

## **Bridging the gap: Sharing responsibility for ecological restoration and wildlife conservation on private lands in the Western Ghats\***

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**A major conservation issue, particularly in the tropics, is habitat loss and fragmentation due to developmental activities and increasing human populations. Ecologists today recognise that much of the once-pristine forests that are now secondary forests, as well as large areas outside existing conservation reserves, harbouring significant levels of biological diversity need to be targeted for long-term conservation. Governmental agencies such as the Forest Department and the conservation community have come to accept that the conventional patrol and protect method has its limitations in addressing the increasing threats to such conservation areas. A complementary strategy is to develop conservation plans for protection and improvement by ecological restoration of forests, particularly isolated fragments and degraded areas on private lands. This requires bridging gaps between private landowners, governmental agencies, and non-governmental conservation organisations and fostering efforts based on mutual cooperation and collaboration as well as developing positive incentives for private landholders involved in conservation of forests and biological diversity. In this paper, we discuss one of the first examples of such an effort of sharing responsibility for long-term conservation in a highly disturbed tropical rainforest region of the Western Ghats.**

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## **Introduction**

In the appreciation of nature as in the enjoyment of art, humans place greater value on those objects that are rarer, finer, or on the verge of being lost forever. It is thus interesting that the words 'conservation' and 'restoration' are most frequently used in connection with the preservation of ancient archaeological monuments, works of art, or rare books on the one hand and on the other hand, in relation to protection of the world's wildernesses, natural ecosystems, and wild plant and animal species. In the modern world, a direct consequence of the increasing scale and magnitude of human activities has been the alteration and degradation of diverse natural ecosystems that human societies draw resources from and feed wastes into. The active repair and renewal of such ecosystems into conditions approaching the pristine pre-disturbance state is gaining ground as an important activity to supplement conventional conservation efforts such as the setting-aside of National Parks and Wildlife Sanctuaries (Hobbs and Norton 1996, Young 2000). This assumes particular importance in areas of high biological diversity such as tropical rainforests, which are the greatest living repositories of biological diversity on Earth (Richards 1996, Wilson 1992).

The rapid loss of tropical forest has been a matter of global concern. Between 1981 and 1990, about 150 million hectares of tropical forest (9% of the world's tropical forest area) were lost to various forces of deforestation, most (85%) of this being tropical moist forest (Whitmore 1997). In addition, land uses such as logging, conversion to agriculture and pastureland, and various other forms of exploitation and disturbance have created over 150 million hectares of secondary forest vegetation (31% of total forest land) in tropical closed forest formations (Brown and Lugo 1990). Ecologists of the present century will thus have to contend with the fact that previously pristine landscapes contain mostly remnant fragments and secondary forests (Brown and Lugo 1990, Myers 1991, Whitmore 1997). This undoubtedly contributes significantly to the present global extinction crisis (Wilson 1992).

As large forest tracts are degraded, converted to secondary forests or reduced to fragments or 'islands' in a 'sea' of altered and developed areas, the survival of rainforest biodiversity and wildlife species will hinge upon their ability to persist in human-modified landscapes and on human efforts to conserve and manage them. This requires approaches that supplement habitat protection by conserving wildlife habitats adjoining protected areas, increasing landscape-level connectivity of patches, and restoring degraded areas (Laurance and Bierregaard 1997). Ecological restoration of degraded habitats is now regarded as an effective response to reduce and reverse the negative effects of forest loss, degradation, and fragmentation on native plant and animal species (Lamb *et al.* 1997). The restoration of degraded habitats that may be within government protected areas or private lands belonging to individuals, local communities, or corporate companies, is a challenging task. In this paper, we present the conservation background and need for restoration in the Western Ghats region of India, and describe in outline a case study where such a programme has been initiated.

## **Conservation issues in the Western Ghats**

The Western Ghats mountain chain along the country's west coast is an ecologically important region within India. It is recognised as one of the eight 'hottest hot spots' of biological diversity in the world (Myers *et al.* 2000) and among the Global 200 most important ecoregions (Olson and Dinerstein 1998). Among the global biodiversity hotspots, the Western Ghats and Sri Lanka rank third in terms of the number of endemic vertebrates/area ratio (species/100 km<sup>2</sup>, Myers *et al.* 2000).

