Current Ecological and Social Status of Rubber Estates in the Shencottah Gap

FINAL REPORT

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About this Report

This report was compiled as a part of our project on ecologically sustainable practices in rubber plantations in the southern Western Ghats to serve two purposes, a) to understand current practices in rubber cultivation and assess positive and negative practices to be able to provide suggestions on making this region more ecologically sustainable and b) if rubber plantations were interested in eco-certification, this document will help to give us a background. The information that has been presented here are from interviews with small and large rubber growers in the landscape, from field visits and data collected both during the course of this project and from our other projects in this landscape. The third source of information is from information available in the public domain, accessed online.

Contents

Rubber Production Areas in Kerala

The most important source of natural rubber is the latex from the plant *Hevea brasiliensis*, an introduced species, native to the Amazon river basin of South America. This quick tall growing tree grows well in the tropics and requires a warm and humid climate (21^{o}C – 35^{o}C) and a fairly evenly distributed annual rainfall of not less than 200cm. The type of soil is not a constraint as long as it is deep and well drained.

The traditional rubber growing areas in India are confined to a narrow strip mainly on the west of the Western Ghats extending from Kanyakumari district of Tamil Nadu in the south to Dakshin Kannada and Kodagu districts of Karnataka in the North. The state of Kerala contributes to nearly 90% of the natural rubber production in India with an area of more than 53400 Ha under rubber cultivation.

Within Kerala, the districts of Kottayam, followed by Pathanmthitta and Ernakulam have the most areas under rubber cultivation and contribute most to the total production of rubber in the state.

