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Dedicated to the memory of
Our friend, colleague and companion,

Dr Ravi Sankaran

(4th October, 1963 – 17th January, 2009)

‘As a conservation biologist, as a *practitioner* of conservation, you would actually have to build upon science, management, policy, advocacy, *implementation*—very important—and of course education for the larger grouping of people... it is not a narrow field, you actually have to be multi-multi-disciplinary for working with conservation.’

Dr Ravi Sankaran,
Address to an ornithologists’ conference in Haridwar,
December 2008.
(Emphasis in original)

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RESTORING NATURE

Wildlife Conservation in Landscapes Fragmented by Plantation Crops in India

*Divya Mudappa, M. Ananda Kumar
and T. R. Shankar Raman*

Introduction: Conservation and the Countryside

Agricultural expansion has historically been a major global cause for the loss and fragmentation of natural ecosystems, and remains one of the largest threats to the world's remaining tropical forests today.¹ In tropical regions, conservation concerns have arisen over the implications of the anticipated increase in the area under agriculture by as much as twenty-five per cent.² Concomitant with biodiversity loss due to extinctions,³ the loss of tropical forests may lead to decrease in ecosystem services of great value to humanity such as carbon storage in biomass and soils, watershed regulation and rainfall, modulation of climate and river flows, and amelioration of infectious disease and human-wildlife conflicts.⁴ The primary conservation response to such trends has been the creation of Protected Areas such as National Parks, sanctuaries and nature reserves with restrictions on resource use to protect threatened species and ecosystems. Over 1,00,000 Protected Areas covering roughly 18.8 million square km (or twelve per cent of the earth's terrestrial surface area) have been set aside worldwide to preserve natural areas under various management regimes.⁵

Still, most Protected Areas are relatively small (over fifty-eight per cent are less than 10 square km), continue to face internal and external threats and remain susceptible to influences from surrounding landscapes.⁶ These include habitat loss, conversion to other land uses, fragmentation and degradation, spread of invasive species, hunting, timber logging, disruption of animal corridors, unregulated harvest of forest products, fires, tourism and various developmental activities. Even when deforestation within Protected Areas is curtailed, surrounding areas continue to face forest loss and conversion, further isolating these parks and highlighting the need for a broader conservation approach that considers surrounding landscapes, poverty and livelihoods, and unsustainable land-uses.⁷ There is now global interest in these surrounding landscapes, including those with resident or itinerant people and agriculture. They have the potential to complement wildlife conservation in Protected Areas by preserving the habitats adjoining them, increasing landscape level connectivity of patches and restoring degraded areas.⁸

Considerable biological diversity also exists outside the boundaries of designated conservation areas in human-modified habitats and secondary forests. The assessment of conservation values and forms or practices of land use that sustain higher levels of native biodiversity in the landscape of productive agriculture and protected or restored natural areas has been termed 'countryside biogeography' and has stimulated much recent research.⁹ In tropical forest regions, numerous studies have focused on tropical agroforestry crops and commodity plantations such as coffee, cocoa, tea, rubber, oil palm, cardamom and vanilla, which occupy large areas in regions of high conservation significance. Frequently, plantations adjoin protected conservation reserves or contain embedded remnants of forests or other natural ecosystems known to be significant for conservation of biological diversity.¹⁰ These studies seek to understand the conservation values of various plantations relative to unaltered forests in Protected Areas, identify better production or cultivation practices, potential costs and conflicts, as well as economic and ecosystem service benefits accruing to plantations from conservation. In this essay, we examine the context

of conservation in landscapes with plantations and Protected Areas, taking the specific case of a region of great global and regional conservation significance: the Western Ghats range of mountains in India, a global biodiversity hotspot¹¹ and World Heritage Site, containing some of the world's most irreplaceable Protected Areas for species at risk of extinction.¹² We highlight research findings and ongoing interventions relevant to extending conservation beyond borders into plantation landscapes.

Plantations and Conservation in the Tropics

In the context of forests and conservation, the word 'plantation' often appears in the term 'plantation forests' established for timber and fuel wood, and 'plantation crops' such as tea, coffee, cocoa, rubber and oil palm. Plantation forests established through various forestry practices, often as monocultures of a small number of alien and native species, occupy some 140 million ha (c. 3.5 per cent of the world forest area) and are increasing annually by about 2–3 million ha (two per cent), even as world forest cover is in decline.¹³ Keeping plantation forests outside the scope of this essay, we examine here some tropical commodity crops in terms of their conservation values relative to unaltered forests in Protected Areas, potential benefits and conflicts of such cultivation, and better production or cultivation practices.

Tropical plantation crops are globally significant for conservation because of the area they occupy, location in significant biodiversity hotspots, and land-use practices. For instance, globally, around 11 million ha is under coffee cultivation, almost entirely in tropical forest regions.¹⁴ With an annual value of over \$100 billion, coffee is the second highest traded commodity in international trade after oil, making assessment of its impacts on biodiversity imperative.¹⁵ Traditional coffee growing areas also coincide closely with many of the global biodiversity hotspots.¹⁶ Tea cultivation spans 2.3 million ha around the world, and conservation concerns include conventional cultivation as intensive monocultures, soil erosion and agrochemical inputs.¹⁷ Similarly, cocoa is grown in over 7.5 million ha worldwide (principally in Africa and Brazil and

Mesoamerica), while cardamom is primarily cultivated in tropical forest areas, with the leading producing countries being Guatemala and India. A major conservation concern in recent years is the expansion and impact of oil palm (*Elaeis guineensis* and *E. oleifera*) in tropical forests, especially in South East Asia, with concomitant deforestation, loss of biodiversity, climate change impacts, and other social and environmental concerns.¹⁸ Palm oil is a key commodity in intra-Asian trade and India is a major consumer of South East Asian edible oils.

