending in court. Meanwhile efforts are being made to work along with the Panchgani Council towards developing an ecotourism approach for long-term benefit of the local people. An extremely promising vegetation recovery was seen in the year 2012 when horses and horse carts did not ply on the main tableland. This raises hope for the area which is a biological heritage site.



Horse carts on tableland© Hema Ramani



Football ground on tableland© Aparna Watve

Ambral, Dandeghar and Khingar are better protected from tourism as they are RF areas and have not been advertised. But plantation of exotics, digging was undertaken owing to ignorance about biodiversity values of the rocky plateaus.

Suggestions for Conservation:

- Implementing the provisions of the MPESZ with focus on biodiversity and ecology protection for the region
- Designing and implementing biodiversity and ecology conservation plan with regular monitoring of the sites
- Designing strategy for recovery of natural biodiversity (flora & fauna) and microhabitats of Panchgani tableland
- Creating Awareness amongst local government, people and visitors regarding biodiversity of tablelands and natural heritage.
- Regulating and reorienting tourism and related activities to promote nature awareness



Euphorbia panchganiensis © Aparna Watve

Based upon information provided by :

Hema Ramni, David Cardoz, Faroukh Wadia, Dr. J. Samant, Bombay Environmental Action Group; Mona Patrao, Redstone Eco Center; Panchgani Municipality Council; Dr. Hemant Ghate, Shri. Shiraj Jakhalekar, Siddharth Kakarni, Sameer Padhye, Dept. of Zoology, Modern College, Pune; Vinaya Ghate, Dr. Gargee Pandit, Agharkar Research Institute; Dr. Aparna Watve, Biome Conservation Foundation; Yatish Lele, Apeksha Patil, Saniya Kirloskar, Anupriya Kariappadath,



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MAHABALESHWAR GROUP OF PLATEAUS, Satara District

Mahabaleshwar group of plateaus is famous location for recreational tourists as well as naturalists for many years. Mahabaleshwar plateaus also have cultural, religious and historical significance.

This region is a flat expanse of laterite plateaus, between 1300-1426m ASL. It is spread from 17°55'39.14"N, 73°41'23.57"E to 17°55'43.47"N, 73°39'6.26"E. Large parts of these plateaus are clad by forest on lateritic soil, while outcroppings are seen on the hill tops. Wilson Point is the highest point of Mahabaleshwar plateau. It is flat with several boulders. Similar exposures are seen at Babbington point and around Venna Lake area. The laterite at Mahabaleshwar is also exposed on the hill slopes at many places and has vegetation and diversity similar to the plateau tops. Most of these areas are landscape viewing points for the tourists and have tarred access roads.

The entire area is part of Mahabaleshwar Panchgani Ecosensitive Zone. Most of the plateaus are in Reserve Forest under Kolhapur Territorial forest division.

Ecosystem services:

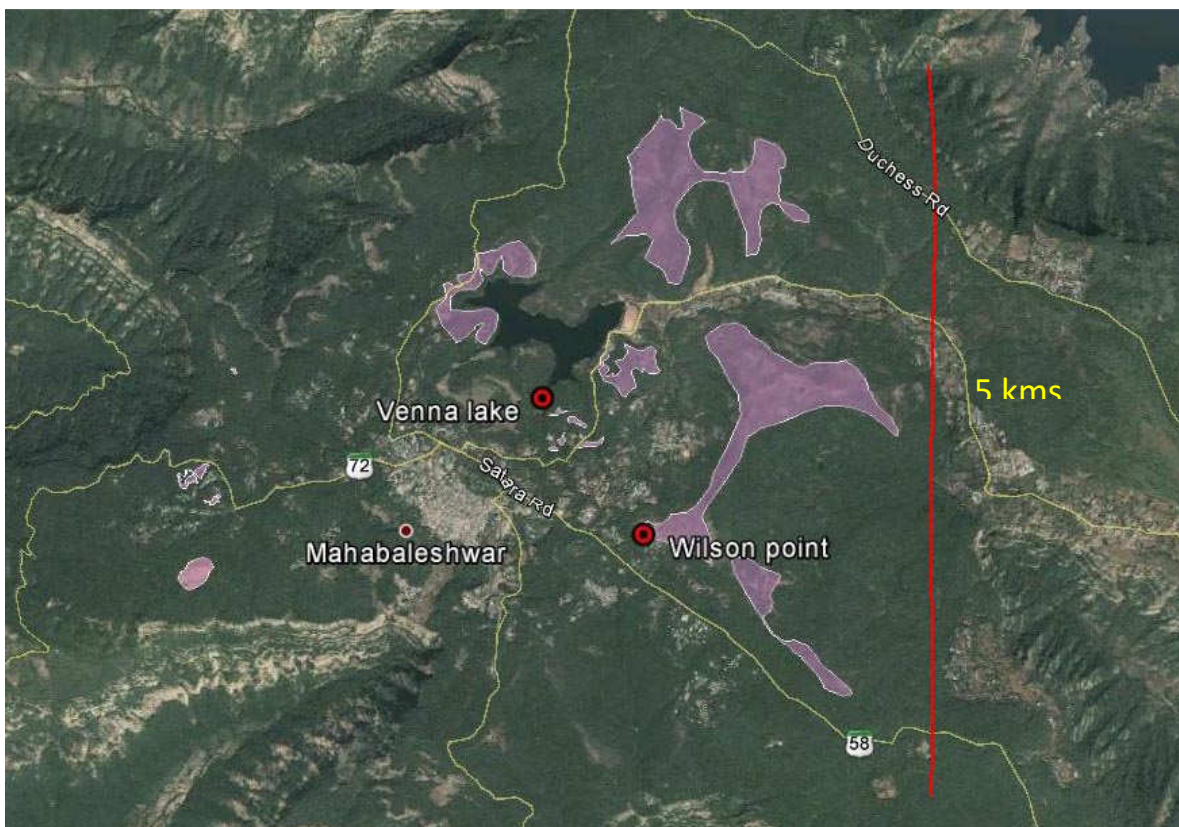
Many hill streams originate from this plateau and feed into 5 rivers, Koyna, Krishna, Venna, Savitri and Gayatri. The first two important rivers of Maharashtra. The Panchganga temple (built in 1220 A.D.) at the confluence of these 5 rivers is a place of pilgrimage.

The area is also famous for honey production. An apiculture institute has been established here since the British period. Medicinal honeys of various kinds is a major source of local income. The flowering plants of the region are important food sources for the honey bees, which also provide pollinator services to the farmers.

Original agriculture and farms are now converted into strawberry, carrot, mulberry farms. Production of jams, jellies and other sweets is a major industry in Mahabaleshwar, and tourists provide regular clientele.

Biodiversity Profile

Mahabaleshwar plateau is botanically one of the most studied area. The early papers by



British Botanists around 1900s have described many species from the region. A specific study on the lateritic plateau flora has never been undertaken but many species have been reported from the plateau habitats.

The general flora reports more than 1000 species, of which many are herbaceous.

The dominant monsoonal vegetation has typical lateritic plateau communities with *Utricularia-Eriocaulon* along with *Rotala* spp. *Indigofera dalzellii*, *Habenaria* spp. *Glyphochloa* spp., *Jansenella griffithiana* etc. *Impatiens dalzellii* is seen in abundance in deep soil areas along the plateau edges.

Robber's cave plateau located south of Mahabaleshwar is well known for a very large underground cave with large resident bat colony. The site has still not been surveyed in details as the cave interior is fairly inaccessible. A stream coming out of this cave is a type locality of Bombay Swamp Eel (*Monopterus indicus*), an endemic fish declared vulnerable in recent IUCN red list assessment.

Several saxicolous lichen as well as moss species are reported from Mahabaleshwar area, although plateaus have not been surveyed for these taxa.

The ephemeral pools formed on the rocky plateaus have several aquatic invertebrates including ostracodes, shrimps and water beetles.

The freshwater streams of Mahabaleshwar are type locality of *Cremnoconchus carinatus*, an Endangered (IUCN, 2011) freshwater snail. *Neoscorpions satarensis*, an endemic scorpion and *Coptocephala mahabaleshwarensis* Takizawa, 1990, an endemic leaf beetle has also been described first from Mahabaleshwar plateau.

Threatened lilies, *Crinum brachynema* Herb., *C. eleonora* Blatt. & McC. f. *eleonora*, *C. Eleonora* f. *purpurea* Blatt. & McC. and *C. Woodrowii* Baker found at Kate's point, are endemic to Mahabaleshwar and adjoining areas. *Taxilejeunea ghatensis*, a bryophyte has been described in 2007 from Chinaman's waterfall in Mahabaleshwar.

Current and potential threats

The Mahabaleshwar tourism so far is purely recreational and is hardly oriented towards

nature protection. Mahabaleshwar tourism is not too intense on the plateaus. It is limited to some famous viewing points. These points are greatly disturbed by trampling and littering. But direct impacts on the biodiversity are low.

Mahabaleshwar group (wrt Venna lake)	Area (sq. kms)	Disturbance
East No. 1	0.5938	grazing, fires, littering, trampling
East No. 2	0.0668	
East No. 3	0.1196	
North	0.538	
West	0.1639	
Smaller plateaus	Approx. 0.018	
Total	1.5001	Tourism

Mahabaleshwar municipality had planned making of Rock Gardens on the Wilson Point as a part of beautification of the area. This would have destroyed the natural vegetation. It was stopped by the intervention of the High Level Monitoring committee.

Another threat to the rocky plateaus is from the Forest Department. The department had undertaken plantation and trenching activities on some plateaus, causing much disturbance to the soil. However, due to the control of High Level Monitoring Committee, most such activities are controlled till now.

Suggestions for Conservation:

- Developing a biodiversity and ecological management plan as part of MPESZ management.
- Mapping distribution of endemic and threatened biodiversity rich areas and providing special protection from any disturbance
- Regular monitoring of indicator species
- No work of plantation, beautification, soil or water conservation should be undertaken without developing biodiversity management plan.
- Special protection of drainage and diversity of freshwater habitats

Based upon information provided by :

Hema Ramni, David Cardoz, Faroukh Wadia, Bombay Environmental Action Group, Dr. Hemant Ghate, Dept. of Zoology, Modern College, Pune, Dr. Gargee Pandit, Agharkar Research Institute Yatish Lele, Apeksha Patil Dr. Aparna Watve, Biome Conservation Foundation



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Wilson Point: Efforts of bunding leading to disturbance of boulder field



©Aparna Watve

NETWORKING PROJECT
BACK OUTCROP NE

KAS PLATEAU, Satara District

Kas plateau, is one of a group of 4 plateaus located about 25 kms east of the crestline area of the Northern Western Ghats in Satara district. The main tableland of Kas is located roughly between 17°45'21.95"N, 73°47'29.13"E to 17°43'36.50"N, 73°50'56.51"E, the highest altitude being 1200m. Two smaller plateaus lie on the eastern side, between Yadavwadi, Bhambavli, Umbri and Dhavij villages. The area lies approximately 5kms away from the nearest boundary of the Koyra Wildlife Sanctuary (now part of the Sahyadri Tiger Reserve).