Photo 1: View of a rubber plantation

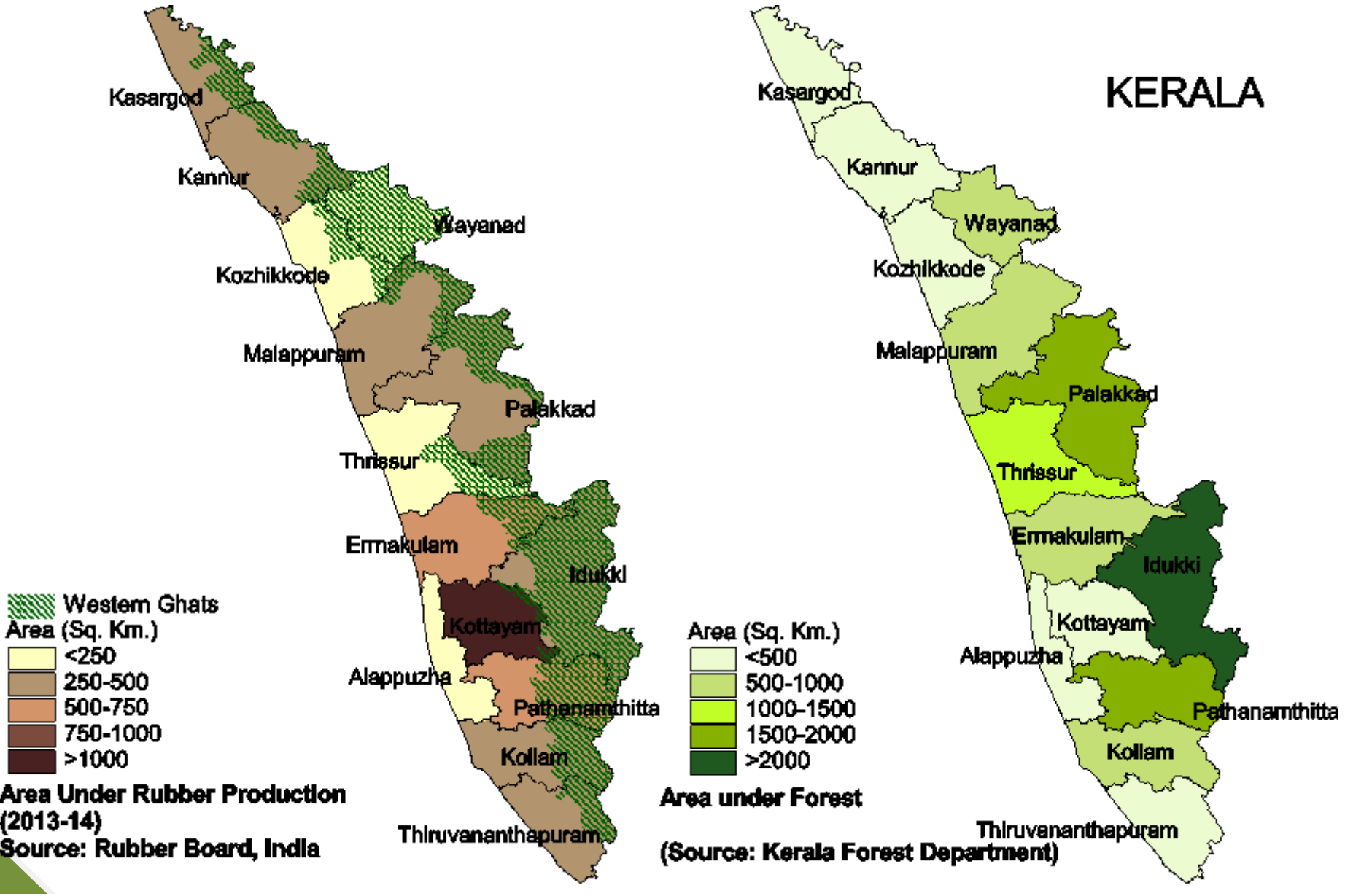

Figure 1: Area under Rubber production and under Forest in the State of Kerala

Rubber Cultivation in the Landscape

In Kerala, the Agastyamalai-Periyar landscape falls within the administrative districts of Pathanamthitta, Kollam, and Thiruvananthapuram. For the year 2013-14, these districts accounted for nearly 22% of the area under rubber cultivation, and contributed nearly a fourth of the total rubber production of the state. These districts also include forested area that account for 25% of the forest cover of the state and cover 53%, 62% and 67% of the geographical area of the Kollam, Thiruvananthapuram and Pathanamthitta Districts respectively. The forested areas are interspersed with and separated by rubber plantations on small land holdings as well as larger estates managed by some of the oldest companies in the plantation business. The several small rubber farms are typically homesteads where rubber trees are interspersed with other crops and fruit trees. Such farmers tend to employ a smaller labour force for rubber tapping, use less chemicals to increase their yields, tend to have more sustainable practices compared to larger estates. The area under holdings (defined by the Rubber Board of India as plantations of area <20Ha) for the year 2008-09 in Kollam District was 28960 Ha, Thiruvananthapuram was 29309 Ha and Pathanamthitta was 42473 Ha while area under Estates (defined as plantations > 20 Ha in area) in Kollam District was 6705 Ha, 700 Ha in Thiruvananthapuram and 7341 Ha in Pathanamthitta District.

Of the four larger estates in this area, three located in the Venture valley belongs to the RPG group owned Harrison Malayalam Company Ltd. The fourth, namely the Ambanaad estate belongs to the Travancore Rubber and Tea Company Ltd.

Harrison Malayalam Limited estates in the Venture Valley in the Shencottah gap is spread across three estates namely, Nagamallay, Isfield and Venture estates covering a total area of approximately 2555 Ha of which about 67% is under rubber cultivation, 11% under fuel wood and other plantings and 21% under reserves and other land use types[1].

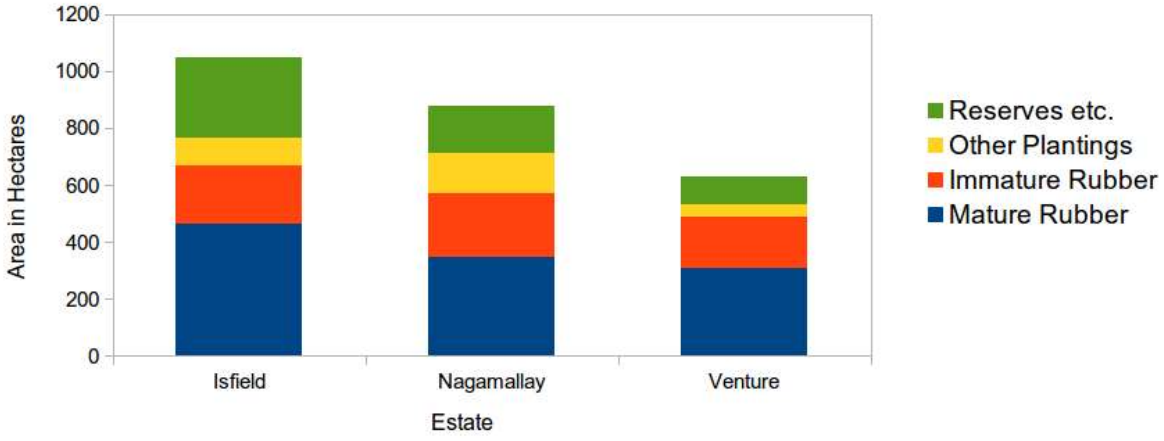

Figure 2: Harrisons Malayalam Limted: Land use in Estates in the Venture Valley, Kerala

[1] Harrisons Malayalam Limited. 2014. Annual Report 2014. Cochin, India

The Travancore Rubber and Tea Company Limited's Ambanad estate is the other large estate in this landscape with about 400 Ha under rubber plantations and 380 Ha under tea. Other crops that are grown in this estate include pepper, clove and small areas under coffee and cocoa[2].

