

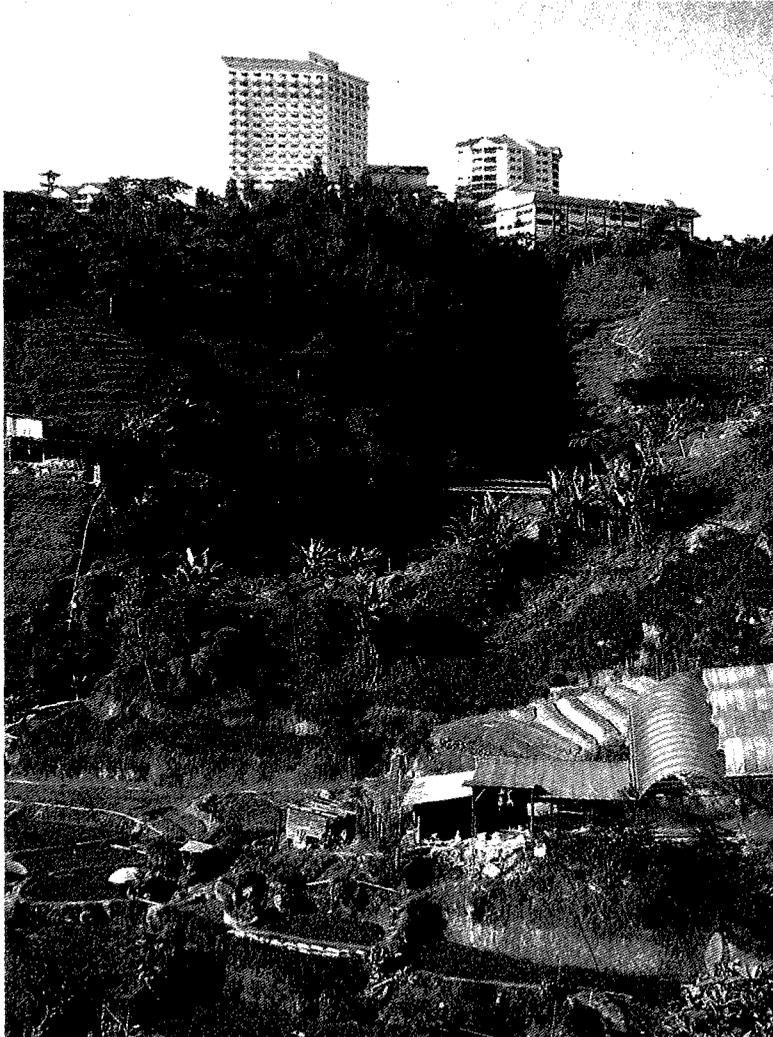
**CAMERON HIGHLANDS**  
**ISSUES & CHALLENGES IN**  
**SUSTAINABLE DEVELOPMENT**

**Editor**  
**Chan Ngai Weng**



# **CAMERON HIGHLANDS**

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***CHAN NGAI WENG***

**CAMERON HIGHLANDS**  
***ISSUES AND CHALLENGES IN***  
***SUSTAINABLE DEVELOPMENT***

*Editor*

*CHAN NGAI WENG, Ph.D. (Middlesex)*

*School of Humanities*  
*Universiti Sains Malaysia*  
*2006*

School of Humanities  
Universiti Sains Malaysia  
11800 USM Penang  
Malaysia

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## FOREWORD

At the invitation of The British Council DFID Higher Education Links and The School of Humanities Universiti Sains Malaysia, I was honoured to be amongst the distinguished company of government officers, scholars and academics, researchers, policy makers, hoteliers, tourist guides, consultants, farmers, NGOs, and members of the public to officiate in the seminar “Sustainable Development of Cameron Highlands: Issues and Challenges”. The seminar is most timely as in recent years, profound changes have occurred in Cameron Highlands, including environmental change. The title of the seminar strikes me as one that is most appropriate at a time when Cameron Highlands, like many highlands in the country, are experiencing rapid development and intense development pressures. We are all in favour of development. To progress, we need development. The people of Cameron Highlands need development. However, that is not to say that development must have a price and bring about negative effects. We can develop Cameron Highlands based on the sustainable development concept. If we development the area carefully with stringent control in terms of environmental protection, we can ensure minimal effects on the environment. Obviously we need to protect the environment in Cameron Highlands. After all, it is the environment (cool climate, clean fresh air, pristine forest, rich biodiversity, etc) that forms the main attractions to tourists. Hence, environmental protection and conservation via sustainable development is crucial for the future of Cameron Highlands. Cameron Highlands will not be a popular tourist destination if its uniquely rich natural attributes are destroyed.