Scenario in the Western Ghats

Around fifteen per cent of the land area of the Western Ghats currently receives some protection within sixty-eight wildlife sanctuaries and twenty national parks.¹⁹ This region, occupying some 1,80,000 square km, holds about thirty per cent of India's plant and vertebrate species diversity in less than six per cent of its area.²⁰

The Western Ghats faces continued forest loss, degradation and fragmentation, and only around a third of the area contains some form of natural vegetation. Menon and Bawa estimated that between 1920 and 1990, forest cover in the Western Ghats declined by forty per cent due to agriculture, plantations, hydroelectric projects and other activities, resulting in a fourfold increase in the number of fragments and an eighty-three per cent reduction in size of forest patches.²¹ Similarly, Jha, Dutt and Bawa estimated that in a 40,000 square km area of the southern Western Ghats, 25.6 per cent of the forest cover was lost between 1973 and 1995, giving an annual deforestation rate of 1.16 per cent.²² Large scale conversion to tea, coffee and other plantations had already occurred in many areas prior to 1920.²³ The substantial (and increasing) area under commercial plantations, adjoining key tropical forest conservation areas in the Western Ghats, is a matter of conservation concern (see Appendix).

Over the last two decades, much research has revealed the impact of plantations on biodiversity, and conversely, the conservation value of such plantations in the Western Ghats.²⁴ Some of the key

findings are summarised below, with an emphasis on research on bird communities. The insights from these scholars make us critically re-examine a common view that plantations are ecological deserts or dead zones. Their distinct human-crafted ecosystems deserve a closer look as do cultivated spaces or pastures.²⁵

The most striking effect of plantations is to cause habitat fragmentation, thereby leading to isolated populations and some local extinctions of species, especially if the remnants are not large enough to sustain individuals or groups of species such as primates.²⁶ Habitat degradation to more open, deciduous or secondary vegetation occurs due to human extraction of firewood and other forest products or the gradual replacement of mature forest species by pioneer, widespread and common species,²⁷ or spread of invasive alien species.²⁸ At the community level, even if the number of species (species richness) or overall abundance of taxa such as birds does not vary much between forests and plantations, there is invariably substantial alteration of species composition (identity of species that occur and their abundance) in these modified habitats. For instance, Bhagwat, et al. report that while plantations may hold between sixty-four per cent and 139 per cent of the number of species seen in forest reference sites, the compositional similarity with forest was lower at between twenty-five to sixty per cent.²⁹ As in other tropical regions,³⁰ when mature tropical rainforest is converted into plantations such as tea and coffee, species that are more common or widespread across a larger region gain ground, while range restricted or endemic species decline or disappear as they are less tolerant to alteration of the dense, closed canopy environment.³¹ The extent of alteration in animal community composition is in turn related to the magnitude of change in the natural vegetation (e.g., forest) when plantations are established, as intensification of land use is accompanied by structural simplification of habitat.³² In the Anamalai hills, Western Ghats, the proportion of rainforest bird species in the community increased from less than forty-three per cent in the open monoculture tea plantations³³ to fifty-nine per cent in shade coffee plantations with moderate tree cover to ninety per cent in rustic cardamom planted under denser shade of native rainforest trees.³⁴ In the Western Ghats of Karnataka, ninety per cent

of bird species associated with regional forests also occurred in areca nut plantations.³⁵ Cardamom, coffee and areca nut plantations thus seem to hold more species, partly due to the extensive use of shade trees including native tree species, than is the case in more severely modified land use of tea plantations. However, such comparisons based on species presence still need to be complemented by analysing differences in abundance and breeding.³⁶ There has been little study of the effects of plantations such as rubber and oil palm on biological diversity in the Western Ghats, although a study from Thailand showed that rubber and oil palm plantations can have significant detrimental effects on biological diversity, especially species restricted to mature lowland forests.³⁷ Oil palm, because of the serious deforestation related concerns over this crop in South East Asia, has been the focus of many studies that have established its serious impacts on biological diversity, climate and implications for social justice.³⁸

Plantations, usually under private ownership or lease, in the Western Ghats contain a large number of natural habitat remnants including rainforest fragments, shola grasslands and streams, which have considerable conservation value as refuges of biodiversity, including many charismatic and globally endangered and endemic species.³⁹ The fragments are important also as corridors for wide ranging species that move between surrounding wildlife sanctuaries across the fragmented landscape.⁴⁰ The more plantations are structurally and floristically similar to forests, the more similar they are in their animal community composition with forest.⁴¹ Several studies have shown that plantations such as coffee and cardamom, which use native shade tree species, help support many forest species and act as a buffer habitat in the wider landscape context of cultivated areas, habitat remnants and Protected Areas.⁴²

Besides differences in habitat structure or floristics, landscape context also matters: forest patches and plantations influence each other. For instance, while bird species richness and abundance in coffee plantations in Karnataka increases with increase in basal area of native tree species, it declines with increasing distance of the plantation from contiguous forest.⁴³ Plantations such as coffee that adjoin or are closer to forest patches may have enhanced

conservation value for taxa such as birds,⁴⁴ even as the buffering role of shade coffee plantations around fragments may enable enhanced persistence of forest bird populations.⁴⁵ Still, many species are restricted to forests and will survive only if existing remnant forests such as Reserved Forests, Protected Areas, rainforest fragments and sacred groves are also protected in the landscape.⁴⁶ Thus, besides native shade trees, food resources, habitat and canopy connectivity in plantations, retention of forests in the wider landscape is essential to support large populations of sensitive species and increase the conservation potential of remnant habitats at the landscape level.⁴⁷ Presence of natural habitat fragments within plantations, control of wildlife poaching, maintenance of native shade tree cover, ability of species to use the plantation matrix itself as habitat or for movement—all of this contributes to the conservation values of plantation landscapes and persistence of many wildlife species in plantations.

Plantations and Human-Wildlife Conflict

Plantation landscapes in the Western Ghats often adjoin or occur as enclaves within wildlife Protected Areas. This interface brings wide ranging animals such as Asian elephants (*Elephas maximus*) and leopards (*Panthera pardus*) into greater contact with people and production landscapes. The presence of such species is pervasive, often with little or no conflict. Conflicts occur when there is damage or threat to the economy, livelihood and safety of people, or incidents leading to injury or death of wildlife. Understanding the nature of conflict and the species involved is necessary to identify preventive and mitigating actions and promote coexistence of people and wildlife.