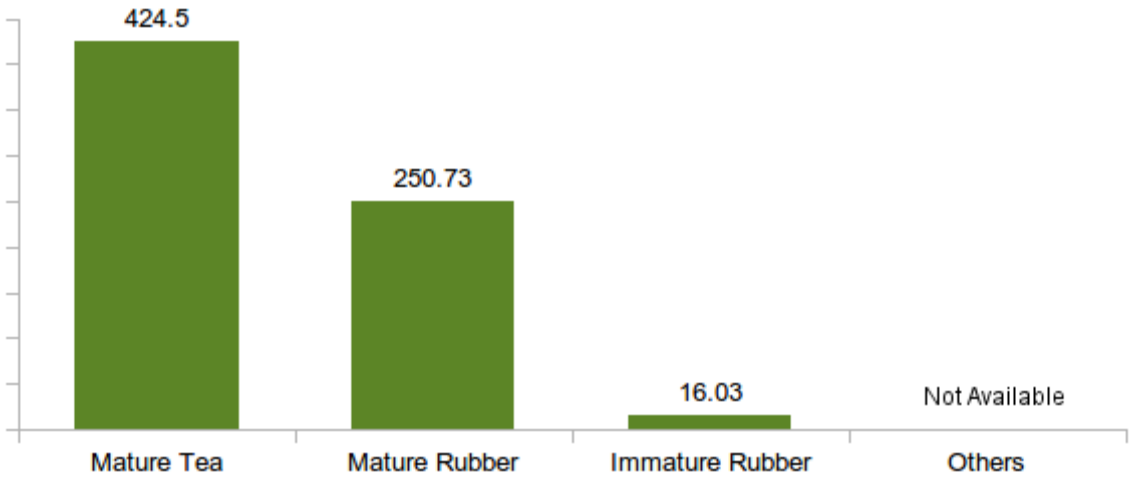

Figure 3: Travancore Rubber & Tea Co. Ltd.: Land use in teh Ambanaad Estate

In this report we summarize observation on the ecological and social status of these rubber estates in this landscape.

[2] Travancore Rubber & Tea Co. Ltd. 2013. Annual Report 2012-13. Thiruvananthapuram, India.

Current Ecological Status

Information on the ecological status of the plantations has been procured from a) field data collected on previous projects, and b) from information gathered during field visits during the current project.

Ecosystems within the plantations

The large rubber estates are typically monoculture of the rubber plant (*Havea brasiliensis*), a species native to the Amazon river basin. However, in some estates like the Ambanaad estate, there is inter-cropping with clove and pepper in areas under tea cultivation while rubber remains a monoculture. The Rubber Board of India prescribes the use of at least 5 varieties of rubber to be planted. This is however, not followed in most areas. An earlier initiative by HML to intercrop immature rubber with pineapple and Banana was not observed during the field visits to Ambanaad. The Harrison Malayalam Ltd. Estates and the TRTC estate have recently planted cocoa as intercrop in some parts of their estate. This is in contrast to small holdings in this landscape where rubber is regularly intercropped with ginger, turmeric, and jack fruit, especially with the immature rubber tree.

Photo 2: Cocoa intercropped with rubber in the landscape

Within the planted areas, cover crops, usually legumes such as *Pueraria phaseoloides* and *Mucuna bracteata* are planted as a soil conservation and improvement measure and to reduce soil temperature and suppress weed growth.

Photo 3: View of a rubber plantation, cover crops and the forest boundary

Weeds that are known to be often found in the southern landscape in rubber plantations include, *Axonopus compressus*, *Chromolaena odorata* (an invasive, which is noted to be problematic for forest regeneration in rainforests in Africa, Struhsaker, et al, 2005), *Borreria sp.*, *Cyatula prostrate*, *Mimosa pudica, Imperata cylindrical*, *Alternanthera sp.*, and *Mikania micrantha* (an invasive weed) (The Rubber Board, India, 2013).

Photo 4: Silver oak is used a shade plants in this tea estate, and clove and pepper are the intercrops

The land holdings of these companies include ecosystems other than those that are being actively planted. This includes, natural forests, and grasslands that are linked either directly or through the production areas to the reserve forests that border these estates. Some of these forested areas are either contiguous with the estates or are found as enclaves within the estate and are classified as reserve forests managed by the state

forest department. Private forest enclaves within these estates are also found, some of which have been declared as vested forests coming under the purview of the Thenmala Division of the Kerala, Forest Department.

