World Heritage Sites

Protected Areas and World Heritage

WESTERN GHATS

INDIA

The Western Ghats are a chain of low mountains running 1,600 kilometres parallel to India's western coast from Gujarat to southern Kerala between 30-50 kilometres inland. They have some of the finest non-equatorial tropical evergreen forests in the world with very high levels of speciation and endemism. They shelter at least 325 globally threatened species including 51 that are critically endangered. The serial site contains 39 protected areas in seven separate clusters stretching over a distance of 1,250 kilometres.

COUNTRY
India

NAME
Western Ghats

NATURAL WORLD HERITAGE SERIAL SITE
2012: Inscribed on the World Heritage List under natural criteria (ix) and (x).

INTERNATIONAL DESIGNATION
2000: *Nilgiri* designated a Biosphere Reserve under the UNESCO Man and Biosphere Programme (core area 124,000 ha).

STATEMENT OF OUTSTANDING UNIVERSAL VALUE
The UNESCO World Heritage Committee adopted only a provisional Statement of Outstanding Universal Value (SoOUV) at its meeting in 2012. The Committee is expected to approve the final SoOUV at its meeting in June 2013.

IUCN MANAGEMENT CATEGORY
Unassigned

BIOGEOGRAPHICAL PROVINCE
Malabar Rainforest (4.1.1)

GEOGRAPHICAL LOCATION
The Western Ghat mountains run parallel to the western coast between 30 and 100 kilometres inland from southernmost Gujarat state in the north through the states of Maharashtra, Goa, Karnataka and Tamil Nadu to southernmost Kerala in the south between 17°43' N to 08°25′ N by 73°03' E to 77°59′E.

DATES AND HISTORY OF ESTABLISHMENT
The dates of establishment of each site are given in the comprehensive table below. Most of the Forest Reserves were first protected a century ago. Later sites were designated under the various national and state Wildlife (Protection) Acts, Forest Acts and the Environmental Protection Act, 1986

LAND TENURE
The sites are owned by the state forest departments of Kerala, Tamil Nadu, Karnataka and Maharashtra and administered by their Chief Wardens under the national Director General of Forests (Wildlife).

AREAS

The property covers 795,315 ha. The property consists of seven separate groups (sub-clusters) containing 39 sites spread over 1,250 kilometres, listed below from south to north:

Site creation date	No	Site	Area (ha)	State	Latitude (N)	Longitude (E)
1 Agasthyamalai Group						
1962/1989	1	Kalakad-Mundanthurai Tiger Res.	89,500	Tamil Nadu	08°25′ to 08°53′ N	77°10′ to 77°35′ E
1984	2	Shendurney Wildlife Sanctuary	17,100	Kerala	08°44′ to 09°14′ N	77°59′ to 77°16′ E
1958	3	Neyyar Wildlife Sanctuary	12,800	Kerala	08°31′ to 08°37′ N	77°08′ to 77°14′ E
1983	4	Peppara Wildlife Sanctuary	5,300	Kerala	08°34′ to 08°42′ N	77°07′ to 77°15′ E
1901	5	Kulathupuzha Range Reserved Forest	20,000	Kerala	08°40′ to 08°56′ N	77°00′ to 77°19′ E
1898	6	Palode Range Reserved Forest	16,500	Kerala	08°40′ to 08°56′ N	77°00′ to 77°19′ E
2 Periyar Group						
1934/1950/1978	7	Periyar Tiger Reserve	77,700	Kerala	09°16′to 09°36′N	76°56′to 77°24' E
1904/1987	8	Ranni Forest Division	82,853	Kerala	09°11′to 09°28′N	76°50′to 77°17′
1897/1987	9	Konni Forest Division	26,143	Kerala	09°02′to 09°15′N	76°50' to 77°17′E
1901/1987	10	Achankovil Forest Division	21,990	Kerala	09°02′to 09°12′N	77°03′to 77°16′E
1989	11	Srivilliputtur Wildlife Sanctuary	48,500	Tamil Nadu	09°23′to 09°48′N	77°20′to 77°42′E
1997	12	Tirunelveli (North) Forest (part)	23,467	Tamil Nadu	09°03′to 09°24′N	77°12′to 77°23′E
3 Anamalai Group						
1978	13	Eravikulam National Park + extension	12700	Kerala	10°05' to 10°20′N	77°00' to 77°10'"E
1976	14	Grass Hills National Park	3,123	Tamil Nadu	10°02' to 77°04′ N	77º 04′ E
1989	15	Karian Shola National Park	503	Tamil Nadu	10°13' to 10°33′ N	76°49' to 77°21' E
2001 (1973)	16	Karian Shola in Parambikulam Wildlife Sanctuary	377	Kerala	10°28' N	76°49' E
1984	17	Chinnar Wildlife Sanctuary	9,044	Kerala	10°00' to 10°21′N	77°06' to 77°16' E
1980	18	Mankulam Range Forest	5,284	Kerala	10°00' to 10°10' N	76°50' to 77°00' E
1901/2003	19	Mannavan Shola	1,126	Kerala	11°12' N	77°13' E
4 Nilgiri Group						
1984	20	Silent Valley National Park	8,952	Kerala	11° 03' to 11°12' N	76°22' to 76°29' E
1980/1990	21	Mukurti National Park	7,850	Tamil Nadu	11° 10' to 11°22' N	76°26′ to 76°34′ E
	22	New Amarambalam Reserved Forest	24,697	Kerala	11° 13' to 11°23' N	76°19' to 76°32' E