In tea and coffee plantation landscapes, conflicts between people and elephants occur in the form of crop and property damage, injury and loss of lives.⁴⁸ However, there remains scope for coexistence between elephants and production as shown by studies of elephant movement, habitat use and conflict with people in these landscapes. In the Anamalai hills, Kumar, et al. tracked movements of elephant herds through a landscape dominated by tea plantations,

with coffee, eucalyptus and interspersed natural vegetation in the form of rainforest fragments and riparian vegetation.⁴⁹ Although these natural vegetation remnants occupied a small fraction (less than five per cent) of the 220 square km landscape, elephants strongly preferred riparian vegetation and rainforest fragments (thirty-three per cent of observed elephant locations). Elephants avoided (in relation to area available) large tea monocultures and human settlements, particularly during the day, and used tea plantations more by night to move between natural refuges of riparian and remnant forests. Elephants use plantations as habitat not due to preference or attraction, but because plantations provide some resources.

In the coffee dominated landscape of Kodagu, Karnataka, area under coffee cultivation doubled over thirty years.⁵⁰ Elephants may enter coffee estates due to presence of palatable food such as rice paddies and fruit trees, and perennial water sources including artificial water bodies.⁵¹ Bal, et al. argue that conflict mitigation must be based on stakeholders' awareness of the true nature of the problem and a combination of adaptive management strategies.⁵² In addition, they call for better transparency in decision-making and solutions that increase public tolerance of elephants, possibly through provision of direct benefits, in such plantations. Still, smallholders in this landscape, who face higher costs and disincentives from conflict, hold positive attitudes towards conservation and express willingness to engage with participatory efforts and more decentralised government institutions.⁵³

For leopards, different approaches may be required. The leopard is a wide ranging solitary and territorial carnivore, highly adaptable to changes in habitat and is known to live in close vicinity of human habitations, which sometimes leads to conflicts.⁵⁴ Leopards may also be attracted to human use areas, because of stray dogs, goats and cattle, and improper waste disposal, leading to incidence of injuries or fatal attacks on humans as well. Capture and translocation of so called 'problem leopards' is used as a management tool, often due to public pressure and media attention following leopard attacks on people. Recent research suggests however that such capture and translocation may actually increase conflicts at release sites (shifting

conflict with the individual) or intervening areas (due to strong homing instinct of carnivores), and possibly increase density of leopards at the capture site due to vacant territories being filled by new individuals.⁵⁵ Leopard populations can persist in agricultural landscapes with little or no conflict if such improper management measures are avoided. Instead, efforts to proactively prevent conflict are required, such as better livestock herding and corrals, and basic precautionary measures in areas where people and leopards share spaces.⁵⁶

In the plantation dominated Valparai plateau landscape surrounded by Protected Areas, large carnivores (mainly leopards) predominantly preyed upon available wild prey.⁵⁷ Over a three year period (2008–2010), thirty-two head of livestock (of a population of around 2,000 cows, buffalos and goats) were reported by respondents as lost to carnivore depredation. Over the same period, there were eight attacks on people, resulting in three fatalities (all children). To those households that kept livestock (less than five per cent of total households), livestock depredation was perceived to cause an estimated loss of thirteen per cent of the annual household income. People's attitudes toward leopards were not affected by monetary losses; however, in colonies where people were injured or killed by leopards, people held a negative attitude towards the species.

Clearly, if conservation is to extend into plantation landscapes the issue of conflict incidence needs to be squarely addressed. Measures need to be implemented based on scientific understanding of the landscape and social context, the patterns and magnitude of conflict, and the ecological and behavioural traits of the species concerned. A number of initiatives are currently being implemented in plantation landscapes, which appear to hold potential to positively involve plantations, local communities and government departments in conservation.⁵⁸

Involving Plantations in Conservation

In the absence of adequate recognition, protection or habitat restoration, areas of conservation value in and around plantations

continue to face threats, degradation and several other problems common to fragmented tropical landscapes.⁵⁹ Despite their considerable extent (more than 10,000 square km), plantation landscapes in the Western Ghats have seldom been directly incorporated in conservation policy and management. In this section, we describe efforts to involve plantations in conservation through the following interventions in plantation lands: 1) habitat restoration and native shade tree use, 2) fostering sustainable land use practices linked to certification, and 3) proactively minimising conflicts.

As the retention of existing forest remnants within plantations and enhancing habitat quality through ecological restoration and native shade tree use can have positive effects on biodiversity, these are essential components of wildlife conservation in private lands. Such a programme to restore degraded rainforest fragments within private plantations has been underway in the Anamalai hills, Western Ghats, in partnership with tea and coffee companies since 2001.⁶⁰ Until 2012, this effort has focused on ten rainforest fragments (sized between one and 100 ha), three sites contiguous with the Anamalai Tiger Reserve and one perennial stream in tea plantation, all identified and protected with support of plantation companies (Parry Agro Industries Ltd, Tata Coffee Ltd, Tea Estates India Ltd) and the Tamil Nadu Forest Department. While the total area of the sites is around 300 ha, restoration plantings targeted forty-five plots (with a total area of 50 ha) in the most degraded portions, especially fragment edges. Around 26,500 saplings of over 160 native rainforest tree and some liana species have been planted in these sites. Early monitoring showed that at the end of a two year period, sapling survival averaged around sixty-one per cent across forty-four species studied.⁶¹ In early sites, many saplings of some particularly fast growing species (such as *Vernonia arborea*, *Bischofia javanica*, *Elaeocarpus tuberculatus* and *E. munronii*) have already attained tree dimensions with girths of over 30 cm at breast height (1.3 m from ground) and heights of over 6–8 m. This work has clearly established the possibility, potential and protocols for ecological restoration of degraded rainforest across a range of degraded sites, ranging from open grassy meadows, sites under

erstwhile plantations of eucalyptus, sites invaded by alien species such as *Lantana camara*, *Mikania micrantha* and *Chromolaena odorata*, and other degraded rainforests and streamsides. Using developed protocols, such restoration can be applied to different areas in similar landscapes, which is likely to help conserve wildlife and watersheds and minimise human-wildlife conflicts in the long run.⁶²