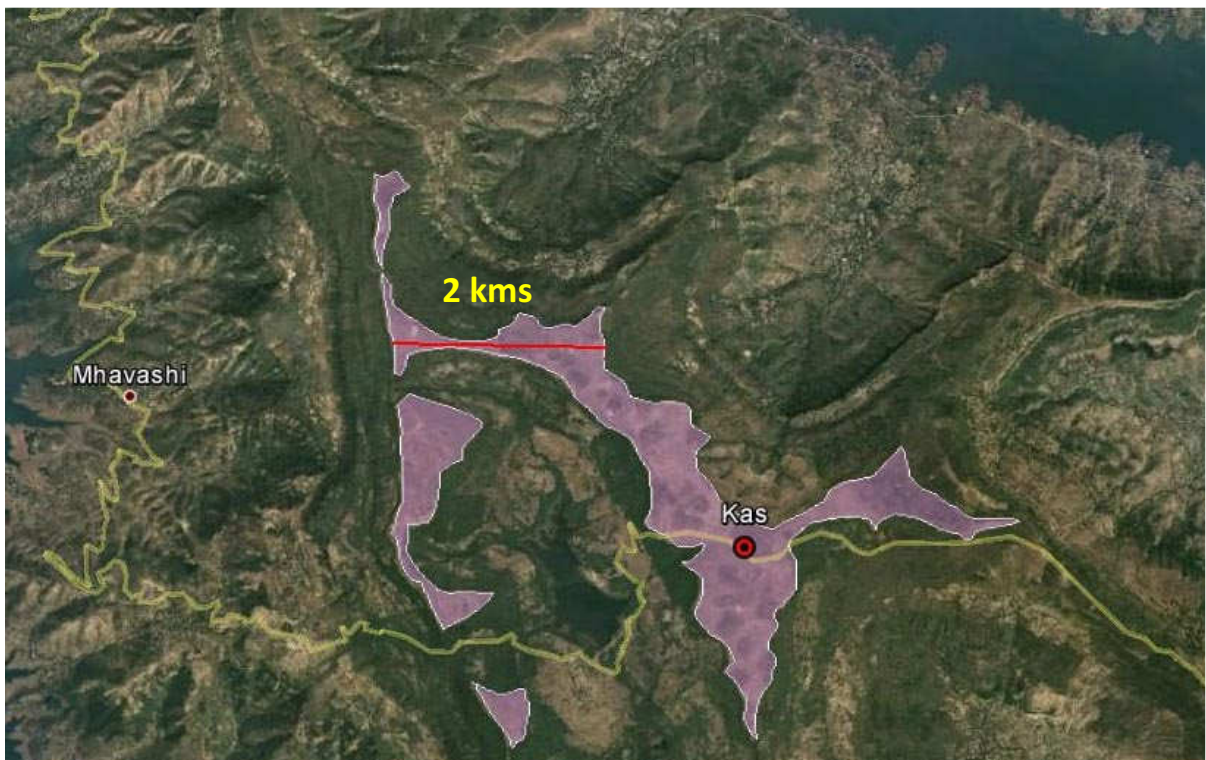
The large plateau at Kas is a declared Natural World Heritage site (UNESCO 2012). This tag has been given considering its aesthetic and biodiversity values. It supports around 200 flowering plants, many classified as endemic and threatened. The plateau blooms to life during September- October. Wide media coverage of the mass blooming phenomenon, close proximity to mega cities such as Mumbai and Pune; and accessibility has made Kas a popular tourist attraction. The plateau is popularly referred to as '**Plateau of Flowers**' or '**Valley of Flowers of Maharashtra**'. More than 95% of the plateau is open rocky exposure, with an intermittent

presence of a few stunted shrub thickets dominated by *Memecylon*, in areas where soil is deeper. The surrounding hill slopes mainly include forest and parts of the villages. The valley portion surrounding the Kas lake is covered with low, partially disturbed semi-evergreen forest dominated by *Memecylon umbellatum*.

The major part of the plateau and its surrounding steep slopes fall under RF category. The area is listed under the Protection Working Circle and falls within Ekiv, Kas, Kasani, Atali, Dhangarwadi, Kusumbiwadi, Kelghar, Shembadi khurd, Bhambavli RF areas. The presence of malki (private) lands on the Kas plateau has been reported by the forest department. They exist towards the eastern end of the plateau. However, this needs to be verified using survey maps.

Ecosystem services:

Many streams originate from this plateau. Perennial streams are present on the northern side near village Ekiv. The surrounding villages are dependent on the streams and water percolating from the plateau tops.



The plateau top has one large pond near centre (now popularly known as Kumudini lake) which holds water till winter and two smaller ponds which hold water for about a month after the end of rains. Both are important for local cattle and wild herbivores. The Kas plateau and its surrounding forest area plays an important role in water catchment in this region (Batra Pujia pers. comm. 2012). The hill streams originating from the region feed the four dams, Kanher, Kas, Parali and Koyna (Shivsagar lake).

Domestic as well as wild herbivores graze on all the plateaus. A large number of pollinators feed on the mass blooming plants. They provide pollinator serviced to the surrounding farms and orchards.

Villagers also have many small shrines on the plateau and around it.

Biodiversity Profile

The main plateau of Kas has been surveyed in detail by many researchers. The other three plateaus have not been surveyed. Earliest work on the plateau was by Chavan et al. (1973). Dr. Bachulkar studied endemic flora of this area. Bhattarai et al. 2012 has identified 103 species of local concern on the Kas plateau and surrounding area. Lekhak and Yadav, 2012 have documented floristic wealth of the Kas plateau.

The vegetation and biodiversity values of the Kas plateau as a representative site of the threatened rocky plateau habitat has been discussed by Watve (2003, 2007, 2009, 2010). Two studies have been published on the pollination mechanism (Hobbhahn et al, 2006 and Anand et al 2007) that include field studies carried out on Kas.

A list of lichen species from Kas area has been compiled by Dr. Gayatri Chitale & Archana Dube during their doctoral studies from Maharashtra which includes 14 species of macro lichens and 6 species of micro lichens found on Kas plateau (Chitale G. pers. comm. 2012).

Chikane and Bhosale (2012) have compiled herpetofaunal list of the Kas area including 57 species. A checklist of spiders is being

compiled by Siddharth Kulkarni (Kulkarni *pers comm.* 2013). Photo documentation of spiders from Kas is available with Vishal Deshpande, Ranwata (Deshpande *pers comm.*). List of birds (about 200+ species) has been compiled by Vikram Hoshing, Sanjay Thakur and many other bird watchers of the area. Fishes of Kas area are studied by Sunil Bhoite and Dr. Neelesh Dahanukar. Although a list of invertebrates has not been compiled, Dr. Hemant Ghate (Modern College, Shivajinagar, Pune) and his students have been recording faunal diversity of Kas for more than a decade.

The pond has also been studied for microfossils by the Department of Geology, Agharkar Research Institute.

Many popular books have appeared in Marathi and English, including photoguides by Shrotri (2007), Ingallahikar (2012), and by Salara Forest department (2012).

Herbaceous plant communities of this plateau were systematically surveyed during 2004-2006 as a part of Department of Science and Technology funded project on plant communities of rocky plateaus. In a sampling area of 25 sq.m, $H' = 3.88$ and 40 herbaceous species were reported in September 2004, followed by $H' = 3.971$ and 29 herbaceous species in September 2005, indicating rich herbaceous diversity.

Kas is **type locality** of following species

Flowering plant:

1. *Arisaema ghaticum* Punekar & Kumaran
2. *Chrysopogon castaneus* Veldkamp & Salunkhe
3. *Eriocaulon epedunculatum* Potdar et al.
4. *Eriocaulon kasiense* Punekar (*in ed.*)
5. *Evulia shrirangii* Salunkhe & Potdar
6. *Jansenella neglecta* S.R. Yadav et al.

Fungi: *Lycoperdon satarensis* Randive & Punekar (*ined.*)

Insects (Beetle): A new genus:

1. *Kashmirobia* Konstantinov & Prathapan

A new genus & species:

1. *Kashmirobia hugeli* Konstantinov & Prathapan

2. *Chiridopsis nigropunctata* Borowiec & Ghate

on the plateau diversity, as no baseline data is available.

In addition to this, following species have been rediscovered from Kas

Flowering plants:

1. *Crinum brachynema* by M. Bachulkar
2. *Dipcadi maharashtrensis* by Tetali *et al.*

Tortoise beetle:

1. *Cassida flavoguttata* - rediscovered from Kas by Ghate *et al.* earlier known from the Nilgiris

Snake:

Striped Coral Snake: Patteri Povala was rediscovered by Sahyadri Trekking Groups - Bagal *et al.*

Kas is very famous for the mass blooming of *Eriocaulon spp.*, *Utricularia spp.*, *Impatiense lawii* and *Smithia* spp. All the typical microhabitats and species complexes of lateritic plateau are seen here.

The plateau also has several invertebrates throughout the year. Tiger beetles are observed mating in large numbers on Kas during September-October. Praying mantises, ants are common. Tadpole shrimps were reported some years back. Fairy shrimps are present in the small pond.

The plateau has several signs of presence of barking deers, hares, civets and rodents. Gaur has been reported by Sunil Bhoite (2012). Ruddy mongoose, Rusty spotted cat have been observed in surrounding scrub area (Lele, 2012 pers comm.) Presence of Leopard has been reported from the surrounding forest area. Endemic Malabar Lark is commonly observed nesting on the rocky plateau.

Current and potential threats

The plateau was always under local pressures of grazing and burning. Domestic cattle compete to a certain extent with wild mammals. Disturbance was also caused by the road that passes through the plateau. Many road kills of snakes have been reported. Addition of dung leads to eutrophication. Heavy trampling by cattle and people has created many paths on the plateau. It is not possible to judge the impact of these activities



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An airstrip was proposed on the plateau but it was stopped by NGOs from Satara. Windmills were also proposed during 2005-2006, but the proposal was rejected.

Recent popularity and sudden growth in tourism are at present the most serious threats, not only to the plateau but also to the surrounding areas.