1971	23	Kalikavu Range Reserved Forest	11,705	Kerala	11° 05' to 11°16' N	76°19' to 76°27' E
	24	Attapadi Reserved Forest	6,575	Kerala	11° 03' to 11°12' N	76°26' to 76°31' E
5 Talacauvery Group						
11904/1987	25	Pushpagiri Wildlife Sanctuary	10,259	Karnataka	12°29 ′to 12°42' N	75°38 ′to 75°42 ′E
1974	26	Brahmagiri Wildlife Sanctuary	18,129	Karnataka	11°55 ′to 12°09 ′N	75°44 ′to 76°04 ′E
1987	27	Talacauvery Wildlife Sanctuary	10,500	Karnataka	12°17 ′to 12°27 ′N	75°26 ′to 75°33 ′E
1984/1998	28	Aralam Wildlife Sanctuary	5,500	Kerala	11°59 ′to 11°54 ′N	75°47 ′to 75°57 ′E
1906	29	Padinalknad Reserved Forest	18,476	Karnataka	12°05 ′to 12°19 ′N	75°25 ′to 75°40 ′E
1903	30	Kerti Reserved Forest	7,904	Karnataka	12°04 ′to 12°11 ′N	75°25 ′to 75°40 ′E
6 Kudremukh Group						
1987/2001	31	Kudremukh National Park	60,032	Karnataka	13°01′ to 13°29' N	75°01' to 75°25' E
1979	32	Someshwara Wildlife Sanctuary	8,840	Karnataka	13°29' to 13°37' N	75°59' to 75°05' E
1979	33	Someshwara Reserved Forest	11,292	Karnataka	13°22' to 13°30' N	75°04' to 75°10' E
1913	34	Agumbe Reserved Forest	5,709	Karnataka	13°30' to 13°38' N	75°02' to 75°07' E
1913	35	Balahalli Reserved Forest	2,263	Karnataka	13°27' to 13°30' N	75°05' to 75°10'
7 Sahyadri Group						
1913/1985	36	Kas Plateau Reserved Forest	1,142	Maharashtra	17°43' N	73°48' E
1989	37	Koyna Wildlife Sanctuary	42,355	Maharashtra	17°23' to 17°44' N	73°34' to 73°51' E
1985/2004	38	Chandoli National Park	30,890	Maharashtra	17°03' to 17°17' N	73°03' to 73°41' E
1958/1985	39	Radhanagari Wildlife Sanctuary	282,35	Maharashtra	16°10' to 16°30' N	73°52' to 74°05' E
TOTAL			**795,315**			

ALTITUDE

50m - 2,695m (Mt. Anamudi in Eravikulam National Park). Most of the sites range from a coastal plain lowland to high mountains. The approximate average height of the mountain chain is given as 1,200m.

PHYSICAL CHARACTERISTICS

The Western Ghats, known in India as the Sahyadri Hills, are a 160,000 sq.km chain of forested mountains running 1,600 kilometres parallel to India's western coast from Gujarat to southern Kerala on the faulted western edge of the Deccan plateau between 30 and 50 kilometres inland from the Indian Ocean. The ranges, of an average height of 1,200m, form a physical and climatic barrier between coast and interior interrupted only by the small Goa gap between Maharashtra and Karnataka and the 30-km wide Palghat Gap between the Nilgiri and the Anamalai Hills in Kerala. North of Goa the mountains are angular and steeply stepped lateritic plateaus (*ghat* means step), south of Goa they are more rounded, though in the far south they form the highest peaks. The western slopes receive monsoon and convective rainfall and up to 1,500m, higher in the south, are usually covered by rainforest; the eastern slopes in their rain shadow are dry. The many rivers of the western slopes are short and fast, form gorges and waterfalls and are heavily dammed, Several protected

areas are formed of the headwater catchments. The rivers of the eastern slopes drain to the Bay of Bengal hundreds of kilometres east. Together, the more than sixty rivers originating in the Ghats form the catchment of almost 40% of the sub-continent.

The Ghats are geologically older than the Himalayas. They originated in the rupture of ancient Gondwanaland in the Jurassic period 200-150,000 million years ago when over millennia, India became an isolated landmass thrust by tectonic movement against and under the massive block of Laurasia. The movement took the plate over a hotspot 60-65 million years ago where many magmatic upwellings of basalt lavas tilted the plate eastward. The collision occurred around 45 mya. Under the resulting Deccan plateau the basalt is nearly three kilometres thick. The northern ranges are formed of massive trap rock in stepped walls of horizontally bedded layers which form an escarpment to the west. The mountains south of Goa are of ancient steeply dipping gneisses and schists rounded by denudation which dip gently to the east. The southernmost highest ranges contain much charnockite granite. It is a region of high rates of uplift, erosion and sediment yields. Much of the country is steeply hilly rather than mountainous but is visited for its beauty, especially in Agasthyamalai and Kudremukh.