Restoration of rainforest fragments should ideally be complemented by enhancing land use practices, particularly involving tree cover, within the surrounding matrix of plantations. In the Anamalai hills, our experience has demonstrated that a large number of native tree species hold potential for use as shade trees in plantations, but have been hitherto ignored or seldom formally tried out. Between 2004 and 2012, over 12,300 saplings of sixty native rainforest tree species were supplied to and planted in coffee, vanilla and tea plantations (only five species in the latter). Observations suggest that in vanilla and cardamom plantations, most of these species do well, grow reasonably fast and provide suitable shade, while in tea plantations, at least two native species (of the five) appear as well suited or preferable to the conventionally used alien silver oak (*Grevillea robusta*). Similarly, research has shown that some native tree species may be superior to silver oak as shade in coffee plantations in southern India.⁶³ It is also increasingly evident that in the Western Ghats, use of native shade trees and presence of forests in the landscape can have direct benefits to farmers through enhanced pollination, yield and pest control services, particularly in crops such as coffee.⁶⁴ More research and trials using native shade tree species are needed, which requires the involvement of plantation crop research institutes and institutions such as United Planters' Association of South India (UPASI) and coffee and tea boards that can transmit research findings to planters for wider adoption in field practices. There is also a need for state and central governments to foster the use of native species and modify permit systems to allow planters to lop trees and carry out crop shade regulation. Presently, one of the reasons that planters seldom plant or use native shade tree species is the fear that they will never be permitted by the forest department authorities to fell or lop branches of native species to regulate shade.

Does Certification Provide a Way Forward?

In tropical plantations, can businesses and small farmers become involved in conservation and sustainability, where sustainability represents a triple bottomline of social, environmental and economic concerns? In more catchy terms, can plantations meld people, planet and profit? One approach to this is through certification of plantation business and produce, linked to growing markets for ethically and sustainably produced commodities. Certification has been criticised for the standards it uses (or fails to use), the reliability of the independent third party audit systems, as a non-tariff trade barrier and as costly for producers, but nevertheless remains the most extensive extant incentive system for sustainability in the plantation sector.

A variety of certification schemes is available, each with its own focus and limitations. This includes organic certification (emphasis on avoidance of chemicals for health and environmental reasons), Fair Trade certification (emphasis on social issues, worker welfare and safety), Utz Capeh (social and environmental concerns, but lax in criteria) and others (such as Ethical Tea Partnership, Starbucks's Cafe Practices, 4C Code of Conduct and Nespresso AAA Sustainable Quality Program in Coffee) evaluated on farms through self-assessment questionnaires or possibly third party 'verification'. However, these schemes are generally weak on environment and wildlife criteria. The Smithsonian Bird-Friendly Coffee Certification is strong on stipulating organic agriculture and specific conditions related to shade tree cover but ignores other aspects of sustainability such as the hunting of wildlife and social welfare. Rainforest Alliance (RA) certification, perhaps the largest certification programme in tea and coffee plantations at present, includes social, environmental and economic criteria in a set of standards for individual farms or groups developed by a network of nonprofit organisations, called the Sustainable Agriculture Network (SAN).⁶⁵ Farms that meet required criteria, screened by third party auditors, can become Rainforest Alliance Certified™ and apply for use of the 'frog' seal on packets and bags to market their produce.

Since 2007, the authors engaged with RA (and NCF also became a member of SAN in 2009) to work to raise awareness on better social, environmental, and land use practices, especially those pertaining to ecosystems, wildlife, soil and water, based on adoption of the SAN Sustainable Agriculture Standard, linked to market benefits for producers from RA certification.⁶⁶ Social aspects, including workers rights, freedom, welfare, and living and working conditions, continue to remain vital concerns in India's plantations, requiring attention in sustainability efforts, but these are outside the scope of this essay.

Under the SAN Standard, in certified farms, critical criteria prohibit hunting of wildlife, destruction of high value ecosystems and pollution of water bodies. Other criteria require certified farms to retain all existing natural ecosystems, plant native shade trees (at least twelve species per hectare in coffee and agroforestry crops), and retain animal corridors and habitat connectivity through plantations. These measures are in consonance with research cited earlier on the values of plantations for conservation and vice versa. Additional criteria on human-wildlife coexistence are proposed for inclusion in the 2014 version of the SAN Standard. These require farms to be aware of potential conflict species and design and deploy proactive prevention and emergency response measures appropriate for those species. Instead of detrimental reactive responses such as blocking or deflecting movements of animals such as elephants, or capture, translocation and lynching of wildlife such as leopards, proactive measures need to prevent or minimise conflict incidence. These include improving livestock corrals, restricting the use of barriers and fences to sensitive property and housing areas, installing early-warning systems to detect wildlife entry before damage is caused, avoiding wildlife deaths due to farm infrastructure (deep drainage ditches, illegal electrified fences), and cooperating with state authorities in neighbouring Protected Areas in implementing wildlife management plans in the wider landscape.

Through stakeholder consultation and outreach, aspects related to conservation were also discussed and disseminated widely in the plantation sector in numerous training events, workshops, presentations, field audits, posters, detailed local interpretation

guidelines document, and a comprehensive website and visual guide on sustainable agriculture in tea and coffee.⁶⁷ As a result, some plantations began reaching out to regional civil society organisations (e.g., Keystone Foundation in the Nilgiris, Ecosystems India in Assam) for issues such as wildlife inventory, ecosystems protection, sourcing native shade tree seedlings and waste management. Since 2008, several estates applied for certification, underwent certification or recertification audits and became Rainforest Alliance certified (e.g., Valparai Coffee of Tata Coffee Ltd, a large estate with seventeen rainforest fragments adjoining the Anamalai Tiger Reserve). Commitments from global buyers such as Unilever, Tetley and Kraft, spurred the growing market for certified tea and coffee. By December 2013, the certified operations had expanded to include twenty-two farms and thirty-one groups occupying 1,04,605 ha (c. 72,000 ha in actual production), primarily tea and coffee plantations and limited pepper and cardamom, in southern and eastern India. Although certified produce from these farms have started appearing in foreign markets, the effects of changes due to certification on conservation at the ground level remain to be seen. There have been no targeted studies so far exploring the economic or ecological benefits from certification in Indian farms and many problematic issues remain (see Appendix). Also, because a large volume of Indian tea and coffee is sold for domestic consumption, often in auctions, certification is of little interest to many companies particularly in southern India, due to lack of domestic awareness of the sustainability issues and low domestic demand for certified produce.