Photo 5: Grasslands are found within the estates, which have been left in the natural state

Photo 6: Forests adjoining rubber plantations

The forest types (Champion and Seth, 1968) that are found in this landscape includes,

1. The west coast Tropical Evergreen Forests (IA/C4):
2. Southern Hill top Evergreen Forests (2A/C2)
3. The West Coast Semi-evergreen Forests (2A//C2)
4. Southern Moist Mixed deciduous Forests (3A/C2)

Photo 7: Solar fencing between plantation and forest

Biodiversity

Rubber plantations support a number of plants and animals.

A recent study on the vegetation of rubber plantations showed that compared to tropical forests and open areas, the species diversity in rubber plantations was lower and a lower abundance of several plant species. However, the study also revealed that as many as 160 species of medicinal plants and 48 endemics were recorded (Sabina, 2008). The study further revealed that the vegetation in rubber plantations were changing towards a vegetation composition similar to open areas with the main vectors driving this change being *Ishaemum indicum*, *Oplismenus compositus*, *Cyathula prostrate* and *Cyrtococcum patens* (Sabina, 2008). This study also concludes that in rubber plantations located in very close proximity to forests in Thenmala, did not reflect the vegetation of the forest. Instead they showed comparatively low species richness and a vegetation composition typical of a successional change with a large number of pioneer species with the surrounding forest matrix also getting invaded by these species (Sabina, 2008).

From our long term study of wildlife in this area, and from other recent studies, we have compiled a list of fauna and flora reported from the plantations. These are listed in Appendix1.

There are several rare and endangered fauna, many of which are endemics to the Western Ghats in this landscape, and many of these have been sighted within or in proximity to the rubber estates.

Photo 8: A stream running through a rubber plantation

Water resources

Several streams including many perennial streams pass through these plantations. There are also some springs located within the estates. All water requirements are met from these sources for the plantations including water for the factories, workers housing, and for the crops. Although no tests have been done to determine the quality of water, from field observations effluents from factories are released into nearby streams. The Travancore Rubber and Tea Co. Ltd. estates in its Annual report for 2011-12[3] states that it is the First Company to be

[3] Travancore Rubber & Tea Co. Ltd. 2012. Annual report 2011-12. Thiruvananthapuram, India. Accessed from: http://www.reportjunction.com/CompanyProfile/Travancore-Rubber-Tea-Co-Limited-T0216.htm

awarded "best effluent treatment plant" in state of Kerala. As part of their Corporate Social Responsibility efforts, RPG, the parent company of Harrison Malayalam Limited has pledged to convert all their 21 plants into "green facilities," with a reduction of power and water consumption by 20 percent and effluent discharge to nil[4]. The status of the effluent treatment needs to be assessed in more detail.

In some parts of the larger estates, we noted during field visits that to strengthen banks of streams, stone support walls have been put up by the estate. However, in other parts, erosion of banks was observed, especially along streams in the production areas.

Photo 9: Stream flowing through rubber production area: erosion of banks is seen in some areas

The fish diversity is not known in these water bodies, as also other invertebrate taxa. However, several species of amphibians, dragon flies and damsel flies that use habitats close to water sources are known from these estates (a list is provided in Appendix 1).

Soil management and conservation

Terracing in some parts of the estate were noted. In addition, cover crops are established and maintained in rubber plantations. The most common cover crop used in rubber plantations especially in the southern states are *Mucuna bracteata* and *Pueraria phaseoloide.* Not all areas planted with rubber have cover crop, however most areas where possibility of soil erosion is high, appears to have been planted. Although the palatability of these cover crops for wildlife is doubtful, (*Mucuna bracteata* is known to

[4] http://www.rpggroup.com/corporate_citizenship/overview/overview.aspx

be non-palatable to cattle, while *Pueraria phaseoloide* is known to be highly palatable, but use by wild herbivores is not known) it could provide corridors for movement of smaller animals. Also in some areas, good grass cover, which could be a possible source of food for herbivores, in addition to prevent soil erosion is retained.

Photo 10: Grass cover is retained in some areas planted with rubber, which helps control soil erosion.

Chemical fertilizers are commonly and regularly used, both for the main crop and cover crop. The recommended frequency depends on the age of the crop and soil characteristics and properties. In contrast to small farms, the large estates undertake soil tests for determining this. In general, the recommended frequency of application for this landscape is once every 4 months and the most common fertilizers used include NPK, potash and Phosphorus, in both the small holdings and larger estates. Although a large number of cattle are present in these estates, extensive use of dung as manure was not noted during field visits. Vermicompost pits are maintained in the TRTC estate.