© Prerna Agarwal

Till 2007, tourism on Kas was negligible. Day trips were conducted by some tourist companies or it was a stop-over for a few lone travelers. Kas was not on the 'tourism destination' list of anyone. However, things changed from 2008. The photos of the plateau in full bloom were widely covered by newspapers, blogs, and the news was mainly spread by word of mouth. Overnight, the pristine, undisturbed Kas turned into a popular tourist destination. A 'plateau of flowers' so close to mega cities such as Mumbai and

Pune, where one could simply drive through was an opportunity that could not be ignored by the urban dwellers. Thus, numbers rose from few thousands in 2005-2006 to an astonishing number of 3,50,000 in 2011 (official records of Satara forest department). Although the numbers went on rising there was no plan for management of tourism. People trampled the plants, plucked them, treated it as a football field, and some amateur gardeners even filled their cars with the plants with hope to make their gardens in Mini Kas!

The alarming rise in the number of tourists became a serious concern between 2008-2012.

The tourism of Kas can be divided into

a. **organized tourism:** Nature watching tours by tourism operators from Satara, Pune, Mumbai, Kolhapur and other areas

b. **unorganized tourism:** Day visits for aesthetic value by families, and tourist groups

The easily visible ecological impacts of tourism are high levels of vegetation trampling, microhabitat damage and solid waste problem. The not so easily visible impacts are changing land-use in surrounding area, socio-economic and cultural changes in the surrounding villages. Both these are irreversible unless immediate measures are taken.

The tourism in its present state is, unfortunately, very flower-centric. Hence some precautions have been taken by the Forest Department to protect this aspect. In 2012, most of the area was fenced off by the forest department as part of management plan. Only a part of the area was opened to tourists. Awareness drive was done to stop people from plucking the flowers, system of fines was started. JFM committee of four villages was involved in the management. Parking space was created away from the plateau and public transport organized on days of heavy tourism. All this reduced the amount of trampling to a certain extent, especially in areas away from the road. However, in the accessible areas, trampling of vegetation was not avoided. A better planned strategy to deal with mass tourism is required.

The tourists visiting the area bring a continuous change all around the plateau. Although solid waste from the plateau has been cleaned by the JFM committee, the lake and surrounding forests do not come under the management of JFM. Number of stalls near the lake is increasing and it has to be regulated by the Satara municipal council. Land conversions and removal of vegetation from the private lands surrounding the plateau is a serious issue, which will affect the biodiversity of the region.

The most serious threat is establishment of invasive weeds, which are introduced through foreign soils and can compete with the indigenous flora.

The Natural World Heritage Site status is expected to increase tourism. However, the unpredictability of mass blooming and the very short period of blooming poses problems for international tourists interested in visiting the site.

The major issue which needs to be understood while managing the area is that the endemic biodiversity is not limited to the plateau, but spread in the adjacent scrub forests too. Hence, fencing off a part of the plateau and managing only a portion of land can protect a percentage of biodiversity but is insufficient for dealing with the broader issue of conservation. The World Heritage Site declaration does include much wider area than the plateau on the map. Hence, planning for the entire area is a must.

Suggestions for Conservation:

- Appropriate LEGAL protection needs to be given to the entire region, including the smaller plateaus and surrounding slopes.
- A proper assessment of the conservation and management issues needs to be carried out for identifying appropriate conservation measure under the Wildlife Protection Act and/or Biodiversity Act.
- Research for monitoring of biodiversity, impact of biotic pressures, tourism, defining carrying capacity needs to be undertaken
- Awareness amongst the society regarding the biodiversity value of flora as well as fauna needs to be undertaken urgently

- Conservation tourism should be microplanned and encouraged.
- Protection of microdrainage and surrounding streams
- Involving the citizens in long term monitoring of the area as part of citizens' science project.



Burning of Kas © Aparna Watve

Prerna Agarwal, Apeksha Patil, Yatish Lele, Suhas Gurjar, Siddharth Kulkarni, Sushil Chikne, Vikram Hoshing, Dr. Nina Hobbhahn, Dr. Sachin Punekar, Agharkar Research Institute, Dr. Gargee Pandit, Agharkar Research Institute, Dr. Prathapan, Dr. M. Bachulkar, Sunil Bhoite, Dr. S. Shrotri, Dr. Hemant Ghate, Zoology Dept., Modern College, JFM Committee Kas & Ekiv, CCF Kolhapur (Territorial), DCF, Satara (Terr.) Dr. Aparna Watve, Sanjay Thakur Biome Conservation Foundation



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Ongoing research projects

Tourism and its impact on the Kas area and biodiversity has become a serious concern. It is necessary to study this in detail and undertake appropriate conservation measures. Ultimately, defining carrying capacity of the tourists and adhering to it will lead to sustainable tourism on Kas. Many research projects on these have been started.

Following is a compilation in the words of the young researchers and students of this issue

Prerna Agarwal : funded by the Rufford Small Grants Foundation, UK

Mass blooming of flowers during the monsoons, media attention and proximity to megacities has lately made Kas a major tourist attraction. When lakhs of people visit the plateau every year, the plateau experiences disturbance pressures such as high levels of vegetation trampling, tonnes of solid waste littered by the tourists, plucking of the flowers, vehicular traffic related problems among others. The present kind of mass tourism could have a serious negative impact on the extremely sensitive plant communities and insect pollinated ephemerals that this UNESCO natural World Heritage site supports. However, if the tourism is managed well and in a sustainable manner, it can serve as a boon for the job deprived locals, who have to migrate to cities every year in search of a livelihood. At the same time, this could help in developing a sense of ownership among the local communities for support towards conservation of this biodiversity rich area.

With this background in mind, a research project was started in August 2012, titled 'Assessing the ecological impact of tourism and developing ecotourism through stakeholder participation for conservation of Kas plateau'. The study is interdisciplinary in nature, combining quantitative ecological surveys through vegetation plots, with qualitative interviews of tourists and locals, capacity building workshops, awareness drives and solid waste quantification to develop suggestions for ecotourism.

As part of this project, we have sampled the vegetation of Kas plateau, quantified the solid waste generated and conducted interviews of

tourists as well as the locals to understand their perception towards conservation and management of the plateau. Though each of these objectives may appear to be discrete, they should be viewed as bits and pieces of information to build the larger picture of ecotourism on Kas plateau.

Some preliminary observations from the field of this ongoing project are:

Interaction with the Tourists: After interacting with the tourists, we realized that the tourists were keen on conserving the plateau and know more about the biodiversity of the place. However, many visitors complained that they were looking for a more enriching experience from a World heritage site and felt disappointed. They gave a positive feedback to many of the management strategies started by the Forest department but provided some key suggestions such as increasing the frequency of buses, drinking water facility, information boards and toilets. A very interesting finding was that out of 198 respondents, 88 (44.94%) preferred being accompanied by a local nature guide over a book (30.2%) while 17% said they would want both the options i.e. a book and a local nature guide among other options. We are now focusing efforts in training the locals as nature guides who can lead guided tours in a sensitized manner. This will also help in providing alternative income sources for the local youth.

Discussions with the Local communities: Through discussions with the local communities (both men and women) of the four villages, what came out very strongly was that Kas plateau is now bread and butter (at least for the four months of tourist season) for many job deprived villagers and thus, they are keen to conserve the plateau. Other income sources such as homestay and nature guides were also discussed with the locals. We received mixed opinions on each of these from different villages. However, when it comes to awareness about biodiversity of the place, many seemed unaware of it. It is important to sensitize the locals about the special features and ecosystem services of Kas plateau, to initiate a sustainable conservation process.

Project impact so far:

Solid waste- As part of the project, for the first time on Kas plateau, solid waste was segregated through local community participation and the recyclable waste was sold through local participation, to demonstrate a solid waste management model. We have also been actively involved in the capacity building of the local people towards various activities that will help in the conservation of this habitat. Efforts are now being made to develop such sustainable linkages. A MSc environmental student, **Apeksha Patil**, is doing her masters dissertation on the solid waste management of Kas plateau and has contributed immensely to this component of the project.

Interactions with the JFMC: This was the first season after the JFMC was formed. From the start of the project, we have been engaging in capacity building of the Forest department field staff and the local members of the JFMC. This included in depth discussions with the members regarding management related problems faced by them. On field nature guide training for the interested men, basic training in use of a hand held GPS.

Volunteer support: Support of young enthusiastic students is always the backbone of any project. And we are proud to say that around twenty young students of Pune and Satara, from different academic backgrounds, had volunteered on the various components of the project. This project thus helped them in gaining a sense of understanding about the real issues of conservation and how these can be addressed. As one of the volunteers, Avik Banerjee at the end of the field season mentioned '*I started noticing minor things, like general distribution patterns, microhabitat effects on vegetation, and correlations between the entomological life and the plants.*' While yet another BSc environmental science student, Shivona Bhojwani, shared her experience with us - '*Kaas was my first proper on-field experience. I have never lived without my family for over 15 days. Firstly, without doubt it gave me the ever-so-helpful knowledge that has actually come to use ever since I've left, whether in academics or on-field. I didn't know that I would ever be that interested in learning*

just about plants that now I find it as interesting as any other mammal, reptile, amphibian or bird'.

Final outcome: The project will help in building scientifically sound tourism management guidelines with the help of stakeholder participation, to ensure a sustainable, nature based tourism to the plateau of flowers of Sahyadris.

Acknowledgements: I would like to thank the Rufford Small Grants foundation for funding this project, Satara forest Department and the Kas pathar JFMC for constant support and Biome conservation foundation for support. Special mention to all the volunteers.

Apeksha Patil: Project on Solid Waste Management at Kas

The littering of waste on a fragile habitat such as Kas can have huge impacts on its biodiversity and can lead to a number of problems associated with waste in natural areas. With this idea in mind, I took up the task of assessing the solid waste management on Kas plateau as my Master's dissertation. This work is part of the larger project which is funded by Rufford small grants foundation.

During the tourist season of 2012, it was observed that the waste on the plateau was being managed very well by the four men appointed by the JFMC. So, there was hardly any waste found on the plateau during this season, as it was covered twice in a day by the village men. However, through vigorous surveys and interactions with the locals, it was found out that there was no defined disposal sites of waste. Hence, waste collected from plateau was being dumped in the forest. With no vehicle to dispose the collected the waste, it was finally being burnt. After our intervention, we convinced the locals to segregate the collected waste which was later sold to demonstrate an alternative income source by managing the solid waste.

After the tourist season, we received a positive feedback from the waste collectors and they have promised their participation in the next season for solid waste management.

In the present study, an attempt has been made to assess the solid waste generated on the Kas plateau and in nearby areas where tourism is responsible for the generation of solid waste. Efforts were made to locate major sites of deposition, identify the composition of waste and quantification of waste generated every month. Based on the major findings, short term and long term management plans suitable to the plateau will be proposed.

Yatish Lele: Project on designing guidelines for conservation and management planning of Kas.