Living with Wildlife: From Conflict to Coexistence

Several science based conservation efforts appear to hold promise in reducing incidence of conflicts between people and wildlife in plantation landscapes. For instance, in the Valparai plateau in the Anamalai hills, conflicts between people and elephants are mainly in the form of property damage in food storage areas, with most incident locations centred in the middle of the plateau and some specific locations repeatedly damaged by elephants.⁶⁸ This suggested

that targeted measures at food storage locations can help reduce conflicts. Several food storage sites were shifted, patterns of storage changed, and buildings insured by plantations and government authorities, leading to reduced costs and incidence of damage in subsequent years.

The major concern in human–elephant conflict in plantation areas is the loss of human life due to elephants. In the Valparai plantations between 1994 and 2012, a total of thirty-seven people lost their lives in unexpected encounters with elephants. A majority (sixty-five per cent) of the deaths occurred over a three month period between December and February and many (twenty-five per cent) occurred in a small area (Ryan division of TANTEA [Tamil Nadu Tea Plantation Corporation]). This suggested that providing early warning systems for local people of elephant movement can help reduce conflict incidents while allowing elephant movement through the larger landscape.⁶⁹ We therefore set up an ‘information network’ to communicate about elephant presence to people in order to avoid fatal encounters with elephants, coupled with ‘in house’ warning systems for people living along elephant movement routes. An experimental study revealed that communication about elephant presence and movements through plantations to people over local television media as a ‘crawl’ and through a daily bulk SMS service to individual people’s mobile numbers were received positively by the community.⁷⁰ Mobile-operated red LED flashing lights were installed in strategic locations to indicate elephant presence in the vicinity at night as an in house early warning system that is now largely operated by local people themselves. These systems, which now benefit nearly 70,000 people living in habitations across the Valparai plantation landscape, appear to be cost effective and sustainable solutions for human–elephant coexistence.⁷¹ In addition, the Tamil Nadu Forest Department (TNFD) set up a conflict response unit with forest watchers and vehicle support, to respond to calls for assistance from local people. For the conflict prone and remote areas of TANTEA, the TNFD ordered closure of around 128 ha of tea plantation in 2012 and handover of these and other unplanted areas within TANTEA to the Anamalai Tiger Reserve. People living in remote labour

colonies may also be relocated to better housing in an adjoining division of TANTEA with better road access and amenities. Such measures are also likely to reduce conflicts in the long run.

Other landscape level issues do remain in addressing human–wildlife conflicts. For instance, in many plantation areas, there has also been a proliferation of the use of power fences around private estates, creating barriers to animal movement. Fences erected between Protected Areas and private plantations are also often poorly maintained or ineffective because of lack of community participation.⁷² Fences may reduce conflict if implemented in a participatory manner around specific property or crop fields, but may be ineffective or exacerbate conflict if used to fence off large areas including remnant natural forests, swamps and water sources. Proper deployment of fences for protection, leaving spaces for movement and access to water bodies by wildlife, will help in reducing costs and inefficiency (associated with long fences), mitigating conflicts better and supporting the conservation of wide ranging large mammals.

For carnivores such as leopards, addressing conflict with people requires a shift away from reactive measures such as providing compensation or capture and translocation of leopards after incidents occur. Instead, reducing incidence of human–leopard conflict requires proactive and precautionary mitigation measures such as improved livestock corrals, managing waste disposal, basic safety precautions for people especially young children,⁷³ creating awareness among local people to promote social acceptance of leopards in human use areas, and strict prohibition on stealing or removal of leopard kills.⁷⁴ Studies in the plantation areas of the Anamalai hills have similarly proposed conflict management based on leopard biology through proactive measures mentioned above. Safer living conditions for both the wild animals and a secure life for human co-inhabitants, especially children, are both goals to be pursued concomitantly. In common with the Deccan⁷⁵ and the Himalaya and Transhimalaya,⁷⁶ there are large, critical areas of overlap of people with large vertebrates, and conflict reconciliation with respect to life is a continuing challenge.

Property damage and human deaths cause economic losses, pain and trauma among residents, and other opportunity costs, resulting in undesirable retaliatory measures against wildlife. The loss of human life is tragic and irreversible, and efforts to minimise and eliminate such losses are imperative. Preventing human fatalities through appropriate measures, in particular, can also help increase greater tolerance levels of people. Community involvement and awareness in dealing with human-wildlife conflict has been crucial in developing a positive attitude among local communities and human co-inhabitants of the plantations. Living and working as we do in such a landscape, we are deeply aware of and sensitive to safety concerns at a human level even as we hope to work out ways in which neither animals nor people put each other's lives at risk.