Pesticides that are commonly used include bordeaux mixture, copper, and sulphur powder. These are mostly used for fungus that comes during the rainy season. While the recommended use is once every 45 days, they apply the pesticides every 16 days because of the severity of the fungal attacks. They also use bordeaux mixture and calcium carbonate to help peel bark for tapping. Finally, they use formic acid for latex coagulation. They do not rotate pesticide use or store chemicals separately, which are two SAN requirements for chemical management. While these are often considered to be acceptable inorganic farming practices, the use of weedicide such as glyphosate (trade name: roundup) is often used in the rubber plantations. Glyphosate has been recommended for restricted use in Kerala by the rubber Board of India. Although not on the prohibited

Photo 11: Cover crop under young rubber plantation

list of pesticides put together by SAN, glyphosate is known to be toxic to several non-target animals and in some studies have shown to have adverse effects on humans[5].

A list of other chemicals recommended by the Rubber Board of India for use as either herbicide or to treat disease in rubber plantations are given in as appendices 5 and 6.

Clearing and burning of land followed by terracing of the slopes for new plantings is common. Contour bunds in the form of stone walls can be seen within the estate which reduces the loss of soil during rainy season.

Integrated waste management

Photo 12: Discarded polythene rain guards disposed off on the plantations

Plastic wastes from planted areas: To allow tapping during rainy season, a rainguard is fixed above the tapping cut. The material recommended for this is the LDPE virgin polythene 300 gauge. Approximately, 12-14kgs is the estimated requirement for 300 trees. When these are replaced, the estates do not appear to have any systematic way for disposal and these are disposed in the plantation

Photo 13: Polythene rain guards collected and ready for disposal outside the plantation

[5] (see: http://www.beyondpesticides.org/pesticides/factsheets/Glyphosate.pdf; http://www.epa.gov/oppsrrd1/REDs/factsheets/0178fact.pdf; http://npic.orst.edu/factsheets/glyphotech.html).

itself. In some estates the plastic is collected at a central point and sent out.

Social Status of large rubber estates

The information on the social status of workers on the rubber estates was procured from interviews with local people, field observations and from annual reports of the companies.

Working conditions

Both men and Women are employed on these estates, for tapping and for maintenance work. In the HML estates, they particularly note that women are employed on the same terms and conditions as their male counterparts. The daily wages for a tapper on these estates is around Rs. 150 + a fixed amount (Re. 1) for every tree tapped (and slightly more for older trees). In large estates, each worker is assigned one block of trees and is expected to produce a specific quantum of latex from that one block. For any extra latex he produces, the worker gets paid Rs 2/tree. Women sometimes work on these estates too, but they do not get paid for this work. Instead, their husbands get assigned another block of trees to tap. Compared to small holdings, the wage is lower, but benefits of working in the larger estates is greater and often includes housing, medical facilities, etc.

In contrast to this, on small holdings, male laborers are employed to dig pits for new or re-planting of trees, while women remove weeds. Both men and women do land clearing, though women get paid less (Rs. 300/day while the men get paid Rs.400/day) for this task.

Safety

The recommended time of tapping to get maximum yield especially during summer season and in wind prone areas such as the Shencottah Gap is the early hours between 0200hrs and 0600hrs. Being before sunrise and very little natural light, the possibility of accidentally encountering wild animals such as snakes, elephants, etc. is especially high in areas adjoining natural forests. Although there have been very few incidences of workers being attacked, there is a concern for safety of workers. The use of firecrackers in these estates to scare away elephants is common. In both tea and the rubber estates, and especially during the monsoon season, the workers are exposed to leech bites. This is commonly taken care of by using local remedies such as snuff powder mixed with oil or application of dettol (active ingredient: Chloroxylenol).

Workers do not seem to use any protective gear while handling chemicals and application appears to be largely done using a backpack dispensers.

Also no safety training or education for field workers is given, especially regarding the do's and don't's while applying chemicals, and the potential safety issues of these chemicals to human beings.

Photo 14: A plantation worker carrying a backpack pesticide dispenser

Housing

Housing is provided for all plantation workers and some basic provision is made for sourcing water for the residential lines. Between the two large estates, the TRCT estate has a basic medical facility, while one of the HML estates has a hospital and better facilities which is also made available to the TRTC workers. Places of worship are also provided for the workers by both the estates.

Photo 15: A worker eating while applying weedicide (happened to be eating a mango that he picked up from the ground while spraying)

Other Benefits

A primary school has been established and is functioning in the HML estate. For higher education, many of the children travel about 30 km to Tenkasi and adjoining areas in Tamil Nadu. The TRTC has stated in its 2011-12 Annual report[6] that it is the first to form a public charitable trust for the welfare of employees of plantation companies and the first company in the plantation industry to extend financial aid, and to provides scholarships to the children of

[6] Travancore Rubber & Tea Co. Ltd. 2012. Annual report 2011-12. Thiruvananthapuram, India. Accessed from: http://www.reportjunction.com/CompanyProfile/Travancore-Rubber-Tea-Co-Limited-T0216.htm

its employees for higher education.