A masters student, I am doing my Master's dissertation on designing guidelines for a conservation management plan for Kas plateau and its' surrounding area. My work involves understanding the biotic pressures and their impacts, interactions with the local communities and collecting information on the land-use changes around Kas. As part of my study, I have also mapped the individual locations of two indicator plant species and surveyed faunal diversity.

Through my interactions with the local communities, I have understood the pressing needs of the local communities which are related to use and management of natural resources. Need of income generating jobs was expressed by all. We are trying to assess how far the tourism or any other activity can help in satisfying the needs of the local community and how it will affect biodiversity of the region.

Community participation is surely the way to tackle many management and conservation issues for Kas plateau. But the details of it need to be planned based on sound social and ecological research. Based on the above mentioned observations, framework for making conservation plan guidelines will be drafted.

ROCK OUTCROP NETWORKING PROJECT
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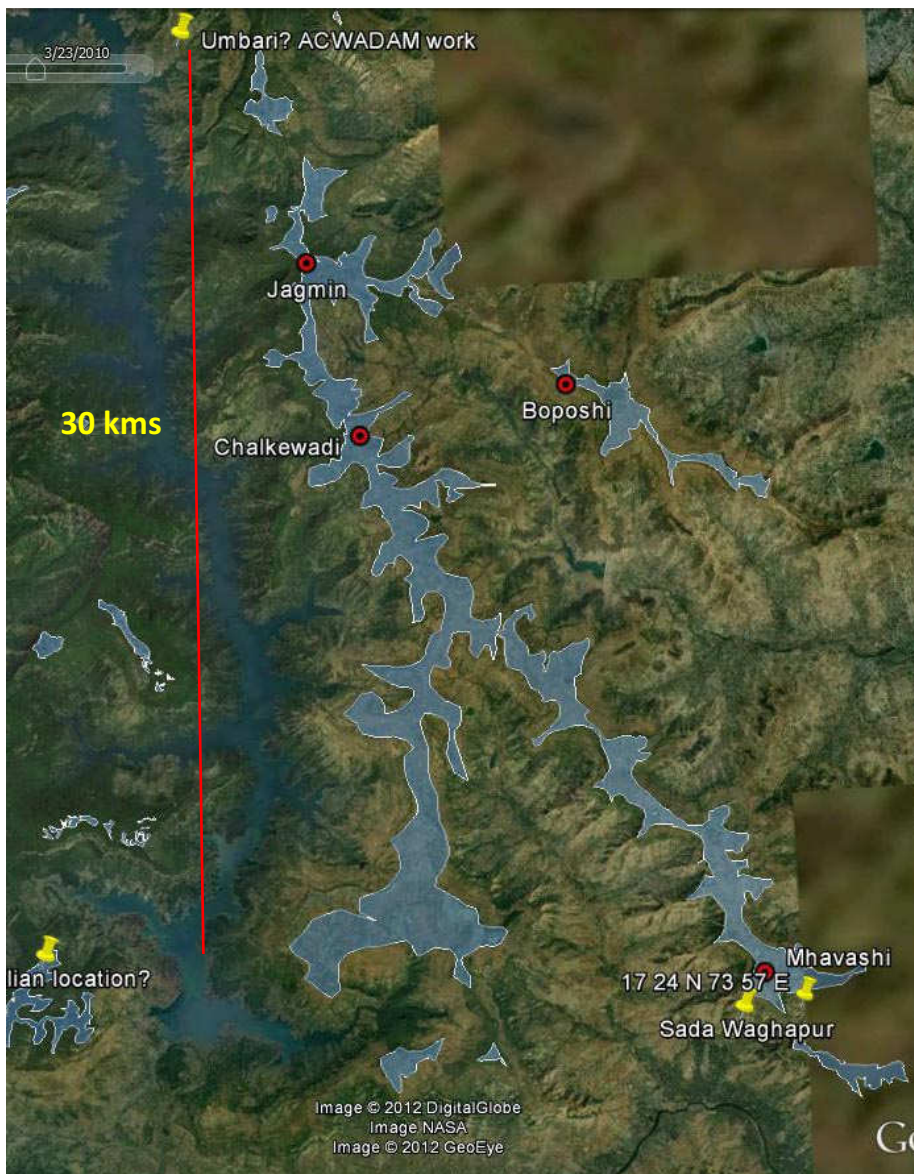
CHALKEWADI-PATAN PLATEAUS, Satara District

The plateau extending from Chalekwadi to Patan area is the largest continuous high altitude ferricrete in the Northern Western Ghats. It has smaller plateaus separated from main plateau on northern and southern sides. These are located in Patan tehsil between 17°22'59"13"N, 73°49'50.71"E to 17°41'37.77"N, 73°48'10.6"E. The elevation varies between 1000-1200m ASL. Patan is the nearest township. A paved but poorly maintained road traverses the entire plateau.

The ferricretes have steep cliff edges which descend into gently sloping hill slopes. The slopes on eastern side are devoid of good forest due to extensive biotic pressures. Mostly low scrub vegetation can be seen. But the

western slopes included in the Koyna WLS (now Sahyadri TR) have dense forest. Major part of the plateau is under private land holdings. It falls in the buffer zone of Sahyadri TR.

Chalekwadi-Patan plateaus	Area (sq. kms)	Disturbance
Bhambavali west	1.5842	Grazing
Chalkewadi1	0.1483	Windfarm, cultivation, construction, roads, soil disturbance
Boposhi	4.2113	
Chalkewadi (Except Mhavashi Sada Vaghapur)	47.5291	
Chalkewadi2	1.3887	Grazing
Chalkewadi3	0.2066	Grazing
Total	55.0682	



Thoseghar waterfall is another ecologically important spot in the area. The waterfall drops along a steep cliff into a picturesque gorge and is a popular tourist spot.

Ecosystem services:

Many hill streams originate from the plateau. They feed into Shivsagar, (Koyana) reservoir in west and Tarali in east. The plateau performs a very important function in the water catchment. The natural depressions of the plateau form ephemeral ponds for the local villages and retain water till winter. Additionally several small ephemeral pools form during monsoon on all the plateaus providing water to local cattle. The villages are located below the plateaus, but the cattle regularly graze on the plateaus in monsoon.

Biodiversity Profile

The area has been floristically surveyed by researchers but separate checklist is not available. The general vegetation pattern is similar to the other Satara plateaus such as Kas and Mhavashi. Most recently Lekhak and Yadav (2012) have documented floristic richness of this plateau.

Ephemeral flush vegetation with *Utricularia-Eriocaulon* dominates the entire plateau. The ephemeral pools have large populations of *Aponogeton satarensis* and *Eriocaulon tuberiferum*. The digging caused by windfarm construction created many temporary ditches on the plateau boosting the populations of these endemics. However, the ditches were filled by mud and other debris leading to loss of these temporary populations.

Herbaceous plant communities of this plateau were systematically surveyed during 2004-2006 as a part of Department of Science and Technology funded project on plant communities of rocky plateaus. In a sampling area of 25 sq.m, H' =3.56 and 23 herbaceous species were reported in September 2004, followed by H' =3.48 and 25 herbaceous species in October 2005, indicating rich herbaceous diversity.

The area is rich in large and small ephemeral rock pools which support tadpole shrimps, fairy shrimps and clam shrimps. Swamp eels are regularly seen in and around the pools.

It is zoologically well known as the **type locality** of *Hemidactylus satarensis*, an endemic gecko which is exclusively seen on this plateau.



The area within the Koyana WLS is less affected by disturbance. Black eagle and other raptors were seen in this area, away from the windmills.

Endemic *Nyctibatrachus humayuni* and *Rana aurantiaca* have been reported from this area.

Current and potential threats

Major part of the plateau is converted into windfarm. More than 1200 windmills are present on the plateau. Lot of disturbance has happened during the construction phase and road building. Parts of the plateau which are within the Koyana WLS are excluded from the windfarms. However, the disturbance often spreads in the region.

Since 2012, tourists coming to Kas have also started visiting the plateau and disturbance is increasing.

Many roads have been constructed all along the plateau, and have heavy traffic due to windfarm company vehicles. Every year the windmills are cleaned using detergents which wash off into the ephemeral water pools.

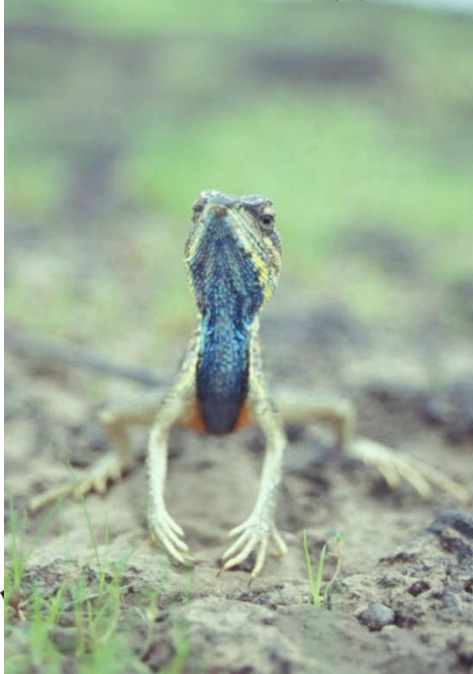
The existing approach roads built for the windmills are mostly untarred and get muddy and waterlogged. Hence during the monsoon jeeps often ply directly on the plateau or along the roadsides effectively widening the existing tracks.

Cabins, guest houses, powerlines of the windfarms have affected very large part of the primary plateau habitat. It is necessary to evaluate the percentage damage caused by these structures.

A effect of windfarm on birds of the area is currently being studied by Harshal Bhosale and Neelesh Dahanukar.

Previously the plateau hardly had any human activity except by the local villagers. But increase in the number of windfarm employees, small teastalls and maintenance cabins have led to increased trampling of the entire area and disturbance to local fauna throughout the year.

Fan-throated Lizard© Sanjay Thakur



Suggestions for conservation

1. Urgent survey of the area to assess impact of high density windfarms on the sensitive plateau habitats and associated biodiversity.
2. Creation of area management plan for conservation of biodiversity and ecology
3. Microplanning of the region for soil, water conservation that supports unique and special biodiversity of the area

3. Awareness, capacity building and participation of the stakeholders (wind farm companies, private land holders, forest department, irrigation and revenue department) in management of the area to maximize wilderness and biodiversity conservation.

It is necessary to prescribe appropriate conservation policies for incorporation in the windfarm land management practices. Otherwise misguided efforts of plantation and soil conservation of plateaus will further deteriorate the habitat quality.