Concluding Comments

A wide variety of approaches is being evolved globally to address the challenges of extending conservation to non-traditional arenas and production landscapes. These include approaches such as conservation easements, direct payments or credits for biodiversity services, carbon sequestration and trading, purchase of lands, conservation certification of commodities and produce, mitigation banking or compensatory mitigation, corporate social responsibility initiatives, and voluntary efforts.⁷⁷ Such initiatives have scarcely been tried in tropical Asia, particularly in India, where the mainstream conservation movement is still overly focused on Protected Areas (wildlife sanctuaries, National Parks, tiger reserves) under a protectionist paradigm.⁷⁸ Globally, evidence on the economic value of biodiversity and forests to plantations mediated by ecosystem services such as pollination, carbon sequestration and watershed benefits, also suggests that such landscape scale conservation can bring direct benefits to production, businesses and local residents.⁷⁹

Better land use and business practices addressing issues such as water and soil conservation, ecosystems and wildlife protection, agrochemical use and safety, and worker welfare and community relations are sorely needed for Indian commodity plantations such

as tea and coffee. Yet, in regions of high conservation importance such as the Western Ghats or North East India, there has been little effort to minimise negative impacts and enhance beneficial aspects of plantations for conservation through appropriate landscape and farm level management and agricultural practices. Our experiences suggest that effective and lasting changes, if they are to come to Indian plantations, cannot come from just the companies or farmers alone, or by any single means such as certification taken in isolation. A farmer primarily concerned with profit or yield or a company mainly concerned about an annual financial bottom line often allots little time or resources to finding and applying the various changes in land use and business practices, consumer awareness and market linkages, required for conservation and sustainability concerns to become mainstream. A mix of approaches is the need of the hour, including legal requirements and sanctions, certification based incentives, continuous civil society engagement to evolve better land use practices and act as watchdogs, and increased research and development in sustainability by plantation industry associations, boards and research institutions (see review of major stakeholders and issues in a SLOT Table in the Appendix). In addition, we require mechanisms of adaptive management of the human-wildlife interface by stakeholders to promote successful and sustainable human-wildlife coexistence.⁸⁰ Such holistic and inclusive approaches are required if we are to conserve wildlife at the landscape level, minimise conflicts and costs associated with ecologically insensitive land use, and sustain businesses and livelihoods profitably in the long haul.

Finally, we also note that, although rarely discussed, there is a deeper, more substantive and desirable approach that can lead to better outcomes. This is when businesses or farmers adopt better land use practices based on their own growing awareness of the need for conservation and the benefits such as watershed protection, pollination and pest control that are provided by diverse natural ecosystems. Farmers can additionally harness their own skills to mitigate the impact of plantations on people and the environment without compromising long term productive capacity of land. As Aldo Leopold wrote in a prescient essay titled

'The Farmer as Conservationist', 'Subsidies and propaganda may evoke the farmer's acquiescence, but only enthusiasm and affection will evoke his skill. It takes something more than a little "bait" to succeed in conservation.'⁸¹

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Appendix

Plantations in Southern India: Area, Growth and Conservation Concerns

Tea plantations occupied a total area of over 1,19,740 ha in southern India in 2007, having increased in coverage by around 6,280 ha (5.5 per cent) in the period between 2000 and 2007, despite a downturn in the industry for much of that period.⁸² This is a matter of high environmental concern as tea plantations are grown as intensive monocultures, with no native shade tree cover and only very sparse shade represented by planted and annually lopped Australian silver oak (*Grevillea robusta*) trees. Tea thus represents more extreme habitat modification from natural forests of the region than is the case for plantations that normally have higher shade tree cover, including native tree species such as coffee and cardamom.

Coffee plantations in India span at least 3,41,518 ha having increased from around 2,70,821 ha in 1990–91 to span over 4,00,000 ha in 2010–11, of which eighty-five per cent of the production area lies in and adjoins the Western Ghats of Karnataka, Kerala and Tamil Nadu.⁸³ While part of the increase in coffee production area is due to increase in coffee growing in non-traditional areas, such as Andhra Pradesh, Orissa and eastern India, even in traditional areas in southern India there has been increase in coffee, often accompanied by loss of forest cover and loss or gradual conversion of private forests or sacred groves. For instance, Kodagu in Karnataka, one of the major coffee growing districts in India, lost an estimated thirty per cent of its forest cover between 1977 and 1997, when the area under coffee almost doubled and coffee cultivation expanded into new areas and evergreen forests.⁸⁴ Coffee plantations now abut all Protected Areas in the district, but forest loss seems to have now stabilised due to forest laws and lack of land availability. Among coffee areas, over half is under Robusta coffee (*Coffea canephora*), a species grown under less shade, with lower biodiversity conservation value⁸⁵ and higher invasive potential⁸⁶ than shade-grown Arabica coffee (*Coffea arabica*).

Small cardamom (*Elettaria cardamomum*) is mainly grown in the three southern states of Tamil Nadu, Kerala and Karnataka, where it spans over 73,228 ha.⁸⁷ Small cardamom, a native plant of the Western Ghats, now cultivated as several varieties in the region, requires denser shade for cultivation and offers opportunity for mixed native tree species agroforestry in the region. On the other hand, conventional cultivation requires high inputs of toxic agrochemicals in cardamom, which is a serious concern.

While tea, coffee and cardamom plantations are the major plantations in the middle and higher elevations of the Western Ghats, considerable expanses of other plantations occur in the lower elevations, foothills and adjoining plains. Important among these are plantations of rubber (*Hevea brasiliensis*), arecanut (*Areca catechu*) and cocoa (*Theobroma cacao*).

Rubber plantations occupy over 6,15,000 ha in India, mainly in southern India (around three fourths of the area is in the state of Kerala alone). India is the world's leading producer of areca nut, cultivated over an area of 3,54,000 ha, mainly in the states of Karnataka (leading producer), Kerala, Assam, Tamil Nadu, Meghalaya and Maharashtra.

Cocoa plantations occupy over 32,000 ha (2007), primarily in the states of Kerala, Karnataka and Andhra Pradesh. These are sometimes grown with areca nut as a shade crop as well as in home gardens, especially in Kerala and Karnataka along the western aspect of the Western Ghats and Malabar Coast. Other cultivated plantation crops in the region include coconut (*Cocos nucifera*), vanilla (*Vanilla sp.*) and pepper (*Piper nigrum*), the latter usually intercropped in coffee, cardamom and other plantations and home gardens.