CLIMATE

The climate along the Western Ghats varies with elevation and distance from the equator. The coast and lower foothills are humid and tropical; elevations above 1,500m in the north and higher in the south are more temperate. The high mountain barrier which influences the biophysical and ecological processes across much of south India is one of the world's best examples of a tropical monsoon system. The west side of the mountains intercepts the prevailing southwesterly monsoon winds between June and September when 65% to 80% of the rain falls. Most of the rest falls during the northeast monsoon between October and November. The forests also trap condensation formed from rising moist sea air and release much back in transpiration. The rainfall on the west side averages 2,000–3,000mm with local extremes up to 10,000mm. The eastern slopes in the rain shadow receive an average of about 1,000mm near the crest. Average annual temperatures range from around 15°C in the north to 35°C in the south. At some high elevations temperatures touch 0°C during the winter and frost is common. In the south the coldest periods coincide with the wettest.

VEGETATION

The property covers 0.5% of the mountains (CEPF, 2007). It is composed of seven groups of protected areas, three with four to six contiguous sites, Agasthyamalai, Periyar and Nilgiri, and four with four to seven largely contiguous sites, Anamalai, Talacauvery, Kudremukh and Sahyadri.

All 39 sites in the property belong to the same biogeographic province, and are the isolated remnants of a once continuous forest. These mountains, especially in the south, support exceptional levels of plant diversity and endemism which make it a region of major global importance for their conservation. The mountains are a major ecological divide: monsoon forests of tropical wet evergreen and moist deciduous forest species grow on the windward slopes and tropical dry thorn forest in their lee. Stunted evergreen montane forests *(sholas)* and extensive grasslands with groves in moist hollows grow at higher altitude. The rainforests contain a very large number of tree species of which at least 60 percent in the upper canopy individually comprise not more than one percent of the total. Clumps of bamboo grow along streams or in poorly drained hollows throughout the forests in areas probably once cleared for shifting agriculture.

The dominant vegetation types are as follows:

Vegetation type	Elevation	Rainfall	Dominant flora
Tropical evergreen forest (west slopes)	200-1,500m	2,500-5,000mm	emergents up to 60 m; *Acrocarpus, Aglaia, Artocarpus, Calophyllum, Canarium, Cullenia, Dipterocarpus, Holigarna, Knema, Myristica*
Moist deciduous forest (most on high east slopes)	500-900m	2,500-3,500mm	*Bridelia, Pterocarpus, Sterculia, Tectona, Pterospermum, Lagerstroemia, Terminalia*
Dry deciduous *Buchanania* (east slopes)	300-900m	1000-2000mm	*Albizia, Anogeissus, Bauhinia, Butea, Dillenia, Emblica*
Scrub	200-500m	300-600mm	*Acacia, Carissa, Capparis, Flacourtia, Gardenia*
Shola	above 1,500m	medium to high	short trees 15-20m: *Actinodaphne, Elaeocarpus, Euonymus, Michelia, Rhodomyrtus, Schefflera, Symplocos*

Grassland	1,700–1,900m	medium to high	grasses: *Chrysopogon, Arundinella, Eulalia, Heteropogon*
Montane grassland	montane	very high	herbaceous to shrubby cover: *Ligustrum, Rhododendron, Anaphalis, Strobilanthes*
Peat bog	< 2,000m	high	grasses, sedges and mosses: *Carex*, *Cyanotis, Cyperus, Eriocaulon*
Myristica swamp	0m to 600m	medium to high	*Myristica, Knema, Hydnocarpus, Lophopetalum*

A total of 4,000 vascular plant species with 1,500 endemics (37.5%) was recorded by Nair & Daniel in 1986. Of the nearly 650 tree species found, 352 (54%) are endemic. The region has 58 endemic plant genera, for example *Impatiens* balsams with 76 of 86 species endemic, *Dipterocarpus* with 12 of 13 species endemic and *Calamus* with 23 of 25 species endemic, which exhibit extreme evolutionary radiation. There are 267 species of orchid, 130 being endemic, and 320 species of pterydophyte, 11-13 lianas, 280 liverworts and 682 mosses. The property conserves several threatened habitats: the unique seasonally mass-flowering wildflower meadows, *shola* thickets and Myristica swamps. *Cullenia,* widespread in the south in the *Cullenia exarillata-Mesua ferua-Palaquium ellipticum* rainforest association is an important resource for primates. The forests also contain tree species of great commercial value such as Indian rosewood *Dalbergia latifolia,* mardi *Terminalia crenulata* and Malabar kino *Pterocarpus marsupium* which have now been cleared from many areas.