Based upon information provided by :

Ketaki Ghate, Manasi Karandikar OIKOS, Ecological Services; Siddharth Kulkarni, Shriraj Jakhalekar, Dept. of Zoology, Modern College, Pune; Sushil Chikne, Harshal Bhosale, Dr. Aparna Watve, Sanjay Thakur , Biome Conservation Foundation Pune; Christopher Thorne Dixon, University of Plymouth.

© Sanjay Thakur



MHAVASHI–SADA VAGHAPUR PLATEAUS, Satara District

Mhavashi-Sada Vaghapur plateau is continuation of the large Chalekewadi-Patan plateau towards south east. Another small plateau is present south of it. These are present in Patan tehsil between from 17°22'31.64"N, 73°59'9.4"E to 17°30'56.22"N, 73°51'57.48"E. The elevation varies between 1000-1100m ASL. Patan is the nearest township and a tarred but poorly maintained road traverses the entire plateau.

The ferricrete has steep cliff edges which descend into gently sloping hill slopes. The slopes are devoid of good forest due to extensive biotic pressures. Mostly low scrub vegetation can be seen.

Although parts of the plateau and slopes reportedly fall in the RF area, private land holdings are large.

Ecosystem services:

Many hill streams originate from the plateau. They feed into Tarali dam at North and four small dams located along the valleys around the plateaus. The natural depressions of the plateau are expanded to build waterponds for the local villages and retain water till winter. Additionally, several small ephemeral pools form during monsoon on all the plateaus providing water to local cattle. Area supports large number of cattle kept by the gavli-dhangars.

Mhavashi-Sada Vaghapur plateaus	Area kms ²	Disturbance
Sada Vaghapur	18.4299	heavy grazing, villages, windfarms agriculture
South of Gujarwadi	1.994	
Total	20.4239	

Biodiversity Profile

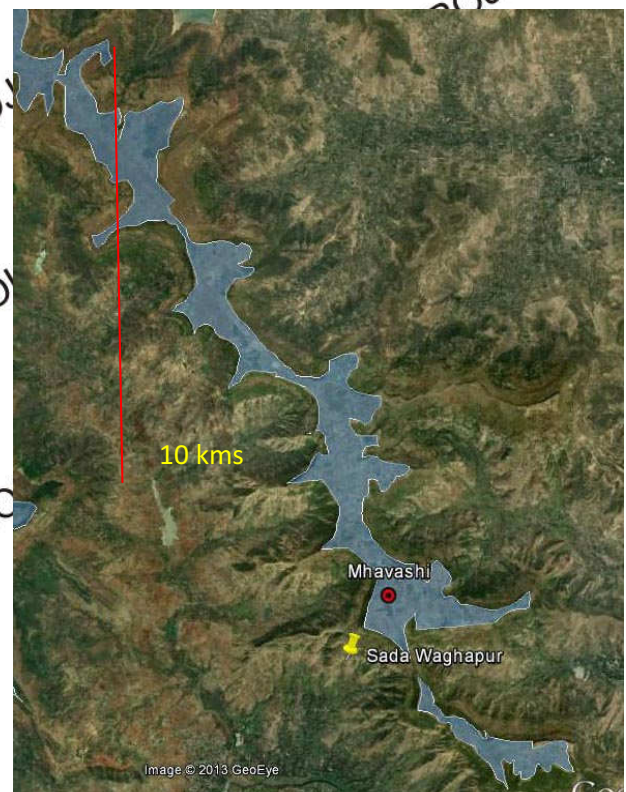
The area has been floristically surveyed in details but separate checklist is not available. It is botanically well known as the **type locality**

of *Apocroton satarensis*, an endemic and Endangered (IUCN, 2011) species. The general vegetation pattern is similar to the other Satara plateaus such as Kas and Chalkewadi. Most recently Lekhak and Yadav (2012) have documented floristic richness of this plateau.

The less disturbed rocky patches are covered by lichens and other cryptogams. The small ephemeral pools so characteristic of the rocky plateaus have tadpole shrimps. The boulder habitats are more or less gone for use in the house and road construction.

Indian courser, Lapwing, Larks and many other birds use the habitat for nesting and foraging. Many raptors are seen around the area.

The cryptogamic vegetation and fauna has not been documented in details. Presence of extensive waterbodies is good for presence of amphibians. *Ichthyophis bombayensis* is reported from Mhavshi area. More explorations are necessary.



Current and potential threats

Major parts of the area are occupied by old Gavli-Dhangar villages viz. Kalaki Sada and Sada Vaghapur. The Khanduai temple in the hill pass and Mauli Mandir at the top of the plateau are places of pilgrimage. The annual fare at the temple causes heavy trampling around the temples and garbage dumping.

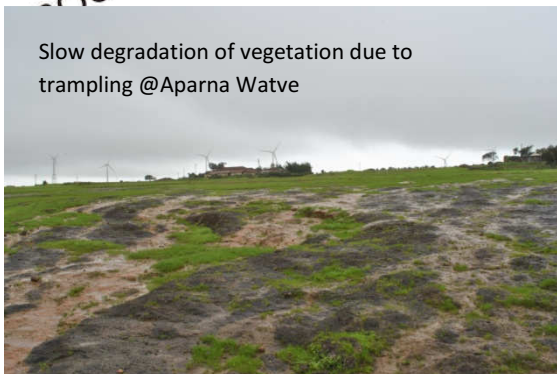
There are many scenic spots, but fortunately the tourism is limited to a few local tourists and is very limited in impact.

The area has minor bauxite estimates, as per surveys by Geological Survey of India, but so far no effort of mining has been reported.

The villages on plateau tops are very old and grazing has led to some amount of disturbance, especially disturbing the wild fauna associated with the plateau. Plantation of *Eucalyptus* trees was made as part of soil conservation efforts in the past. Digging of ponds also caused some disturbance of natural vegetation. In 2012, the area was heavily trenched, altering the water flows and flooding some parts. Plantation of trees has been undertaken over large areas. These are bound to fail due to the harsh microclimate of the plateau. But disturbance has led to impoverishment of rocky plateau communities and spread of invasive species.

Windfarm development all along the plateau has led to much disturbance due to construction of new roads, traffic of heavy vehicles and loss of natural vegetation in and around the windmills. In spite of this, plant diversity has survived in less affected areas. However, if the land use changes further to more urban, residential or industrial, the remaining natural biodiversity will be adversely affected.

Slow degradation of vegetation due to trampling @Aparna Watve

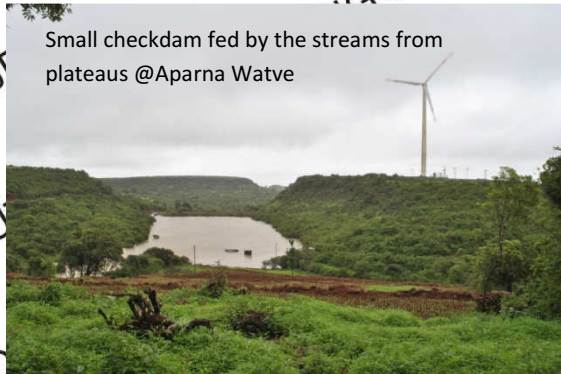


It is therefore necessary to take urgent steps to manage the area to effectively preserve the natural beauty and biodiversity of the plateau.

Suggestions for conservation:

1. Urgent survey of the area to assess impact of high density windfarms on the sensitive plateau habitats and associated biodiversity.
2. Creation of area management plan for conservation of biodiversity and ecology
3. Microplanning of the region for soil water conservation that supports unique and special biodiversity of the area
3. Awareness, capacity building and participation of the stakeholders (wind farm companies, private land holders, forest department, irrigation and revenue department) in management of the area to maximize wilderness and biodiversity conservation.

Small checkdam fed by the streams from plateaus @Aparna Watve



Changed drainage due to trenching @Aparna Watve



Based upon information provided by :

Dr. Aparna Watve, Sanjay Thakur , Biome Conservation Foundation Pune;

Christopher Thorpe-Dixon, University of Plymouth UK

Eucalyptus plantation and pond on plateau @Aparna Watve



Indian courser juvenile @ Sanjay Thakur



PANHALA GROUP OF PLATEAUS, Kolhapur District

Panhala group of plateaus includes a chain of around seven distinct plateaus in Panhala tehsil stretching from 16°48'16.14"N, 73°08'2.87"E to 16°50'56.07"N, 73°52'20.86"E. The easternmost of them is about 30 kms away from Kolhapur town. They can be accessed by small untarred roads, off the Kolhapur-Shahuwadi state highway leading to Ambaghat.

Panhala plateau of this group is a well known hill fort of King Shivaji, and currently a famous tourist spot. The entire landscape from Panhala to Vishalgad fort is famous historically as a route of one of King Shivaji's great escapes via Masai plateau through Pavankhind and is a famous trekking route. The hill slopes surrounding the plateau are gently sloping and fall under RF category. *Eucalyptus* plantations have been made around Mahalunge, Salshi, Borivade area. Dense semi-evergreen forest is present around Ambarde-Sonurle area.

Ecosystem services:

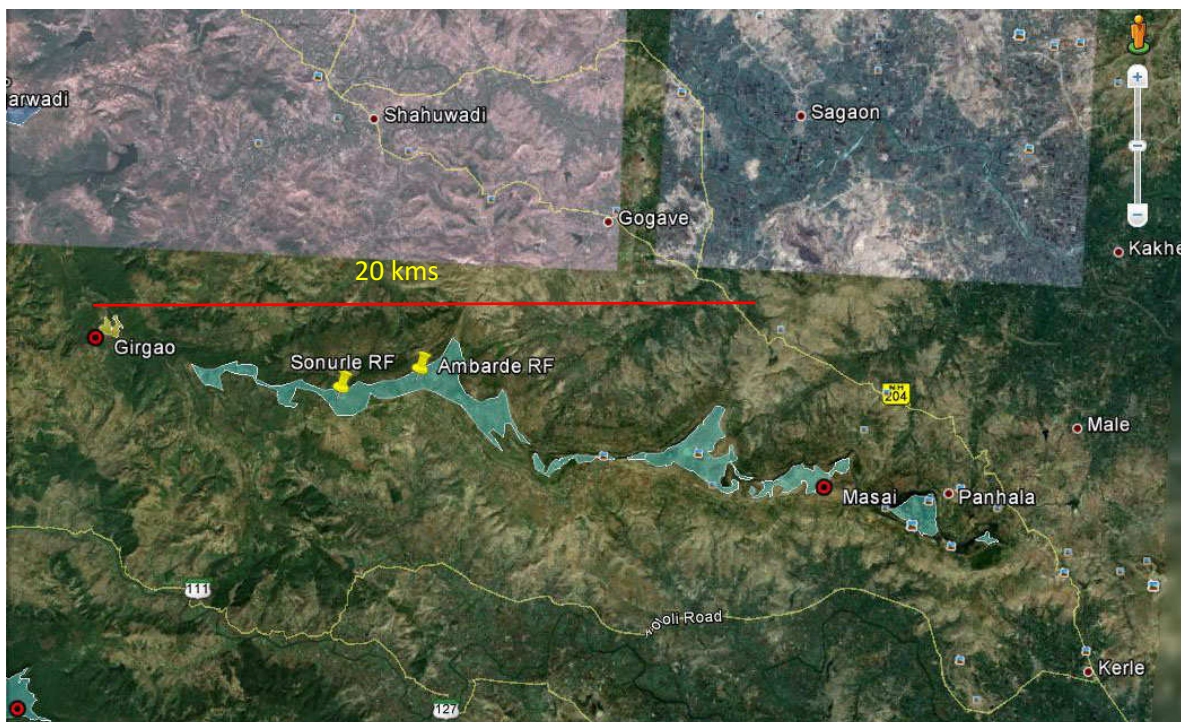
Many hill streams originate from this plateau. They feed into Kasari and Warana river system. Perennial springs are reported from around the area. The plateau tops have large ponds which retain water till the beginning of

winter. Several small ephemeral pools form during monsoon on all the plateaus. Eastern part of the plateau near Mahalunge is used for agriculture by local people. The plateau is used for grazing of goats and cattle by the local communities.