Oil palm cultivation in India spanned about 53,161 ha in 2004, of which oil fruits production area was about 40,650 ha.⁸⁸ It is cultivated mainly in the states of Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Maharashtra, with smaller areas in Orissa, Gujarat, Tripura, Mizoram and the Andaman and Nicobar Islands. While the crop failed to gain initial acceptance by farmers (with substantial areas under oil palm being uprooted by farmers between 2001 and 2003 due to poor prices and other factors), there is a push

to increase the area under oil palm in India, partly to reduce the growing dependency on imports. The Government of India has however identified around 7,96,000 ha as suitable for oil palm. In the Western Ghats, some of this increase is likely to occupy locations within or adjoining tropical forest areas in Kerala, Karnataka and Tamil Nadu. Cultivation of oil palm is already seen in landscapes adjoining Protected Areas in many districts of southern Karnataka (e.g., Mysore: Bandipur TR, Kodagu: Nagarhole NP) and Kerala (e.g., Waynad: Wayanad WLS, Trichur: Parambikulam TR).

Rainforest Alliance Certification and Conservation in Indian Tea and Coffee Plantations

The global SAN Standards underlying RA certification developed mainly on the basis of experiences from the neotropics and has lacunae in local contexts in Asia and Africa. In the environmental context, for instance, are issues related to conservation of large wildlife species like elephants, human-wildlife conflicts and animal corridors. Many farms in Africa and Asia are also much older and therefore there is a need to integrate traditional practices (higher diversity of native shade trees in traditional coffee estates, sacred groves, home gardens) and knowledge of local communities.

Introducing and fostering adoption of sustainable agriculture practices among Indian tea and coffee plantations faces challenges on social, environmental and economic fronts. In India, social concerns are sought to be addressed by legislation, particularly the Plantation Labour Act, 1951 (amendments up to 2010), Minimum Wages Act, 1948, and Factories Act, 1948. Despite the legislations, a number of vital social concerns remain on payment of living wages, adequate housing and sanitation facilities for workers, situation of contract workers and good working conditions.

Concerns over environmental sustainability arise from many of the present production practices in plantations. Threats to biodiversity include hunting of wildlife and land clearing leading to habitat fragments such as forests, grasslands and wetlands in plantations being degraded or converted to land uses that cannot sustain endemic species. Examples include clearing forest and secondary growth to establish monocultures of tea, the planting of alien tree

species such as eucalyptus in grasslands, swamps and along streams, and draining of swamps or overuse of water or pollution of wetlands. The spread of invasive alien species introduced in plantation areas (e.g., as crops or cover crops, or for biological control), or which have established following disturbances is another serious concern with spillover effects in surrounding landscapes. A key issue in agroforestry plantations such as coffee and cardamom, where shade trees are integrated in the production area, is the intensification of production accompanied by removal of shade trees or the gradual replacement of diverse native shade trees with fewer or single tree species, often alien or exotic species such as silver oak or eucalyptus or *Maesopsis eminii*. Water conservation and pollution is another key issue. Waste water runoff into fresh water sources from coffee wet pulping or from washing of tea factories, especially the former, can be a significant source of water pollution. Groundwater use and surface water diversion and overuse, for irrigation, sprinkling and washing are also concerns from environmental as well as social (community relations) perspectives. Opportunities for improving water use efficiency, reducing wastage, water reuse, rainwater harvesting and better treatment systems exist, but are yet to see widespread implementation.

Certified farms are not allowed to use any of the agrochemicals (insecticides, acaricides, fungicides, herbicides, plant growth promoters, manures and fertilisers) listed in the periodically updated SAN List of Prohibited Pesticides (November 2011, revision due 2014). Although the standards do not stipulate organic cultivation, the list of prohibited pesticides ensures that the worst agrochemicals, internationally screened and prohibited, are not used for cultivation and additionally that chemicals falling within the highest toxicity classes are gradually reduced and replaced. In India, the (over)use or dependence on agrochemicals is also a major concern from environmental, economic and social (toxicity, health) perspectives. The use of pesticides is regulated by the Insecticide Act and Rules, but rather inadequately in comparison with international standards. For instance, paraquat (gramaxone), a herbicide on the dirty dozen list of the Pesticide Action Network,⁸⁹ is approved within India and widely used in tea and coffee plantations. Chemicals such as

endosulfan are also widely used in plantations, especially in rubber and cocoa, with the manufacture and use of this chemical prohibited by the Supreme Court only in 2011. Monocrotophos (toxic organophosphate) and carbofuran (furadan) are still recommended for use in cardamom plantations under conventional practices, to name just a few examples.

Further, certified farms are expected to maintain narrow strips of natural vegetation (buffer zones) to separate crop production areas from rivers, natural ecosystems, or intensive human use areas such as schools and public roads. This is to prevent exposure of people and ecosystems to harmful effects of agrochemical drift, besides helping maintain soil and water quality along streams and rivers, and provide spaces for wildlife movement. Tea and coffee estates in India are, however, notorious for planting the crop on every possible inch of land up to the edge of streams and even occasionally on land in the middle of rivers. Despite the fact that the required land area for buffer zones is usually a small fraction of the land area (less than two per cent including unplanted area), even large estates are loath to ensure such protection of people and ecosystems through buffer zones, due to various misgivings and the belief that the only way to run the business is to plant up all available area.

Economic concerns at the farm level, especially when viewed in terms of long term sustainability rather than exclusively on annual bottomlines, also predicate the need to adopt extensive ecological solutions to issues rather than intensive engineering solutions. The adoption of integrated farm management can increase the economic efficiency of many plantations, such as use of regular soil testing to determine exact fertiliser requirements, regulated and targeted spraying of pesticides on pest attack rather than preemptive spraying of entire fields, use of alternatives such as pheromone and sticky traps rather than expensive chemicals, proper assessment of social and environmental impact and suitability of new crops and new production areas before planting, and the use of appropriate soil cover, mulching and shading to address soil erosion, soil health and weed proliferation rather than using concrete revetments, artificial fertilisers and chemical herbicides.