The Western Ghats faces severe threats from human disturbance due to deforestation, developmental activities, conversion to plantations, and habitat fragmentation (Nair 1991).

Menon and Bawa (1997) estimated that, between 1920 and 1990, forest cover in the Western Ghats declined by 40%, resulting in a four-fold increase in the number of fragments, and an 83% reduction in size of forest patches. This is not surprising given that this region is one of the hotspots with the highest human population density (Cincotta *et al.* 2000). Forest fragmentation, following habitat loss, may cause further degradation of remnants through edge effects, increased accessibility for exploitation and hunting, and loss of species due to inadequate habitat availability or island biogeographic effects (Laurance and Bierregaard 1997, Umapathy and Kumar 2000). In areas where wildlife populations and human communities occur side by side, hunting and livestock grazing threaten species and habitats, while serious conflicts such as crop-raiding and manslaughter emerge (Madhusudan and Mishra 2003). In addition, evergreen forests also face degradation to more open, deciduous, or secondary vegetation due to chronic human extraction of fuelwood and other forest products (Daniels *et al.* 1995).

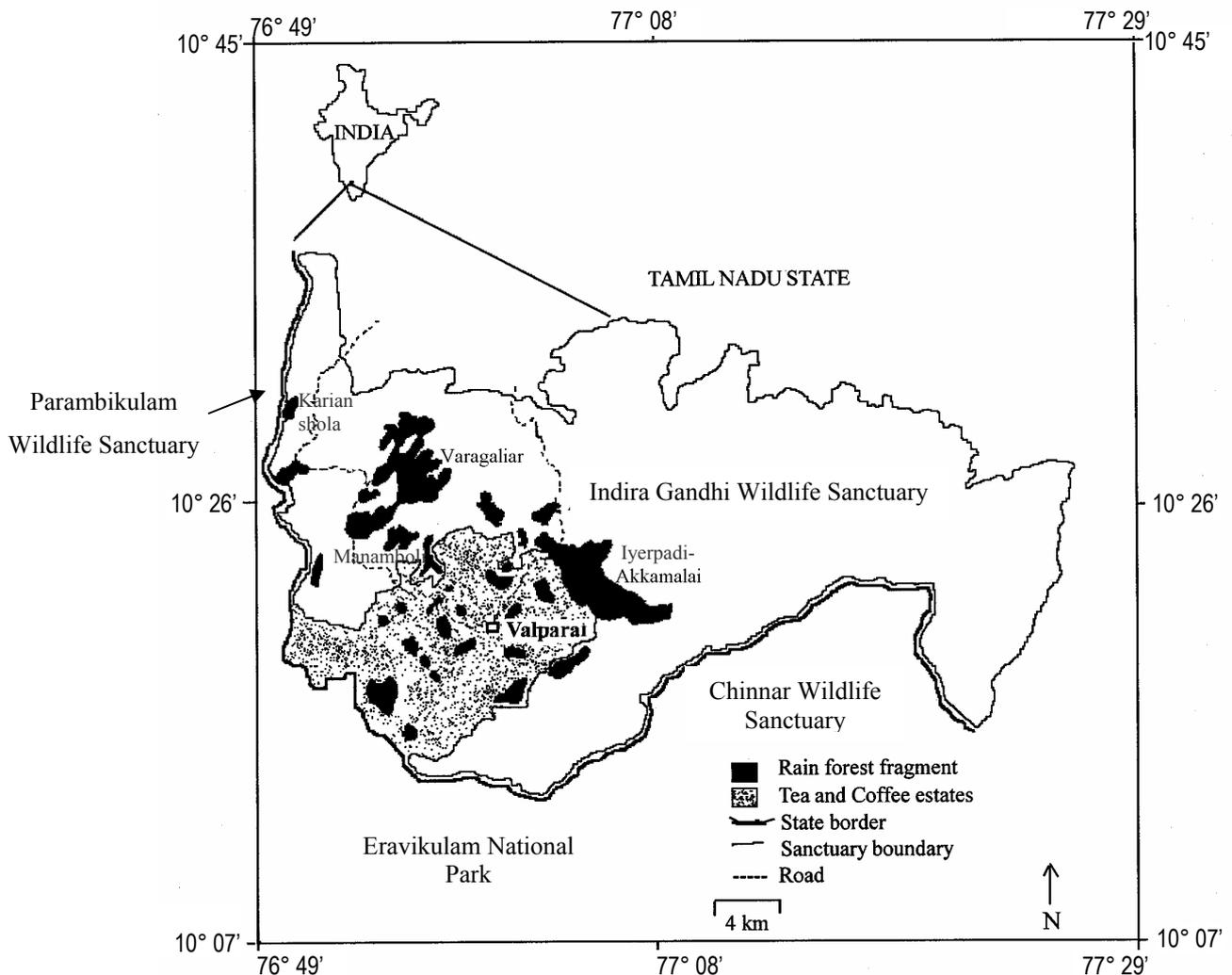
Considerable areas of forest have been converted to plantations in the Western Ghats, particularly of tea, coffee, and *Eucalyptus*. The area under plantations is large and growing. Tea plantations in the south Indian states increased by 17.7% in the period 1987-1998 from 74,765 ha to 87,993 ha (Tea Board 2002). Large areas of *Eucalyptus* plantations also occur with tea as it is used as fuelwood for tea-curing in the factories. Similarly, during 1999-2000, the US\$ 447 million Indian coffee industry had plantations of about 340,306 ha, almost entirely in the Western Ghats region of southern India, having increased in area coverage by 25.7% from 270,821 ha in 1990-1991 (Coffee Board 2002). These coffee plantations, particularly where grown traditionally under the shade of native forest trees, form a substantial area of forest canopy cover in the Western Ghats.