Panhala group	Area (sq. kms)	Disturbance
East of Panhala	0.0955	Unknown
Panhala proper	1.0904	Panhala township
Masai (Mahalunge)	1.3112	agriculture, religious tourism
Masai (Borivade, Salashi)	3.2236	religious tourism
Ringewadi (Parkhandale, Ghungur, Ambarde, Sonurle RF)	6.0512	Mining proposed at Ghungur and Ringewadi
Girgao	0.2304	Ongoing mining
Total	12.004	

Biodiversity Profile

The eastern plateaus are historically well explored by the botanists in Kolhapur region.



Herbaceous plant communities of this plateau were systematically surveyed during 2004-2006 as a part of Department of Science and Technology funded project on plant communities of rocky plateaus. In a sampling area of 25 sq.m, H' =3.751 and 40 herbaceous species were reported in September 2004, followed by H' =3.526 and 33 herbaceous species in September 2005, indicating rich herbaceous diversity.

Vegetation is dominated by typical lateritic plateau communities with *Utricularia* spp., *Eriocaulon* spp. and *Syntherisma* spp. in abundance along with *Rotala* spp. *Indigofera dalzellii*, *Habenaria panhaliensis*, *H. heyneana*, *Cymboplocha* spp., *Jansenella griffithiana*. Most recently Lekhak and Yadav (2012) have documented floristic richness of this plateau.

The Masai plateau and adjacent Panhala plateau have remarkable diversity of cryptogamic vegetation. Thite and Kulkarni (1976) reported **430 species of fungi** from Panhala fort area. Five bryophytes are reported by Sawant and Karadage (2011).

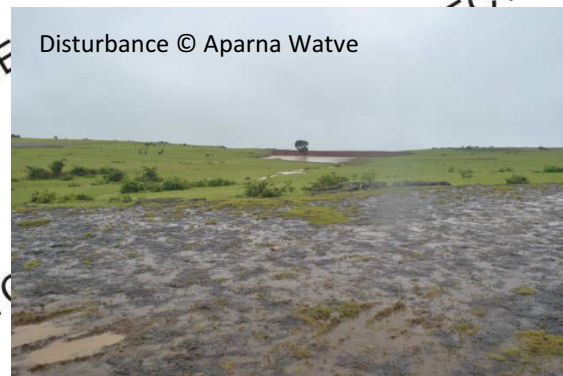
Saxicolous lichens cover most of the boulders on these plateaus. The effects of disturbance are immediately visible along the road, where lichen, moss and algal layer on rocks erodes due to vehicular traffic. Panhala is single location of *Graphis panhalensis* (formerly *Graphina panhalensis*). Four species of *Diorygma* (Makhija et al. 2009) and many other lichens have been reported from Panhala-Masai area.



Lichen crust © Aparna Watve

Faunal diversity of the plateau has not been reported in details so far. However, researchers and naturalists from Kolhapur have reported rich diversity of birds, herpetofauna and invertebrates from the

plateau and surrounding area. Dr. Girish Jathar (ornithologist) has observed many raptors on this plateau. Tadpole shrimps and fairy shrimps were observed in large numbers the ephemeral rock pools during August 2012. Scorpions, spiders, millipedes, ants and many other invertebrates typical of open rocky areas have been documented on the Masai and Panhala plateaus. Leopards and mouse deer have been reported around this area.



Disturbance © Aparna Watve

The western group of plateaus from Borivade-Sonurle, Ringewadi, Ghungur areas have not been explored in details. These are currently free from any disturbance, are remote and surrounded by dense forest vegetation. The diversity of microhabitats observed on these plateaus indicates potentially rich floral and faunal diversity and they need to be surveyed round the year. The Girgaon plateau is already mined and thus biodiversity on the plateau is already disturbed.

Eriocaulon tuberiferum was first reported from Panhala plateau in 1974. by Kulkarni and Desai. It also grows in shallow ephemeral water pools. Subsequently it has been reported from other lateritic plateaus. It has been assessed as **Vulnerable** (IUCN assessment of freshwater biodiversity).

Eleocharis wadoodii has been reported by Yadav et al. 2009 from the Masai plateau. It occupies shallow pond margins. During October, aerial parts of both the species dry up; the species perennate through under ground rhizomes and stolons and sprout in June with the onset of monsoon. **It is apparently endemic to the Masai plateau.**

A fungus *Cercospora habenariicola* was recorded for the first time from India from

collections of *Habenaria* in Panhala and Kas areas (Patil et al. 2012).



Current and potential threats

Two temples are present on the plateau in the Injole-Borivade RF area. Masai devi temple is well-known spot for pilgrimage. Devotees from far away come and offer sacrifices at festival times. The second temple was previously just a stone mound but has been recently converted into a small temple (Photo 1,2). In recent times, some tourists do visit the plateau and park the vehicle, play and eat on the site. It is possible that soon it will draw more tourists. The popularity of Kas plateau is drawing attention of many towards plateau area and it is possible that in near future, tourism will grow in the more accessible parts of this plateau. A wind mast has also been erected on the plateau, however, currently proposal of windfarm has not been reported.

Ringewadi plateau has been leased out to a mining company for many years. Recently the company has asked for forest clearance of this virgin plateau.

Suggestions for Conservation

- Urgent LEGAL protection is required for all the plateaus of this group and the remnant natural diversity. Eco-sensitive zone declaration can be considered, as it is already in the ESZ1 of WGEEP report.
- The exceptional floristic richness has been proven by many scientific papers and more thorough studies are required for all plateaus.

Further forest conversion for mining of currently undisturbed plateau should not be allowed.

- Endemic flora, fauna and special microhabitat should be protected from trampling traffic and other disturbance.
- Microplanning should be done for regulating tourism, and maximizing natural biodiversity
- Plantation of tree species, digging, trenching for any purpose should not be allowed till biodiversity management plan has been drafted
- Protection of perennial water sources of the villages is required.

Based upon information provided by :

CCF (territorial office) Kolhapur, Dr. M. Bachulkar, Adv. Guruprasad Malkar, Adv. Kedar Munishwar, Envirolegal Forum, Dr. J. Samant, Devrai, Dr. Girish Jathar, WOTR, Dr. Gargee Pandit, Agarkar Research Institute; Sanjay Thakur, Dr. Aparna Watve, Biome Conservation Foundation,



Photo: Guruprasad Malkar
Frog, Masai Plateau, Kolhapur
02/09/2012

Ringewadi plateau © Sanjay Thakur



© Sanjay Thakur

Masai Plateau in 2004 © Sanjay Thakur



ZENDA-DHANGARWADA PLATEAU, Satara District

The plateau known as Zenda dongar is located between Manoli-Gajapur-Dhangarwada villages near Amba ghat. This is a large and continuous plateau, ecologically well preserved due to its low accessibility in the past. Nearest town is Malakapur, however, the previously small Amba village has developed considerably due to its location along a major mountain pass. The plateau top on Manoli side can be approached from a forested footpath branching from Amba to Vishalgad road. The Dhangarwada side is approached by untarred road off the Amba highway. It is mainly used by mining trucks and is in poor state. It is located between 16°55'5.50"N, 73°47'50.62"E to 16°54'16.36"N, 73°50'58.89"E. The highest point is around 1025m ASL.

The ferricrete has steep cliff edges which descend into gently sloping hill slopes. The plateau and its surrounding steep slopes are well protected as they fall under RF category. They are within Manoli RF, Manoli PF, Gajapur RF, Dhangarwada RF, Kansarde RF, Gholsavade RF, Humbavali RF, Yelwan Jugai

and Ainwadi RF areas (see toposheet). These are dense forest patches with more than 60% average canopy. The eastern parts below the plateau and scree near the village Dhangarwada fall outside the RF category and are dominated by scrub vegetation.

Zenda plateau	Area (sq. kms)	Disturbance
Single plateau	7.67	Very low, only local grazing or rarely fires.

The names, Zenda dongar or Bavtyacha dongar are given to this plateau as this is a location used by Survey of India for the land surveys of the region. Every year a new flag is put at specific locations.

Ecosystem services

Many streams originate from this plateau. A perennial spring is present on the northern side within



the forest. The hill streams feed into rivers. Zenda-Dhangarwada-Gajapur plateau and its surrounding forest area plays a prominent role in water catchment in this region. The hill streams originating from the region are in the catchment of four dams, located on all sides of the plateau. Apart from this, the villages are dependent on the streams and water percolating from the plateau tops.

Open rocky exposures are seen on almost 70% of the plateau, while rest is covered by shrub thickets and low *Memoylon* dominated forests. The surrounding area, includes most of the dense forest area (included in Reserve Forest) and parts of the villages.

Biodiversity Profile

This plateau is one of the least disturbed in the Kolhapur district and is surrounded by dense forest area.

Flora of Kolhapur district reports species from this area. However a separate checklist is not available so far.



Ephemeral flush vegetation with *Utricularia-Eriocaulon* dominates the entire plateau. Dense shrub and tree vegetation is seen growing on deep accumulated soil. *Chlorophytum* spp., *Crinum* spp., are common.

The entire plateau is covered by boulders which offer habitat for many lichens, mosses and lithophytic orchids like *Eria*, *Porpax*, *Dendrobium*.

Herbaceous plant communities of this plateau were systematically surveyed during 2004-2006 as a part of Department of Science and Technology funded project on plant communities of rocky plateaus. In a sampling area of 25 sq.m, $H' = 3.98$ and 37 herbaceous species were reported in September 2004, followed by $H' = 4.01$ and 36 herbaceous species in September 2005, indicating rich herbaceous diversity. During this survey 45 endemic species were reported of which four are endangered, one critically endangered and two are vulnerable as per BSI assessments.