In the following the flora and fauna of the sites are described in outline by group, from south to north: Agasthyamalai Group: Kalakad-Mundanthurai Tiger Reserve is the largest site in the property. It has high rounded mountains, plateaus and hilly country rising from 50m to 1,866m; there are also lower hills in the south and three large reservoirs. The climate is monsoonal and fairly typical of all the sites of the property: at least 50% of the 2,000-3,000mm rainfall comes with the southwest monsoon in June to September, most of the rest from the northeast in October to January with a dry period from February to May. The drier east slopes of the property average 1,200mm. The average annual temperatures range between 16°C and 34°C. The Tiger Reserve has a complex of twelve vegetation types dominated by a large area of southern wet tropical rainforest. The drier east slopes have moist deciduous and thorn forests. Shendurney Wildlife Sanctuary is less mountainous, with rainfall up to 5,000mmm, 951 vascular plant species, 309 being endemic to the Ghats, and 100 endangered species. The hilly southernmost sites have 1106 plant species. Neyyar Wildlife Sanctuary has several threatened trees: *Eugenia floccosa* (EN), *E. discifera* (EN), *Hopea utilis* (EN), *Bentinckia conddapanna* (VU), the deciduous *Dalbergia latifolia* (VU) and 125 orchid species. There are small biologically rich *Myristica* freshwater swamps in the southernmost sites with swamp trees threatened by drainage: *Vateria indica* (CR) and *Syzygium travancoricum* (CR).

Periyar Group: Periyar is the largest of the groups and the Tiger Reserve is the third largest site in the property. It is undulating sometimes rugged land with high rounded mountains rising from 100m to 2,019m; there are two large reservoirs. The monsoon climate resembles Agasthyamalai's. 75% of the site is covered by tropical wet evergreen forest, 13% by moist deciduous forest. It is spectacularly biodiverse and has high endemism. The three forest divisions are in rugged hills. Eight vegetation types are present with 1651 vascular plant species - 50% of Kerala's total. There are 77 Cyperaceae including *Cycas circinalis* (EN), the tree *Eugenia discefera* (EN), ten species of palm and 145 orchids.

Anamalai Group: This is the smallest of the groups. Eravikulam and Grass Hills National Parks are in high rolling country above 1,450m with a steep escarpment to the west. The average temperatures range between 3°C and 29°C; rainfall averages 4,500mm. They cover a vast tract of moist grassland with *shola* thickets of stunted montane rainforest in the valleys. There are six vegetation types and 297 grassland and 108 fungi species. Karian Shola is a separate very small mid-level rain forest park at 650m-1000m rich in medicinal plants. Chinnar Wildlife Sanctuary is on the eastern slopes in the rain shadow of the Anamalai Mountains, running from 400m to above 2000m. It has an average rainfall of 1,000mm and a long dry season. There are 11 vegetation types dominated by dry tropical thorn and deciduous forests. Mankulam Range Forest has west coast tropical evergreen and semi-evergreen forests. Mannavan Shola has 275 plant species and montane climax evergreen forest with a very large area of high grassland with *shola* thickets.

Nilgiri Group: This is one of the most important landscapes for the conservation of a wide range of plants and animals, vegetation types and ecosystems. The sites of the group have an altitudinal range of 50m to 2,500m from the Palghat gap to the plateau in the north. There is also a considerable west-east gradient from coastal plain to high plateau and high mountains. The climate resembles that of the

other southern sites though Silent Valley National Park is misty from June to November. There is a 6.000 sq.km tropical evergreen forest in the southwest and dry euphorbia scrub in the southeast. With its adjoining protected areas this is a wide landscape of grasslands, scrub and deciduous and evergreen forests. There are five vegetation types dominated by tropical wet evergreen forest in the west and *shola* grassland in the hills; with 966 vascular plants, 343 of them of medicinal value, and 108 orchids. New Amarambalam Forest is undulating ridged highland between 50m and 2,755m, an undisturbed block of southern tropical, semi-evergreen and montane forests. Kalikavu is another such forest block but lower in elevation. Mukurti National Park is an undulating high plateau with *shola* grassland and peaks up to 2,630m and a parallel inner range. Alpine type flora includes the 12-yearly flowering blue flower after which the Nilgiris, the blue mountains, are named. It has two endangered trees *Vandeleuria nilagirica* (EN) and *Anaphalis leptophylla* (VU). Attapadi Forest rises through *shola* grasslands from 800m to 2,225m in the dryer east.

Talacauvery Group: Pushpagiri Wildlife Sanctuary covers a steep mountainous and hilly terrain between 160m and 1,712m and has many valleys and waterfalls. The climate is southern with slightly cooler winters and, in Pushpagiri, a high rainfall of up to 6,500mm. The vegetation is predominantly west coast dense tropical evergreen and semi-evergreen forest with *shola* grassland at high elevations. 70 tree species are Western Ghat endemics and include *Hopea jacobi* (CR). Brahmagiri Wildlife Sanctuary has undulating terrain with steep valleys and is similar in character with thickets of bamboo growing in formerly farmed areas. Talacauvery Wildlife Sanctuary is hilly country of tropical evergreen forest with a dense understorey of woody climbers, canes and ferns and 300 vascular plant species. Padinalknad and Kerti are dense tropical evergreen forests, Kerti being quite undisturbed. Aralam Wildlife Sanctuary is another block of dense tropical evergreen and semi-evergreen forest plus moist deciduous forest. 52% of the trees are Western Ghat endemics, amongst them *Vateria indica* (CR) and *Hopea parviflora* (EN).