### **The Valparai plateau (Anamalai hills)**

Within the Western Ghats, the region that typifies many of these conservation issues is the Valparai plateau in the Anamalai hills. The Anamalai (which in Tamil, the local language, means the elephant hills) ranges are a major conservation area in the southern Western Ghats. Although a significant portion of the relatively undisturbed tropical rainforests in this region lies within the Indira Gandhi Wildlife Sanctuary (IGWLS, 958 km<sup>2</sup>, 10° 12' N to 10° 35' N and 76° 49' E to 77° 24' E), about 1,000 ha of the rainforest occurs as highly degraded fragments distributed over private lands on the Valparai plateau (**Figure 1**). The Valparai plateau contains a large area of tea, coffee, and cardamom estates occupying around 220 km<sup>2</sup> and lying surrounded by four protected areas (IGWLS, Chinnar WLS, Eravikulam NP, and Parambikulam WLS) and the Vazhachal reserve forests. This plateau has a small town (Valparai) and around 100,000 people, scattered across the town and estates.

Many wildlife species move through this fragmented landscape between fragments and protected areas, including large mammals such as the Asian elephant (*Elephas maximus*), tiger (*Panthera tigris*), leopard (*P. pardus*), and wild dog (*Cuon alpinus*), and birds such as the Great Hornbill (*Buceros bicornis*) and Malabar Grey Hornbill (*Ocyeros griseus*). These fragments are also home to a wide diversity of rare and endemic herpetofauna and mammals (Vasudevan 2000, Ishwar 2001, Kumar *et al.* 1995, Umapathy and Kumar 2000). The conservation of rainforest fragments is also important as corridors for wide-ranging taxa (Kumar 2000). Studies have also pointed out the need for active efforts at restoration of degraded rainforests for conservation (Umapathy and Kumar 2000, Mudappa 2001, Raman 2001, Raman and Sukumar 2002). However, there has been little research or active efforts at restoration of degraded tropical rainforest habitats in this region, particularly in private lands lying outside the protected area network.

**Figure 1:** Map of the Indira Gandhi Wildlife Sanctuary indicating plantations and rainforest areas around Valparai and surrounding Protected Areas.