Some of the benefits provided to the workers on the HML estates include Provident fund (pension fund), gratuity, free housing, crèches (day care center), recreation centres, free medical aid, drinking water, sanitation, schooling for the children up to primary level, protective clothing, sick leave benefits, maternity benefits, and leave with wages. Additionally, HML are reported to have in place a Comprehensive Labour Welfare Scheme (CLWS) on all its estates. The thrust of the CLWS programme being:

1. Childcare and development.

2. Nutrition support and education.

3. Maternal child healthcare and family planning.

4. Health and Social education.

5. Environmental hygiene and sanitation.

6. Planning of leisure.

HML claims that according to these efforts, workers have lower infant and maternal mortality rates, as well as lower birth and death rates, than their counterparts in the rest of Kerala.

TRTC also provides free housing, free medical aid, drinking water and sanitation, schooling for children up to primary level, and shops for procuring household requirements of the workers.

Photo 16: Worker residential lines on the larger estates

Appendix

1. Some plants that are seen in areas where rubber is grown within the study landscape

Botanical Name	Family	Status
Acronychia pedunculata	Rutaceae	-
Actinodaphne malabarica	Lauraceae	VU, RET, EN
Aglaia barberi	Meliaceae	RET, EN
Albizia chinensis	Leguminosae	-
Albizia lebbeck	leguminosae	-
Alstonia scholaris	Apocynaceae	-
*Anacardium occidentale**	Anacardiaceae	-
Antidesma montanum	Euphorbiaceae	-
Aporosa lindleyana	Euphorbiaceae	EN+
Archidendron bigeminum	Leguminosae	VU, EN+
Areca catechu	Arecaceae	-
Artocarpus heterophyllus	Moraceae	-
Artocarpus hirsutus	Moraceae	RET, EN
Benkara malabarica	Rubiaceae	EN+
Bischofia javanica	Euphorbiaceae	-
Bombax ceiba	Bombacaceae	-
Bridelia retusa	Euphorbiaceae	-
Careya arborea	Lecythidaceae	-
Caryota urens	Arecaceae	-
Ceiba pentandra	Bombacaceae	-
Cocos nucifera	Arecaceae	-
Croton malabaricus	Euphorbiaceae	EN
Dipterocarpus bourdillonii	Dipterocarpaceae	CR, EN
*Eucalyptus tereticornis**	Myrtaceae	-
Ficus callosa	Moraceae	-
Ficus exasperata	Moraceae	-
Ficus hispida	Moraceae	-
*Gliricidia sepium**	leguminosae	-
Gmelina arborea	Verbenaceae	-
*Grevillea robusta**	Proteaceae	-
Grewia tiliifolia	Tiliaceae	-
Holigarna arnottiana	Anacardiaceae	EN
Humboldtia vahliana	Leguminosae	RET, EN
Hydnocarpus pentandra	Flacourtiaceae	RET, EN
Knema attenuata	Myristicaceae	RET, EN

Botanical Name	Family	Status
Lagerstroemia microcarpa	Lythraceae	VU, EN
Macaranga peltata	Euphorbiaceae	EN+
Mallotus distans	Euphorbiaceae	EN+
Mallotus philippensis	Euphorbiaceae	-
Mallotus tetracoccus	Euphorbiaceae	VU
Mangifera indica	Anacardiaceae	-
*Manihot carthaginensis**	Meliaceae	-
Melia dubia	Meliaceae	-
Mitragyna tubulosa	Rubiaceae	EN
Moringa pterygosperma	Moringaceae	-
Myristica dactyloides	Myristicaceae	RET, EN+
Pajanelia longifolia	Bignonaceae	-
Persea macrantha	Lauraceae	RET, EN+
Polyalthia fragrans	Annoaceae	EN
Pterospermum reticulatum	Sterculiaceae	RET, VU, EN
*Samanea saman**	Leguminosae	-
Schleichera oleosa	Sapindaceae	-
Scolopia crenata	Flacourtiaceae	-
Solenocarpus indica	Anacardiaceae	EN
Sterculia guttata	Sterculiaceae	-
Strombosia ceylanica	Olacaceae	-
Syzygium aqueum	Myrtaceae	-
*Syzygium aromaticum**	Myrtaceae	-
Tabernaemontana alternifolia	Apocynaceae	NT, EN
Tamarindus indica	Leguminosae	-
Tectona grandis	Verbenaceae	-
Terminalia elliptica	Combretaceae	-
Tetrameles nudiflora	Datiscaceae	-
Thespesia populnea	Malvaceae	-
Walsura trifolia	Meliaceae	EN+
Xanthophyllum arnottianum	Xanthophyllaceae	EN