SLOT Table of various stakeholders to achieve goals of conservation and sustainability in plantations in the region

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
Producers, farmers and workers' unions	Well organised sector with capacity to adopt and implement better practices if they desire. Supported by government, boards and agricultural research institutions. Close relationship with land.	History and colonial legacy of practices and inertia. Poor awareness of ecosystems and wildlife issues, animal corridors. Dominant/ unidimensional focus on intensification and yield per hectare. Dependence on agrochemicals.	Access to new and growing markets of informed consumers via certification. Improving worker welfare and safety. Ethical positioning and worker empowerment. More stable market linkages. Better relations with local community and workers.	Resistance to change, including organised change. Perverse subsidies to intensify improper land use. Conflicts with wildlife. Financial costs of compliance, audit and improvement.	Respecting habitat remnants as ecosystems. Being sensitive to animal corridors and movement through farms. Reducing toxic chemicals. Adopt integrated farm management. Collaborate with NGOs and civil society to remove weaknesses.

(Contd)

Table (Contd)

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
Producer associations and cooperatives	Well placed, strong voice and influence with government and planter communities. Represents huge worker population acting as social capital. Negotiating powers with unions and state on wages.	Often biased towards larger estates and influential companies. Representation of entrenched vested interests, especially over land and natural resources. Lobbying for subsidies, exemptions, often on basis of worker population.	Bringing industry-wide changes in practices to leverage emerging market opportunities. Sustainability and geographical branding and positioning. Increased domestic markets for sustainable produce.	View of worker welfare costs primarily as a liability rather than as social capital. Lobbying with government to increase subsidy and reduce interventions. Negative attitude towards conservation due to inability to deal effectively with conflicts.	Move members towards sustainability and show top management commitment. Lobby not only for subsidies or sharing of labour 'burdens' by state but for better research and development support related to sustainability. Take proactive stance towards enhancing worker welfare and dignity to counteract labour shortage.

(Contd)

Table (Contd)

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
Government boards and industry research institutions	Financially supported. Well equipped and staffed. Excellent access to wide variety of plantations and landscapes across India.	Very poor engagement on social sustainability issues, such as household energy needs, agrochemical impacts on worker health and soils. Almost lacking in wildlife research, and ecosystem services and impact studies. Limited engagement with organic and sustainable agriculture and overreliance on engineering techno-fixes and agrochemical solutions.	Exceptional native biological diversity may hold species of value for shade, pest management, cover crops and others. Boards under Ministry of Commerce can incentivise adoption of good land use (e.g., linking subsidy or tax/customs exemptions to adoption of sustainable practices). Foster domestic markets and labelling for sustainably produced commodities.	Industry membership based institutions have more unidimensional focus on yields and chemical inputs. Paradigmatic approach to mode of intensive industrial agriculture. Costs of broadening research capacity in the institutions to include social and environmental sciences.	Rethink and remove perverse subsidies that cause more land clearing, introduce inappropriate new crops or foster unsustainable land use intensification. Enhance research capacity and agenda to include environmental concerns (agrochemical impacts and alternatives, wildlife and ecosystems research). Develop effective solutions for worker health and safety (e.g., fuel efficient safer fuels/stoves, personal protective equipment).

(Contd)

Table (Contd)

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
NGOs, civil society and independent research institutions	Large number of independent and credible institutions in the region. Wide experience in issues such as wildlife and ecosystems, social and welfare, development alternative, waste management, native plant and animal species.	Constrained by funding. Poor leverage with industry bodies and boards. Lack of access to plantations to carry out enabling research, often due to mistrust by planters.	Contribute to conservation across a larger landscape. Research to foster native species use and minimise aliens and invasives. Enhance worker welfare and dignity, and reduce impacts on natural areas. Identify animal corridors and minimise conflicts.	Reluctance to engage with plantations, seen as a damaging sector. Maintaining independence and credibility in working with corporates and businesses.	Carry out ecosystems and wildlife studies, surveys and identification of suitable native plant species useful in farms. Form partnerships with planters for habitat restoration and mapping animal movement routes. Help develop locally appropriate guidelines and best practices. Play watchdog role on issues such as land clearing, encroachments. Create better awareness among producers, consumers and local communities.

(Contd)

Table (Contd)

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
Forest and environment departments	Strong supporting legislation on forest and wildlife conservation. Widespread presence in plantation landscapes that are also biodiversity rich.	Failure to integrate larger landscapes outside protected areas in conservation. Widespread perception of corruption. Legislation inhibits private efforts at conservation (e.g., growing and managing native shade trees).	As forests are a state subject, site-specific solutions may be evolved. Expertise can be shared and local partnerships created to engage with plantations. Can assist in mitigating wildlife-human conflict in private lands.	Tendency to see private owners as adversaries and to be suspicious of private initiatives. Inability to understand and foster better land use practices. Delays in wildlife compensation payments.	Taking a larger landscape view, including collaboration with local stakeholders. Training officers and field staff to better deal with production sector, conflict management. Change from a focus on booking offences to also supporting positive changes.

(Contd)

Table (Contd)

Stakeholder	Strength	Limitations	Opportunities	Threats/Costs	Required Changes
Workers and local people	Large number of people, resident in the region, often for generations. Being a vulnerable segment as changes in land use practices and working conditions affect them directly, they are sensitive to these changes and more open to adoption of sustainable practices. Often intrinsically tolerant of wildlife and nature conservation.	Usually lack decision-making powers. Significant migrant and temporary worker population, often with limited capacity, vulnerable to exploitation. Lack of training or capacity-building opportunities to deal with skilled tasks or adopt newer sustainable practices.	Potential for empowerment through education, health, and community efforts and civil society involvement. Greater awareness of rights coupled with continued high dependence of plantations on labour in leveraging improvements in housing and working conditions (can benefit from certification). Rights for collective bargaining agreements and labour unions.	Limited understanding of wildlife and conservation issues, and optimal approach to conflict avoidance. Improvements in housing, sanitation (such as toilets), and safety necessitates significant financial cost (investment).	Closer involvement in decisions related to working and living conditions and wages. Constant and continuous training, using appropriate language and material, in sustainable practices and wildlife conservation. Proactive measures for better safety and emergency response procedures in areas with large wildlife species.

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