### Landscape and social transformation on the Valparai plateau

In the mid 1800s, the mid-elevation Valparai plateau region was covered by rainforests. Writing about the landscape at the time, early British explorers noted “miles and miles of evergreen forests” (Congreve 1942). The colonial British East India Company assessed these regions for their economic value, as a source of forest products including timber. As the rainforests, particularly in the higher reaches, were not particularly attractive for their timber, they were considered wastelands that had to be earmarked for developmental activities. Valuing these forests from mainly an economic perspective Lieut. R. H. Beddome, the Assistant Conservator of Forests wrote in 1860 that these were “...very fine plateaux of superb shola forest, admirably adapted for the cultivation of coffee” (Congreve 1942). In 1896, the then Agricultural Secretary noted that an area of about 120 square miles (310.8 km<sup>2</sup>) of evergreen forests within the Anamalai Reserve Forests could be designated for leasing out for conversion to various kinds of plantations that would generate revenue for the ruling British. However, drier forests on the western and eastern slopes were valued as a

source of valuable timber and a watershed area deemed important for the development of agriculture in the plains, and hence these continued to retain protected or reserved status.

This leasing of the land led to the establishment of various commercial crops that included cardamom, coffee, tea, cinchona, rubber, and vanilla. By 1900, already 10.29 km<sup>2</sup> had been converted to plantation, a large extent (78.6%) being initially under cardamom or coffee, which could be grown under the canopy of native tree species (Table 1). Soon, it was seen that this region was suitable for tea and a rapid conversion into tea was carried out. As the area under plantations kept increasing, the proportion under tea plantations also increased from 21.4% in 1900 to 51.9% (2,797 ha) in 1916 and 79% (10,609.9 ha) in 1940. This process continued to a point where tea dominated the cultivated landscape: by the 1970s, almost 95% of the change had occurred and tea plantations occupied over three-fourths of the cultivated landscape area at the turn of the century (Table 1). However, conversion of coffee and cardamom plantations into tea plantations with the felling of shade trees continues during the present day. In a little over a hundred years, the district also went from being peopled mainly by a few scattered hill tribes (Muduvars, Kadars, Pulliars, and Malasars) in the 1890s to a dense and growing population of over 106,000 people in 1991 with roads, offices, hospitals, factories, townships, and hundreds of human settlements scattered over the landscape.

**Table 1:** Changing pattern of agricultural land-use on the Valparai plateau 1900-2000.

Year	Tea	Coffee	Cardamom	Others	Total	Sources
1900	220.6 (21.4%)	467.4 (45.4%)	341.2 (33.1%)	-	1,029.1	Congreve 1942
1916	2,797.2 (51.9%)	913.0 (16.9%)	932.8 (17.3%)	746.2 (13.8)	5,389.2	- do -
1940	10,609.9 (79.0%)	936.3 (7.0%)	1497.4 (11.1%)	389.1 (2.9%)	13,432.7	- do -
2000	11,240.0 (76.3%)	2,501.6 (17.0%)	833.7 (5.7%)	154.8 (1.1%)	14730.1	Tea Board (2002), Coffee Board (2002), Valparai Taluk Office

Figures are areas in hectares under each plantation type and percentage (in parentheses) of the total plantation area under that crop. Note also that this excludes areas under *Eucalyptus* plantations as well as other built-up areas established on erstwhile forest land.

Thus, over less than a century, most of the native tropical evergreen forests had been cleared and what were finally left were small patches of highly degraded remnants along water sources or hill ridges, which were unsuitable for the establishment of tea and most other commercial crops. Although a very large extent of the tropical evergreen forests were lost, a majority of plant and animal species managed to survive in these remnants, probably due to supplementation from surrounding relatively undisturbed forests.

### The modern conservation scenario

During the British period, reservation of forests only partly aided in their protection, as forests on the Valparai plateau were converted to plantations to generate more revenue. A major fillip for conservation in the Anamalai hills was provided only well after independence upon the enactment and implementation of the Wildlife (Protection) Act of 1972. In 1976, the Indira Gandhi Wildlife Sanctuary (958 km<sup>2</sup>) came into being and three portions of it covering 108 km<sup>2</sup> was further declared as National Parks in 1989 (Krishnakumar 1996). The necessity for the protection of the immense and characteristic biological diversity of this region, besides the significant populations of endangered species such as lion-tailed macaque, Nilgiri tahr (*Hemitragus hylocrius*), Great Hornbill, and Asian elephant, was instrumental in

bringing this area within the country's network of protected areas (Rodgers and Panwar 1988). The protection arguably benefited recovery of habitats and wildlife populations and protected forests from large-scale conversion of the sort witnessed in the past. The plantation forests and rainforest fragments of the Valparai plateau, being outside the notified sanctuary but bounded by it on different sides, did not however receive the same level of protection.