Status: CR: Critically Endangered, VU: Vulnerable, NT: Near threatened; RET: Rare, Endangered and Threatened Species; * : Introduced; EN: Endemic to India; EN+: Endemic to India and Srilanka

2. Some butterflies found in rubber plantation in the landscape

Scientific Name	Common Name
Abisara Echerius	Plum judy
Ariadne merione	Common Castor
Caleta caleta	Angled pierrot
Catochrysops Strabo	Forget me not
Catopsilia pomona	Common emigrant or Lemon emigrant
Catopsilia pyranthe	Mottled Common emigrant
Cupha Erymanthis	Rustic
Danaus genutia	Tiger
Euchrysops Cnejus	Gram blue
Euploea Core	Common Crow
Eurema hecabe	Common grass yellow
Graphium agamemnon	Tailed jay
Graphium sarpedon	Common Bluebottle
Hypolimnas Bolina	Great eggfly
Hypolimnas misippus	Danaid eggfly
Jamides Alecto	Metallic cerulean
Jamides Bochus	Dark cerulean
Jamides Celeno	Common cerulean
Junonia iphita	Chocolate pansy
Lambrix Salsala	Chestnut bob
Leptosia Nina	Psyche
Melanitis Leda	Common evening brown
Melanitis Phedima	Dark evening brown
Mycalesis Perseus	Common Bush brown
Neptis Columella	Shortbanded sailer
Neptis Hylas	Common sailer
Pachliopta aristolochiae	Common rose
Papilio polytes	Common mormon
Spialia Galba	Indian skipper
Ypthima Baldus	Common five ring
Ypthima Ceylonica	White four ring
Ypthima Chenui (Endemic)	Nilgiri 4 ring
Ypthima Huebneri	Common four ring
Zizina Otis	Lesser grass blue
Zizula Hylax	Tiny grass blue

3. Some Amphibians found in the plantation areas and in the adjoining forest

S.No.	Name of Species	Family	Habitats Sighted*	Local Status	IUCN Status
1	*Duttaphrynus melanostictus*	Bufonidae	T	Common	Least concern
2	*Fejervarya keralensis*	Dicroglossidae	F+P	Common	Least concern
3	*Limnonectes limnocharis*	Dicroglossidae	F+P	Common	Least concern
4	*Minerverya sahyadris*	Dicroglossidae	F	Rare	Endangered
5	*Ichthiophis sp.*	Ichthiophidae	F	Rare	
6	*Indirana beddomii*	Ranixalidae	F+P	Common	Least Concern
7	*Indirana brachitarsus*	Ranixalidae	F+P	Not Common	Endangered
8	*Indirana leithii*	Ranixalidae	F+P	Not Common	Vulnerable
9	*Indirana leptodactyla*	Ranixalidae	F+P	Not Common	Endangered
10	*Indirana Sp*	Ranixalidae	F+P	Rare	
11	*Indirana Sp.1*	Ranixalidae	F	Rare	
12	*Indirana Sp.2*	Ranixalidae	F	Rare	
13	*Micrixalulas saxicola*	Micrixalidae	F	Rare	Vulnerable
14	*Micrixalus fuscus*	Micrixalidae	F+P	Common	Near Threatened
15	*Micrixalus sp1*	Micrixalidae	F	Rare	
16	*Micrixalus thampi*	Micrixalidae	F+P	Rare	Data deficient
17	*Nyctibatrachus aliceae*	Nyctibatrachidae	F+P	Not Common	Endangered
18	*Nyctibatrachus major*	Nyctibatrachidae	F+P	Not Common	Vulnerable
19	*Nyctibatrachus Sp*	Nyctibatrachidae	P	Rare	
20	*Raorchestes Sp*	Rhacophoridae	F+P	Rare	
21	*Raorchestes Sp.1*	Rhacophoridae	F+P	Rare	
22	*Raorchestes Sp.2*	Rhacophoridae	P	Rare	
23	*Pseudophilautus wynaadensis*	Rhacophoridae	F+P	Common	Endangered
24	*Hylarana temporalis*	Ranidae	F+P	Not Common	Near Threatened

*F= Forest, P=Production (rubber and tea)