Kudremukh Group: Kudremukh National Park, the fourth largest site, rises from 120m to 1,892m and is mountainous with a steep scarp edge to south and west, undulating ridges to north and east. The average annual rainfall of 6,200mm is heavy and even reached 10,000mm in 1994; the area is windy. It has a large continuous forest of tropical evergreen forest below 300m with deciduous forest and a wide expanse of grassland above 1,000m. 88 species are native to the Maharashtra Ghats including *Syzygium bedommei* (EN) and *S. occidentale* (VU). Someshwara is lower at 75m to 870m and very hilly, covered with primary and secondary evergreen forest. Agumbe and Balahalli are similar low hilly forested terrain.

Sahyadri Group: The northern sites are in mountains formed of the angular and steeply stepped lateritic plateaus of the edge of the Deccan Plateau where the average rainfall is 2000mm-2500mm. Their tablelands, escarpments and deep valleys extend over the middle and upper elevations to 2,000m covered in evergreen and semi-evergreen and moist deciduous forests of high biodiversity. The Kas Forest region is called the plateau of flowers: it has 850 plant species including many ephemeral herbs and bulbs. Ferns and mosses grow well on the rocky outcrops. Koyna Wildlife Sanctuary has steep stepped slopes and deep valleys surrounding a long central dammed valley clothed in west coast evergreen, semi-evergreen and subtropical deciduous hill forests. Chandoli National Park also surrounds a long dammed valley covered by dense semi-evergreen forest with a rich flora and fauna. The plateaus have 300 species of grasses. Radhanagari Wildlife Sanctuary contains three ridges with two large reservoirs between them; tropical wet evergreen forest is dominant.

FAUNA

The Western Ghats have an exceptionally high level of biodiversity and endemism, though their full extent is not yet known. The below figures for the property come from the nomination (2010):

Taxonomic group	Total species	Endemic species	Percent endemism	Endangered species
Mammals	120	14	12	31
Birds	508	19	4	15
Amphibians	121	94	78	43
Reptiles	156	97	62	5
Fishes	218	116	53	1
Butterflies	330	37	11	

The designated sites contain at least 325 globally threatened species: 51 Critically Endangered, 145 Endangered and 129 Vulnerable species with 96 under a lesser degree of threat. They contain large populations of the flagship animals which are key indicator species in monitoring states of conservation: Asian elephant *Elephas maximus* (EN), tiger *Panthera tigris tigris* (EN) and gaur *Bos gaurus* (VU), also large populations of the endemic lion-tailed macaque *Macaca silenus* (EN), Nilgiri langur *Trachypithecus johnii* (VU) and Nilgiri tahr *Nilgiritragus hylocrius* (EN). The iconic Asian elephant population of about 11,000 animals may be the worlds' largest and they are widespread but few elephants and tigers actually occur within the property. Research into the species of the Western Ghats continues, constantly adding to the total of species known. Daniels' figures, if accepted, indicate an increase in the discovery of species since the 1986 survey by Nair and Daniel. Further research may increase the number of known freshwater fish species to 345 (Dahanukar *et al.* 2004). Invertebrate diversity and endemism may also be very high once they are better known: for instance some 80% of its tiger beetles are endemic (IUCN, 2000).

The fauna is described below by group and site. Only the most threatened species are mentioned, where known. However, since large numbers of species are still being discovered, the totals and degrees of vulnerability may reflect the incompleteness of published knowledge to date.

Agasthyamalai Group: The Kalakad-Mundanthurai Tiger Reserve with the other sites shelter 43 mammals, 245 birds, 43 amphibians, 46 reptiles and 42 fish. Found in the sites of the group are the Asian elephant (EN), tiger (EN) and gaur (VU); also large populations of the endemic lion-tailed macaque (EN), Nilgiri langur (VU), Nilgiri marten *Martes gwatkinsi*, (VU), sloth bear *Melursus ursinus* (VU) and Nilgiri tahr (EN). This suite of populations is used as a key indicator in monitoring. The cane turtle *Vijayachelys silvatica* (EN) is found in Shendurney Wildlife Sanctuary, also the frogs *Rhacophorus calcidensis* (EN) and the black narrow-mouthed frog *Melanobatrachus indicus* (EN) which is linked to east African species, indicating an origin before the Indian plate split from Africa.

Periyar Group: In Periyar Tiger Reserve and adjoining sites 62 mammals, 330 birds, 27 amphibians, 45 reptiles, 38 fish and 160 butterflies are recorded: almost the highest overall count in the property. Many species are listed by IUCN as threatened. In addition to the suite of large animals given above, the most threatened species include red slender loris *Loris tardigradus* (EN), *Cuon alpinus* (EN), Nilgiri marten (VU), king cobra *Ophiophagus hannah* (VU) and five fishes: Periyar trout *Lepidopygopsis typus* (EN), Periyar lattia *Crossocheilus periyarensis* (EN), Korhai barb *Hypselobarbus micropogon periyarensis* (EN), the endemic blue-finned mahseer *Tor khudree* (EN) and the Periyar reticulated loach *Noemacheilus menoni* (VU). One endemic genus and species, Salim Ali's fruit bat *Latidens salimalii* (EN) is endemic to the High Wavy Mountains just outside the designated area.