Over the last few years, the conservation community has come to realise that conventional steps of managing are not efficient, effective, or sufficient to address the conservation needs of the day. Increase in human population within the plateau and within tribal settlements, the opening up and gradual increase of recreational tourism, felling of trees for timber, fuelwood, and shade-regulation in plantations, all continue to cause further degradation of forests. A primary problem is that the conventional patrol and protect method can only partly mitigate the effects of disturbance. This *laissez faire* or 'wait and watch' approach for degraded habitats or populations to recover may have minimised the rate of degradation, but has not helped restore populations that have become locally extinct (e.g., plants, primates), on the isolated rainforest fragments in the private and unprotected lands on the Valparai Plateau. In such cases, interventions such as active efforts at habitat restoration or eradication of exotic weeds are called for (Umapathy and Kumar 2000).

Secondly, it is difficult for the Tamil Nadu Forest Department, with its limited manpower and funds for administration and protection, to manage forests and wildlife in this 220 km<sup>2</sup> area of plantations on the Valparai Plateau, largely owned by private companies or individuals with a labour force of almost a 100,000 people. A majority of the resident people are dependent on existing rainforest remnants, in addition to the forests in the adjoining vast Indira Gandhi Wildlife Sanctuary, for fuelwood and fodder for cattle. There is also a large dependence by the tribal communities and the surrounding markets on non-timber forest produce from these forests.

A major lacuna in effecting conservation in this region has thus been the lack of a positive linkage between private landowners with forests of conservation value on their properties, the State Forest Department, and the conservation community. Mostly, plantation companies and the Forest Department come into direct contact only when the former applies to the latter for permission to fell trees as regulated under the Tamil Nadu Preservation of Private Forests Act of 1949 and the Tamil Nadu Hill Areas (Preservation of Trees) Act of 1955.

More recently, a positive step towards conservation of the ecology of this diverse, fragile and sensitive ecosystem has been the realisation and acceptance of the responsibility of conservation by the entire community resident or employed here, particularly the landowning private companies and individuals. With increasing awareness, it is dawning upon the various stakeholders that the onus of protection and conservation of wildlife in this region is not the responsibility of the Forest Department, non-governmental organisations, or the conservation community alone, but that joint efforts represent the way forward.

A milestone for a long-term effort and solution for the conservation problems in this region is the collaborative efforts in rainforest restoration initiated by Nature Conservation Foundation (a non-governmental wildlife research and conservation organisation based in Mysore) and local private companies. A significant component of this project, supported by the Tamil Nadu Forest Department, is biological research on plants and other taxa within the Indira Gandhi Wildlife Sanctuary and Kalakad-Mundanthurai Tiger Reserve which contain relatively undisturbed rainforests. The following account briefly outlines this project which represents a significant step towards restoring the biological diverse rainforest ecosystem in highly degraded forest fragments on the Valparai plateau.

## Rainforest Restoration on the Valparai Plateau

The rainforest restoration programme stemmed from a number of prior research studies in this region (Kumar *et al.* 2001, Mudappa 2001, Raman 2001). In brief, our research observations in these rainforest remnants between 1996 and 2000 revealed the biological importance of these rainforest fragments, because although they varied in size and in degree of disturbance, they served as valuable refuges for a whole gamut of endemic and endangered species in an otherwise depauperate plantation landscape. However, we also observed that there were increasing threats to the existing rainforest fragments and a continual degradation of the habitat – a situation that could probably lead to further local extinctions and population declines. These studies thus pointed to an urgent need to (1) demarcate and protect these existing fragments, which, as they were, were not even considered forests or biological value, (2) identify uncultivated or barren areas, that could be restored and developed into corridors, and (3) improve the degraded rainforest fragments by carrying out large scale restoration planting of native plant species.