A complete list of species from the scrubland, shrub thickets and forest area is not available, but will definitely include more endemic and threatened species as this area falls within the critical crestline area of the Western Ghats. Amba ghat is well known for endemic plant diversity and is the locality of threatened as *Ceropegia kuberi*.



Long term monitoring studies of fauna are not yet available from the plateau area. Local naturalists of Kolhapur have detailed listings and photodocumentation of fauna of the region.

The RF areas have presence of giant squirrel and nesting was often seen in the forest. Gaur was observed in the Manoli forest area. Presence of Dhole and Leopard has been reported from the surrounding forest areas of the plateau by Girish Punjabi and Adwait Yedgaonkar (CEPF-ATREE Project 2011). Although tiger has not been reported in the recent times, the area falls under the corridor forest region between Radhangari WLS and Chandoli NP (Sahyadri Tiger Reserve) and hence is one of prime importance for movement of tiger as well as other large carnivores. The bird checklist of this area includes 250 species. Striped necked mongoose is recently reported from Amba area (Varad Giri pers. comm., 2013).

Herpetofaunal surveys details are not available, but the habitat has potential of many specialist species due to low human disturbance so far.

Current and potential threats

Only a few cattle from the surrounding villages graze on it during the late monsoon period. Otherwise it is used only as a route for cattle and grazers to pass to the grazing grounds in the surrounding area. Annually fires put by poachers and grazers burn some parts of the vegetation. Tourism is very low and hardly any trampling garbage is observed on the plateau.

The Dhargarwada side of the plateau, is being actively mined in the area outside of RF. Bauxite forms a sheet like body of variable thickness below the overburden of laterite (Lad and Samant, 2009). Bauxite reserves are estimated at 15.65 million tones. (Geology and Mineral Resources of Maharashtra, 2000). Permission has been sought from forest department for mining in the RF area, the matter is pending decision. This is one of the most serious threats as it will destroy a large portion of virgin plateau area and also cause continued disturbance in the surrounding forested area.

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Suggestions for conservation

- Immediate LEGAL protection of the Amba region with the plateau as a **critical corridor area** between Chandoli NP and Radhanagari WLS. This area was already identified as Amba-Vishalgad mini-core by Dr. AJT Johnsingh and team researching the tiger habitats.
- Further mining should not be allowed. Immediate restoration measures for current mining should be taken
- Protection of drainage and water sources should be undertaken

Based upon information provided by :

Dr. Jay Samant, Devrai; Dr. M. Bachulkar, Green Guards; Kedar Munishwar, Gururasad Malkar, Envirolegal Forum Suhas Waingankar, CEE; Varad Giri, BNHS; Dr. Aparna Watve, Sanjay Thakur, Biome Conservation Foundation Pune, Christopher Thorpe-Dixon University of Plymouth.

DURGAMANWAD PLATEAU, Kolhapur District

Durgamanwad plateau is located in Radhangari taluka of Kolhapur district. It is located between 16°27'8.98"N, 73°57'52.94"E to 16°26'33.65"N, 73°55'57.54"E. It is about 70 kms away from Kolhapur town and can be approached via a small road branching off from the Kolhapur-Radhangari state highway. A tarred road goes right to the top of the mining area, but is in poor state due to continuous traffic of mining vehicles.

A major portion of the plateau is privately owned and belongs to a single individual. This part has been leased for mining by the Hindalco (previously Indian Aluminium Company) company. The mine touches northern boundary of Radhanagari WLS. The lease was granted before the notification of the sanctuary, but the operations commenced only in 1993. Environmental clearance was granted even though the mine actually touches the sanctuary border. A local group, the Radhanagari Taluka Bachao Samiti, had gone to court against this but the court allowed the mining to continue. It is now almost 20 years since the extraction started. A part of the plateau is Reserve Forest area and forest

clearance was requested for mining the area, but it was refused due to proximity to the WLS. The hill slopes surrounding the plateau are gently sloping and have degraded vegetation and some plantations. Degraded semi-evergreen forest is present with some dense pockets adjacent to the plateau scarp. Southern slopes, adjacent to the WLS have slightly better vegetation as compared to the northern slopes which are under local pressures.

Ecosystem services

Many hill streams originate from this plateau. They feed into Radhangari reservoir. Two other small dams are also present to the north of the plateau. The mined out area has large ponds which retain water throughout the dry period.

Durgamanwad	Area	Disturbance
Mined area	ha	Mining and related infrastructure
Plateau area	1.11 sq kms	grazing, and mining related activities
Total		



Since 2007, Hindalco has involved Envirosearch, an environmental consultancy firm, to participate in post-mining restoration activity at Durgamanwad.

Biodiversity profile

There are no previous studies of biodiversity of the plateau, before the mining was started. It is thus difficult to compare the present biodiversity with the earlier vegetation.

Endemic herpetofauna is reported from the region. Common endemics of *Eriocaulon*, *Utricularia*, *Impatiense* are able to recolonize the mined areas. Good regeneration of tall grasses has been observed on the restored area.

A detailed biodiversity assessment of the area has been conducted by Envirosearch and based on it, mining restoration plan is being implemented. The details of this restoration effort have been described by Kulkarni and Moghe (2011). As per the mining restoration guidelines, plantation of indigenous species of trees, shrubs has been carried out successfully over an area of 12 ha. The heavy rains and wind pose a serious challenge to the tree cover restoration effort. In addition, the scarcity of topsoil and low permeability and lack of nutrients of the exposed clay surface does pose a serious challenge to the effort.

The typical lateritic vegetation is also created on a pilot scale and has showed promising regeneration of annual endemic species which have soil seed banks. Efforts are ongoing to recreate the other microhabitats and allow establishment of perennial herbs typical of the habitat. Reestablishment of grass flora is also being tried at pilot scale. Visiting of hares, has been reported. There is a need for assessment of recolonization of herpetofauna and other taxa typical of the lateritic plateaus.

Current and potential threats

Restoration of any habitat is a cost and manpower intensive effort. In case of sensitive

habitats, which are already disturbed, restoration of flora and fauna to near natural conditions is urgency. This also offers an opportunity to study and understand the ecosystem processes, interlinkages of the abiotic and biotic components of this habitat.

Sustainability of restoration is a matter of serious concern. This issue has been emphasized in many mining restoration case-studies. Once the mining lease is over, the area and the fate of restoration model will depend on the owner. It is necessary to support the restoration effort in the Durgamanwad till the area has recovered to sustain on its own.

Suggestions for conservation:

- Restoration effort for mined area needs to be supported
- scientific monitoring and research on the restoration needs to be undertaken to understand response of endemic and specialist species to restoration
- Special efforts need to be done to legally protection the restoration beyond the lease period.
- Microplanning of post-mining use of the region needs to be done with the help of the stakeholders



Based on information provided by :
 Jayant Kulkarni, Envirosearch, Kaustubh Moghe, & reports of HINDALCO company

AMBOLI PLATEAUS, Sindhudurg District

Introduction:

Amboli is well known as a hill station situated in the Sindhudurg district of Maharashtra. Since, 1980s Amboli forests and surrounding areas have attracted tourists. In the last decade it emerged as a popular destination for eco-camps and family holidays.

The NW Ghats in Maharashtra and just south of Amboli area, in the Tilar region. The entire region has well preserved wilderness. Dense semi-evergreen forests are can still be seen. Recent surveys reveal high biodiversity of plants, insects, herpetofauna, birds and good densities of carnivores.

Ajra is the nearest town to Amboli in the Kolhapur district and Savantwadi is nearest in Sindhudrug district

Amboli village is situated on the state highway no. 134 leading from Kolhapur to Sawantwadi. Another road from Amboli passes via Chaukul through Kumbhvade ghat to Dodamarg, but it

is not much in use at present. A road from Ramghat to the Chandgad town exists but is in poor shape.

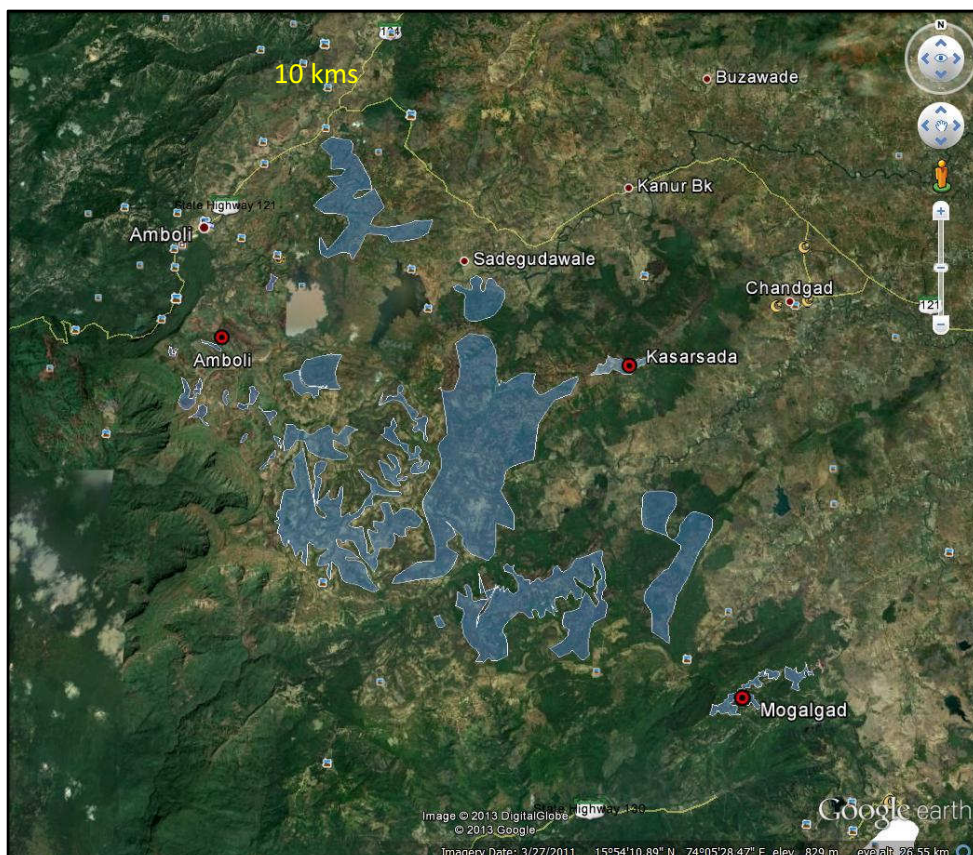
The part of Amboli near the state highway is Bajarwadi, which has many houses, resorts, shops etc. Broadly, the name Amboli is used for area including Amboli Bajarpeth and adjacent villages of Chaukul and Gele.