Anamalai Group: 95% of all Western Ghats species occur in the Anamalai hills. In Eravikulam and Grass Hills National Parks there are 29 mammals, 132 birds, 20 amphibians and 101 species of butterfly. In addition to the flagship and local large mammals there are Nilgiri marten and dusky palm squirrel *Funambulus sublinea.* 1,500 of the Western Ghats population of over 2,000 Nilgiri tahr (EN) are found here. There is also Nilgiri blue robin *Myiomela major* (EN), white-bellied blue robin *M. albiventris* (EN) and broad-tailed grassbird *Schoenicolus platyurus* (VU) A new species, resplendent shrub frog *Raorchestes resplendens* (CR) was discovered in 2010 on Anamudi. Chinnar Wildlife Sanctuary has 28 mammals, 225 birds, 15 amphibians, 52 reptiles, 14 fish and 101 butterflies. Another threatened bird found there is the yellow-throated bulbul *Pycnonotus xantholaemus* (VU). A purple burrowing frog *Nasikabatrachus sahyadrensis* (EN) discovered in 2003 in Idukki, Chinnar, is related to a Seychelles frog which also indicates an origin before the Indian plate split from Madagascar and the Seychelles 60 mya. In Mannavan Shola, 344 insects, 89 butterflies and 110 moths are recorded.

Nilgiri Group: The forests of Silent Valley National Park with its adjoining protected areas contain large populations of the suite of flagship species plus 26 larger mammals, dhole *Cuon alpinus* (EN), 200 birds, (13 endemic), 92 fish (by far the most, 37 being endemic), 100 butterflies (13 endemic) and 100 species of moths. The Nilgiri laughing thrush *Garrulax cachinnans* (EN) with Nilgiri wood pigeon (VU) and Nilgiri pipit *Anthus nilgheriensis* (VU) are found in Mukurti National Park.

Talacauvery Group: In Pushpagiri Wildlife Sanctuary in addition to the suite of large mammals, there are red slender loris (EN), dhole (EN), sloth bear (VU), Malabar civet *Viverra civettina* (CR), sambar *Rusa unicolor* (VU), king cobra (VU), the small tree frog *Rhacophorus lateralis* (EN) and the black torrent toad *Ghatophryne ornata* (EN). Birds include Nilgiri wood pigeon *Columba elphinstonii* (VU),

broad-tailed grassbird (VU) and Nilgiri pipit (VU). In Brahmagiri Wildlife Sanctuary the disappearing oriental white-backed vulture *Gyps bengalensis* (CR) survives. The dense forest of Padinalknad and Kerti Forests is important habitat for lion-tailed macaque (EN), the forest in Kerti being quite undisturbed.

Kudremukh Group: the number of animal species is very high: 33 mammal, 181 bird, 36 amphibian, 54 reptile, 23 fish, 73 mollusc and 149 butterfly species are recorded. There are malabar civet (CR) and rusty-spotted cat *Prionailurus rubiginosis* (VU) as well as most of the suite of larger animals found in the other sites. Birds include Nilgiri blue robin (EN), Nilgiri wood pigeon (VU) and broad-tailed grassbird (VU). The lesser adjutant stork *Leptopilus javanicus* (VU) occurs in Someshwara Wildlife Sanctuary. Agumbe Forest has the lion-tailed macaque (EN), king cobra (VU) and Travancore tortoise *Indotestudo travancora* (VU).

Sahyadri Group: Two now rare vultures are found in Koyna Wildlife Sanctuary: the Indian vulture *Gyps indicus* (CR) and white-backed vulture (CR). In Chandoli National Park sloth bear (VU) live on the rocky cliff edges. Radhanagari Wildlife Sanctuary is the habitat of a large range of animals: 47 mammals, 264 birds, 20 amphibians, 59 reptiles, and 66 butterflies.

CONSERVATION VALUE

The designated sites are all part of the Western Ghats & Sri Lanka biodiversity hotspot, recognized by Conservation International as one of the world's eight hottest hotspots for biological diversity where the climatic and elevational gradients have resulted in exceptionally high speciation. This hotspot area has at least 4,780 vascular plant species, of which 2,180 are endemic (0.7% of the world's plants), and 1,073 vertebrate species, of which 355 are endemic to the hotspot (1.3% of the world's vertebrates) (Myers *et al.*, 2000). At the time of the original definition of 25 hotspots, the Western Ghats and Sri Lanka were the fourth hottest for endemic vertebrate species per unit area and the seventh for endemic vascular plants per unit area. They were also eighth when comparing endemism and the remaining primary vegetation with the original extent. Less than 7% of the original primary vegetation now remains (Myers *et al.* 2000). In considering past and predicted losses of habitat and species, the mountains are also one of the eleven global hotspots in most need of conservation (Brooks *et al.* 2002).