At the same time, many companies with large land-holdings on the Valparai plateau are interested in putting in place environmentally and ecologically sustainable programmes. For example, as part of its global sustainable agriculture initiative (Unilever 2002), the Hindustan Lever Limited was keen on establishing the rainforest remnants on their property as “biodiversity plots”, which would be designated for preservation of wildlife in the long term. Thus, to match the needs of both the conservation community as well as a business company we, as an independent agency, undertook the following initiatives as part of the rainforest restoration programme.

1) *Plot identification and inventory*: We identified, demarcated, and protected three rainforest fragments, called Biodiversity Plots, occupying a total area of about 35 ha, within Injipara, Stanmore, and Sirikundra Estate. As a first step, Injipara was chosen as an intensive restoration site. In this site, an inventory of trees, birds, and mammals has revealed the presence of at least 55 native tree species, 69 species of birds, and at least a dozen species of mammals thus far.

2) *Setting benchmarks*: We then began to establish a benchmark against which the habitat improvement and restoration of these fragments could be monitored. This was based on comparisons with relatively undisturbed rainforests within the Indira Gandhi Wildlife Sanctuary. For instance, we found that the site had a density of 315 trees/ha, which was 55% lower than in primary rainforest and number of tree species was 38.7% lower than in a comparable sample in relatively undisturbed primary rainforest.

3) *Rainforest species nursery*: One of the hallmarks of the project was the establishment of a large, multi-species rainforest plant nursery (currently containing about 10,000 saplings of 70 native species). A large proportion of these were raised from seeds, using simple germination techniques, with some saplings rescued from along roads and edges supplementing the plant collection.

4) *Restoration planting*: We then carried out restoration planting on experimental scales: one large area planted with 1091 saplings along rows of weed-cleared lines, and two 0.25 ha plots with a total of 748 saplings, one which was cleared of all weeds such as *Lantana camara*, *Mikania micrantha*, and *Chromelina odorata*, and the other which was a completely open, grassy area.

5) *Monitoring*: Monitoring the success of planting and establishing a protocol to monitor the recovery of various taxa is one of the key aspects of the ongoing programme. Survival of planted saplings are monitored every six months for at least two years (plant survival after six months ranges from 76% to 97%), whereas birds are censused during the dry, summer breeding season months every year. Work on other taxa is to be initiated.

6) *Extension*: Based on the knowledge gathered during the last three years, we aim to extend the programme over a larger area with the support and involvement of other private companies. The collaboration meets the needs of both sides, as we, the conservation community, have a chance to intervene and probably reverse the process of degradation, while supporting such a programme improves the image of a private company. As part of the programme, in addition to students, visitors (lay persons, conservationists, managers) are frequently brought to the nursery and restoration sites to educate, train, and inform them about the possibilities for rainforest restoration.

### **Outlook and Future Perspective**

The way forward for restoration would depend on the acceptance of the changing perspective on conservation: one that supplements protection of inviolate natural areas with active efforts to rebuild degraded ecosystems. This requires the acceptance and sharing of responsibility and costs among local landholders, the State, and the conservation community. Local involvement and corporate support can reduce the burden on government departments, while conservation scientists can assist in design and monitoring of such programmes. Only through bridging the existing gaps in understanding, interaction, and communication between the different agencies and individuals involved can such programmes take root and develop.

In the long-term, two additional aspects need to be attended to in such a programme. One is the *provision of alternatives* to the people dependent on forest resources, to minimise the consequent degradation of forests. The second is to *institute rewards for participation* in restoration efforts. Developing business incentives (for instance, through tax and revenue sops) for conservation may indicate the way forward for nurturing such programmes within an agricultural-economic milieu. This does not mean that economic value has to be set for every part of nature or natural resources, but only that one has to pay for the maintenance of ecological values just as one does, for instance, for the maintenance of one's own motor vehicle. Finally, if there are individuals or companies coming forward with funds, support, and expertise, there should be means to have a *sustained turnover* that will enable long-term implementation of ecological restoration programmes, whose success can only be anticipated over years or decades.

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