Open lateritic plateaus or "Sadas" are prominent in the landscape. These are one of the largest exposures of laterite in NW Ghats. A typical ferricrete formation with steep cliffs is limited to few locations such as Gau-sada but lateritic rocks are exposed along all hill slopes.

Lateritic plateaus of Amboli fall under Reserve forest and private lands.

Ecosystem services:

Hiranyakeshi river originates near Amboli. This is place of origin is marked by a temple. A tributary of Hiranyakeshi river passes through



the Chaukul area. It is a major source of water. In monsoon waterfalls and cascades can be seen throughout the area. Many monsoonal as well as perennial hill streams originate in the lateritic hills. There is abundance of water in the region and the area is very well irrigated. Rice is the main crop and cultivated twice, in monsoon and also in winter. The winter rice is cultivated in the bed of Hiranyakeshi tributary.

Amboli plateaus	Area (sq. kms)	Disturbance
Amboli-Chaukul plateau	47.46 Approx.	Very low, only local grazing or rarely fires. But increasing land conversion to housing, resorts is a potential threat to habitat
Kasarsada	0.5957	bauxite mining

Ponds on Khamtyacha sada, Gau-sada hold water till December end. Domestic as well as wild animals are dependent on it. Amboli villages are supplied water through Hiranyakeshi, a small dam supplies water to Mulawandwadi. Chaukul has ample supply from 8-10 perennial wells, all of which are supplied by underground drainage channels in lateritic system. All lateritic areas are used as grazing grounds.

Biodiversity Profile:

Amboli area has been surveyed by many botanists and zoologists.

The flora of Sindhudurg and Sawantwadi areas include many species of plants from Amboli. It has become a popular visiting place of birdwatchers and herpetologists. Many reports, records and new species of amphibians and snakes have been described from the area. A separate list and study of lateritic plateaus is not available, but ecological notes in scientific papers indicate the importance of this habitat. Naturalists of Malabar Nature Conservation Club have

documented life cycles of various species on the plateaus.

Moose plateau of Amboli is the type locality of *Ceropegia jainii*, a lateritic plateau specialist. It is one of the smallest Ceropegias and grows exclusively in lateritic rocky areas. *Merremia panchorhiza* is another typical plant of Amboli plateaus. It is also the type locality of *Xanthophryne tigrinus*, the Amboli toad and *Gegeniophis danieli*, an endemic caecilian. A diversity of other rare and endemic amphibians have been reported from Amboli plateaus and streams. In June 2013, a tigress with two cubs was spotted on Malai plateau by the tourists.

Very large underground lateritic caves are seen around Amboli. These have bears, porcupines. The lateritic streams in caves have fish species. Bats roost in these caves.

More surveys of invertebrates and other taxa need to be done to fully understand the biodiversity of Amboli plateaus.

Current and potential threats

Currently the Amboli plateaus are only under pressures of livestock grazing and accidental fires. In the past some local quarrying was carried out near Chaukul. The Chaukul road passes through plateaus.

Bauxite mining was going on at Kasarsada and Nangartas areas near Amboli. But both leases have expired.

Although many tourists visit Amboli, the disturbance is restricted to viewing points. Till now plateau tourism has not started on large scale. Village based eco-tourism is going on in Chaukul, however, it has no impact on the biodiversity.

In the Chaukul area, the Grampanchayat has passed a decision that land will not be sold to any outsiders. Quarrying, mining will not be allowed within Chaukul village limits. These two major decisions have led to protection from rampant destruction by outsiders. With constant support of local naturalists, a good example of community based tourism and conservation is being developed at local level.

The major threat is from conversion of lands for use as resorts and farmhouses. Land in and around Bajarwadi of Amboli, and even in

more remote areas of Jakatwadi, Gaothanwadi, Kamatwadi are also being bought and/ or built over. Clearing of land near Lingachi Rai was seen in 2013. Tourism pressure is slowly increasing and resulting in trampling and disturbance of plateau as well as forest habitats. Garbage has become a major problem. There is a concern that Amboli will be expanding and changing on the lines of tourist place like Khandala-Mahabaleshwar resulting in severe degradation of threatened biodiversity.

Mining is not a major threat at the moment. But it is possible that in future pressures from mining lobby will increase. As the new leases expire and are not extended, demand for bauxite on private and forest lands might increase.

high biodiversity values, its location as corridor area between the Kolhapur and Belgaum a conservation category needs to be identified. The local villagers especially, of Choukul have taken many decisions which are pro-conservation of the area.

Possibility of establishing a biodiversity heritage site, or a community reserve should be discussed with the local communities. This will allow legal protection and management of biodiversity on forest as well as private lands. It will help deter the large scale commercial interests of outsiders and help promote the local ecotourism and community initiatives of green livelihoods

Microplanning of biodiversity and ecological conservation needs to be undertaken. Research and monitoring by local communities is ongoing, and should be promoted.



Information provided by:
Kaka Bhise, Rohan Kangaonkar, Hemant Ogale, Saili Palande-Datar, Rakesh Deulkar, Abhishek Narvekar, Malabar Nature Conservation Club, Amboli; Dr. Varad Giri, BNHS

Suggestions for Conservation:

Enhancing the legal protection of Amboli area and its biodiversity is required. At present the area is mostly under RF. But considering the

CHORLAPLATEAUS, Belgaum District

The lateritic plateaus of Chorla are well explored plateaus in the Belgaum district. This group of plateaus is located south of Amboli and at the border of Goa, Karnataka and Maharashtra. Belgaum plateaus are the southernmost of the high altitude laterites. They can be accessed through Chorlavillage.

The plateaus are located between 15°40'24.29"N, 74°05'11.43"E to 15°40'14.94"N & 73°10'21.46"E. The highest point is around 800m ASL.

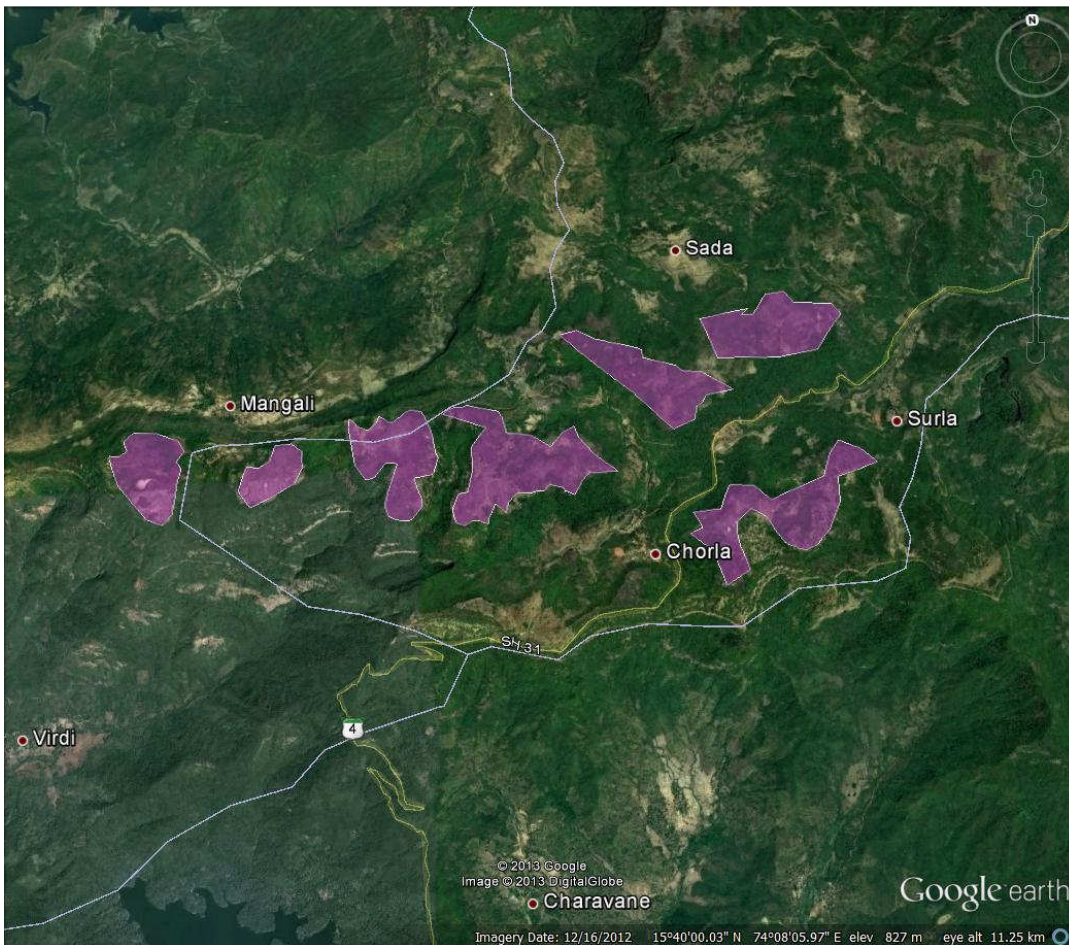
The plateaus and its surrounding steep slopes have small patches of forest, but are mostly private lands extensively cultivated for rice.

Some of the plateaus have local names such as Devachasada.

Chorla	Area (sq. kms)	Disturbance
Chorla group of plateaus	Approx. 5.494 sq. kms	Grazing
Total		

Ecosystem services

The area is in the catchment of the Mhadeiriver. A large area is included in the Mhadei Wildlife Sanctuary. Generally the ponds in the plateau and surrounding regions hold water till February end.



Current and potential threats

The plateaus are open for grazing of domestic cattle. Trampling and fires also occur. Boulder removal and collection of laterite from the community land are potential threats to the habitat.

Biodiversity Profile:

Amphibians including frog and caecilian species are reported from the Chorla village and surrounding areas. *Gegeneophis* and *Ichthyophis* species have been reported from Chorla and Surla areas. Studies of herpetofauna and odonata from Goa area are available. Projects on ants, millipedes and mammal diversity on plateaus are going on. Monitoring of climate, documentation of local people's use of the plateau habitat is being conducted.

Suggestions for Conservation:

- The chorla plateaus represent the southernmost high altitude laterites of the Karnataka region. Special protection should be given to the areas in community lands and under threat from human use.
- Laterite collection should be discontinued
- Research regarding ecosystem functioning, interrelationships amongst the organisms, plant-animal interactions should be conducted and used for better ecological management of the habitats.

Based upon information provided by :
Nirmal Kulkarni , Mhadei research centre;
Parag Rangnekar

Mhadei Caecilian (*Gegeneophis mhadeiensis*) described to science in 2007.

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