The designated sites contain - though not all are within the property - parts of the UNESCO Nilgiri Biosphere Reserve, the Agastyamalai and Nilgiri Hills Centres of Plant Diversity, and four WWF Global 200 priority ecoregions: the south-western Ghats (two regions), the Cardamom Hills, and the rivers and streams of the Western Ghats. Also included are the Western Ghats Endemic Bird Area, with 44 Important Bird Areas and three Zero Extinction sites. Agasthyamalai was designated a national Biosphere Reserve of 3,500 ha in 2001. The mountains also include a number, but not all, of the forest reserve areas of high conservation value identified by Das *et al.* in 2006 using a systematic conservation planning approach.

CULTURAL HERITAGE

The indigenous culture of the mountains is that of the Adivasi indigenous tribal people whose subsistence way of life is under threat. There remain a few ancient dolmens and caves with cave paintings and megalithic burial sites in Chinnar. There are seven well visited temples in Srivilliputtur Sanctuary, others in Agasthyamalai, Periyar, Talacauvery and Someshwara, attracting many pilgrims. Kudremukh has *Ganga moola,* the revered source of three great rivers. 2,000 sacred groves exist among the mountains.

LOCAL HUMAN POPULATIONS

The total population of the region exceeds 50 million, and many interests are pressing for conversion of the forests where some 40 different Adivasi peoples live, to agricultural use. These once isolated rural folk dependent on the forests and upland shifting agriculture are being gradually displaced, marginalised and impoverished by incomers. In several sites the bordering populations are high and infiltration occurs. There was strong opposition to NGOs and the Government over the nomination of the Talacauvery sites in Kodagu (Coorg) district in south Karnataka. Mentioned in the nomination document are a small ethnic community in Periyar Tiger Reserve, three tribes living in Amarambalam Forest, 1910 indigenous people in eleven settlements in Mankulam Range Forest, three tribes living in Kalikavu Range Forest, and two in Mukurti National Park. The managers of Chinnar Wildlife Sanctuary provide livelihoods for and help maintain the cultural heritage of the local tribes. The nomination notes at least 14,450 people living in the Agasthyamalai sites, 10,000 in Kalakad-Mundanthurai alone; 5,050

in the Periyar group; 2,300 in the Anamalai group; 1,280 in the Nilgiris; 6,244 in Kudremukh National Park, 42.5% of them tribes people, and 468 in Someshwara. This totals nearly 40,000 and excludes the often greater numbers in the buffer areas.

VISITORS AND VISITOR FACILITIES

In certain areas, especially sites in the Agasthyamalai, Periyar, Anamalai and Nilgiri groups there is much scenic tourism, especially to waterfalls and to sacred sites. The other groups are less visited but Kerala, Karnataka and Tamil Nadu all have plans for the promotion of ecotourism an in Periyar ecotourism is linked to the support of the local people. The major local tourism is to the many temples and religious festivals. Annual visitor numbers recorded in the nomination are: Shendurney 100,000, Periyar 10,000, Nilgiris 60,000, Eravikulam 150,000, and to Talacauvery 'large numbers'. In fact Periyar Reserve and Eravikulam Park are at present overvisited. Visitor facilities vary between sites but include accommodation in inspection bungalows and dormitories, interpretation centres and nature education and awareness camps. These vary with the amount of visitation.

SCIENTIFIC RESEARCH AND FACILITIES

The nomination does not specify research facilities or current studies but cites some 280 references in evidence of long, detailed and authoritative scientific work done on the many aspects of the mountains, including social-economic factors. However the management plans prescribe long-term and short-term research and monitoring programs and several research institutes, universities, civil organisations and state forest departments are engaged in research in the mountains, the full extent of whose exceptional biodiversity remains to be explored.

MANAGEMENT

The Western Ghats have the highest protected area coverage on the Indian mainland (15%) in its 20 national parks and 68 sanctuaries. Only 5% of the area is included in the property; 40% lies outside the protected area system, mostly in Reserved Forests. However, as these are legally protected and effectively managed they provide good protection from development. The 39 sites are protected under several regimes, in decreasing order of protection: 2 Tiger Reserves, 8 National Parks, 12 Wildlife Sanctuaries and 17 Reserved Forests. All are owned by the State and are subject to stringent legal protection under the following acts: The Wildlife Sanctuaries and National Parks were established under the provisions of the Wild Birds and Animals (Protection) Act of 1912, Indian Forest Act of 1927, the Indian Wildlife (Protection) Act, 1972; also the Kerala Forest Act, 1961, Kerala Private Forests (Vesting and Assignment) Act, 1971, Forest Conservation Act, 1980, Environmental Protection Act, 1986, the National Forest Policy 1988, the Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003 and the National Wildlife Action Plan for 2002-2016. Under these laws the sites are the responsibility of the Chief Wildlife Wardens and state Forestry Departments.

A Western Ghats Natural Heritage Management Committee has been created under the the Ministry of Environment & Forests to integrate the management across four states of the 39 sites in a three-tier management structure at national, state and site levels. This Committee is chaired by the Director-General of Forests and includes representatives from the national government, the state Chief Wildlife Wardens of Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra and Gujarat, and representatives from the Wildlife Institute of India (WII), the Ashoka Trust for Research in Ecology and the Environment (ATREE), the Nature Conservation Foundation (NCF), and the Western Ghats Ecology Expert Panel.