4. Some mammal species found in proximity to rubber plantations in the Shencottah gap

Scientific Name	**Common Name**	**IUCN status**
Cuon alpinus	Dhole	Endangered
Elephas maximus	Elephant	Endangered
Macaca silenus	Lion-tailed macaque	Endangered
Panthera tigris	Tiger	Endangered
Bos gaurus	Gaur	Vulnerable
Herpestes fuscus	Brown mongoose	Vulnerable
Melursus ursinus	Sloth bear	Vulnerable
Rusa unicolor	Sambar	Vulnerable
Semnopithecus johnii	Nilgiri langur	Vulnerable
Panthera pardus	Leopard	Near Threatened
Felis chaus	Jungle cat	Least Concern
Herpestes smithii	Ruddy Mongoose	Least Concern
Herpestes vitticollis	Stripe-Necked Mongoose	Least Concern
Hystrix indica	Porcupine	Least Concern
Macaca radiata	Bonnet macaque	Least Concern
Moschiola indica	Mouse deer	Least Concern
Muntiacus vaginalis	Barking deer	Least Concern
Paradoxurus hermaphroditus	Common palm civet	Least Concern
Paradoxurus jerdoni	Brown Palm Civet	Least Concern
Prionailurus bengalensis	Leopard cat	Least Concern
Ratufa indica	Malabar giant Squirrel	Least Concern
Viverricula indica	Small Indian Civet	Least Concern

5. Chemicals commonly used as pesticides and to treat disease in rubber plantations

Chemicals used	Disease treated/Comments	Human Impacts	Environmental Impacts
Sulphur	Mixed with talc to treat Powdery mildew.		
Tridemorph	Poria root disease * Listed in SAN, moderately hazardous Class II	No significant impacts	"Very highly toxic" to amphibians
Propiconazole (Tilt, Banner)	Poria root disease * Listed in SAN, moderately hazardous Class II	PAN Bad Actor: Developmental/Reproductive toxin, possible carcinogen, suspected endocrine disruptor	Potential groundwater contamination
Phosphorous acid	Shoot Rot		
Metalaxyl (Ridomil, Subdue)	Shoot Rot		Potential groundwater contamination
Bordeaux mixture	Colletotrichum Leaf Disease, Leaf Spot, Pink Disease,		
Mancozeb (Pace, Penncozeb, Nemispor, Vondozeb, Manganese)	Colletotrichum Leaf Disease, Bird's Eye Spot, Leaf Spot, Black Rot	PAN Bad Actor: developmental toxin, carcinogen, suspected endocrine disruptor	Groundwater contamination, highly toxic to fish and amphibians
Carbendazim	Bird's Eye Spot, Leaf Spot, Powdery Mildew.	Possible carcinogen, suspected ED	Highly toxic to zooplankton
Thiride	Brown Rot		
Contaf	Brown Rot		
Copper Oxychloride (Agrizan , Coppesan , Coprantol , Coprex , Coprosan Blue, Cupramar , Cupravit , Cupricol Cuproxol , Faligruen Fytolan , Kauritil , , Kupricol , Kuprikol , Miedzian, Oleocuprit , Oxicloreto De Cobre , Oxicob , Oxivor , Oxycur , Parrycop , Tamraghol , Vitigran , Vitigran Blue)	Shoot Rot, Leaf Spot		

6. Herbicides commonly used in rubber plantations are listed in the following table:

Weedicide	Human health impacts	Natural Resource Impacts
Diuron	Acutely toxic. Dermal exposure: dry and fissured hands, horizontal ridging or loss of fingernails, ulceration and abrasion. Diarrhea, sometimes bloody, can occur. Central Nervous System effects include giddiness, headache, fever, myalgia, lethargy and coma. Pulmonay fibrosis is the usual cause of death. Used in suicide incidents. Listed in SAN, under moderately hazardous Class II chemical under WHO	High toxicity for aquatic species. Potential for groundwater contamination.
Glyphosate (Roundup)	Symptoms from dermal exposure can include Symptoms resulting from dermal exposure incidental to the use of Roundup included periorbital oedema, and chemosis of the eye, with swelling at the site of contact and prolonged skin irritation.	Relatively benign: little bioaccumulation, low toxicity to other species
Simazine (Amizine, Gesapun, Primatol S, Terraklene)	Reproductive/developmental toxin. Suspected to be an endocrine disruptor. PAN Bad Actor.	Potential to contaminate groundwater. Can be toxic to aquatic species.
Cotoran (Fluometuron, Cottonex, Lanex, Urea)	Possible carcinogen	Can potentially contaminate groundwater. Incidents of bioaccumulation, can be toxic to some aquatic species
Paraquat (Weedol, , Pathclear , Pillarxone , Terraklene)	Is a Persistent Organic Pollutant One of PAN's Dirty Dozen pesticides: Listed in SAN, under moderately hazardous Class II chemical under WHO	Potential to contaminate groundwater
Lasso (Alachlor)	PAN Bad Actor: Known to be carcinogen, reproductive toxin	Known to contaminate groundwater, impact on aquatic species.

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