All the sites follow Management Plans or State forest department Working Plans for Reserved Forests. approved by state and central governments. However, the individual plans are complex and uncoordinated, requiring the three-tier plan to harmonise the different components, spell out overall management goals and set principles to maintain and enhance the values of the property. The plans include the intent to persuade local communities to practice sustainable land uses. There are about 40 different Adivasi and indigenous peoples in several of the states and all the sites have developed participatory governance schemes through Village Ecodevelopment Committees.

MANAGEMENT CONSTRAINTS

Several current pressures threaten the integrity of the property. Although the boundaries exclude a number of human settlements, the demand of an increasing population for timber and agricultural land is an increasing threat. A number of settlements, reservoirs, plantations and farms already exist within the borders bringing with them livestock grazing, fodder and fuel wood collection, illegal hunting and fishing, felling and mining and other resource-gathering. Fires are a hazard in grasslands. There is

trade-driven threat to threatened species and in a number of sites human-wildlife conflict is a major issue. There was strident opposition to the designation in Kodagu (Coorg) district around Talacauvery in Karnataka from politicians who favoured its being opened to development. The boundaries of eleven of the 39 sites have been adjusted to excise disturbed areas, principally settlements and parts of reservoirs. Mining is a major threat. The forests of Kudremukh National Park have a large abandoned iron-ore mine in their centre which could be reactivated, and mine rehabilitation is the responsibility of the Park for any land which has been returned. Many sites also contain reservoirs which may be enlarged in future to meet increased irrigation and hydro-electric demand; there are also new windmills in the mountains. Tourist-related activities, already high at temples, may increase with designation of the property.

Officially, infrastructure development is subject to environmental impact assessment, and several ecodevelopment projects largely financed by the Government, have curbed some of these pressures. However, the designated sites may not cover all the elements needed to protect their ecology successfully, and the proposed boundaries may not be large enough for the areas essential for the conservation of key species. Also the use of Reserved Forests as buffer zones may not offer enough protection since they do not surround all the component sites.

COMPARISON WITH SIMILAR SITES

The property's biodiversity and endemism exceed those of the region's other natural World Heritage sites which are all of a different character except for the far smaller Sinharaja Forest Reserve and Central Highlands of Sri Lanka which are in the same biodiversity hotspot. Only the Central Highlands site, which is less than a tenth the size of the property, has similar levels of endemism in amphibians, reptiles and freshwater fish. But it has far fewer species overall, and many endemic species do not occur in both sites (Bossuyt *et al.* 2004, Gunawardene *et al.* 2007, Helgen *et al.* 2005).

STAFF

Component site	Forest conservator	Range officer	Deputy ranger	Forester	Guard	Watcher
Kalakad-Mundanthurai Tiger Reserve	2	12	-	13	39	47
Shendurney Wildlife Sanctuary	1	1	-	4	8	4
Neyyar Wildlife Sanctuary	1	1	-	6	13	2
Peppara Wildlife Sanctuary	0	1	-	6	7	-
Kulathupuzha Range	0	1	1	6	18	-
Palode Range	0	1	1	6	18	-
Periyar Tiger Reserve	3	7	3	33	141	-
Ranni Forest Division	2	3	9	36	135	-
Konni Forest Division	1	3	7	23	85	-
Achankovil Forest Division	1	3	-	9	14	-
Eravikulam National Park + extension	1	1	1	3	12	-
Karian Shola National Park	-	1	-	1	2	-
Mankulam Range	1	1	-	1	9	-
Chinnar Wildlife Sanctuary	1	1	1	3	25	-
Mannavan Shola	1	1	1	4	13	-
Silent Valley National Park	1	1	1	6	13	15
New Amarambalam Reserved Forest	1	1	2	5	22	-
Mukurti National Park	1	1	-	1	4	-
Kalikavu Range	0	1	2	8	36	20
Attapadi Reserved Forest	1	1	1	3	13	1
Pushpagiri Wildlife Sanctuary	0	2	-	2	6	-
Brahmagiri Wildlife Sanctuary	1	2	2	6	14	8

Talacauvery Wildlife Sanctuary	0	2	-	7	7	-
Aralam Wildlife Sanctuary	1	-	1	4	5	-
Kudremukh National Park	1	4	-	24	43	23
Someshwara Wildlife Sanctuary	1	1	1	2	5	5
Sahyadri Group	4	6	-	15	50	-
TOTAL	**28**	**58**	**35**	**238**	**757**	**125**

The field staff are trained at the Indira Gandhi National Forest Academy (IGNFA), Dehradun in forestry and management techniques, supplemented for officers by periodic orientation courses by IGNFA and the Wildlife Institute of India. Lower level officers and staff, are trained at the forestry colleges in each state.

BUDGET

Funds are allocated for each component site of a group by national and state budget heads for management plan and non-plan projects and nationally sponsored schemes.

LOCAL ADDRESSES

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Wildlife Institute of India: http://www.wii.gov.in/

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