Looking at some of the papers to be presented here, it was found that Cameron Highlands hosts more than 700 plant species of plants, of which 60% are found strictly in the highlands. Of the total plants, 145 endemic species are found in Cameron Highlands, orchids comprising 32 species. At total of 56 mammals, 199 birds, 58 reptile and 14 amphibian species have been recorded here. Of these, the Pitcher plant, Serow, Mountain Peacock-Pheasant and Malayan Whistling-Thrush are listed in the 2004 IUCN Red List of Threatened Species. Based on these alone, Cameron Highlands warrant to be gazetted as a protected area under the Convention on Biological Diversity. As Member of Parliament for Cameron Highlands, I urge the government to reinstate the protected area status for Cameron Highlands as highlighted in the local daily, The Star, 18 Dec 2004 (Camerons for National Park) and 19 Dec 2004 (Camerons National Park Proposal gets the Thumbs-up). There is also overwhelming support by NGOs and the Wildlife and National Parks Department (PERHILITAN). I propose that the gazette include all forests and water catchment areas in the highlands. Gazetting Cameron Highlands as a National Park would also protect the area as a water catchment, given the fact that there have been some problems of water supply for towns and farms. We need to minimise water thefts and pollution of our streams and rivers as a result of farming and other activities. Gazetting the highlands would go a long way in protecting the water resources of Cameron Highlands and Pahang as well as a long-awaited step towards protecting the highlands.

Finally, I would like to thank the organisers for a job well done in organizing the seminar as well as in the publication of this book.

YB S.K. Devamany  
 Member of Parliament Cameron Highlands  
 66C, Persiaran Camelia 3, Bandar Baru  
 39000 Tanah Rata, Cameron Highlands  
 Pahang

## PREFACE

Cameron Highlands is one of the major tourist destinations in Malaysia. The area is also one of the important agricultural areas producing tea, a large variety of vegetables and flowers not only for the domestic market but also for export. The area is also rich in biodiversity and form an important water catchment. Geographically, the area is located on the highland “spine” of Peninsular Malaysia with largely steep slopes and hill peaks. The area has cool temperatures and high rainfall. Hence, with all these attributes, Cameron Highlands is classified as environmentally and ecologically sensitive. Historically, Cameron Highlands was discovered by the British colonialists who found life in the hot and humid lowlands “unbearable”. The area was initially developed as a sanatorium but later became a popular highland resort. Tea was subsequently introduced and became a major product of the area, even until today. Subsequently, vegetable and flower farming became popular and the area was rapidly developed. Over the years, as a result of rapid development, Cameron Highlands has undergone phenomenal changes over the last half-century or so. Some of these changes have brought economic benefits but they have also resulted in negative impacts such as environmental hazards and disasters. Rapid development in the areas of agriculture, tourism, urbanization and more recently housing and infrastructure (highways) has brought negative effects on the once pristine environment. Still, development pressures are mounting as more and more areas are coming under increasing threat from uncontrolled clearing of forests, extraction of forest resources, opening of farms, new highways and housing schemes, extraction of forest products for sale, construction, and the vagaries of climatic change. Due to their high altitude and isolated locality, degradation of the mountains is difficult to monitor and often go unnoticed. The remoteness of the area makes enforcement difficult and haphazard development over the years has led to a multitude of environmental problems as pressures from tourism, construction development, pollution, deforestation and climate changes are eroding the landscape of these vital ecological mountain ranges, leading to deforestation, destruction of water catchments, soil erosion and landslides, water shortages and pollution, sedimentation of waterways and reservoirs, and downstream flooding. In terms of human society the impacts have also been felt, especially loss of life, injury, damage to infrastructure and farms, crop loss and income reduction due to landslides.

With widespread environmental degradation and negative impacts on society, both the government, NGOs and the public are taking positive measures to ensure that such effects can be minimized. While development must go on, Malaysia being a developing nation, the type of development in an environmentally and ecologically sensitive area such as Cameron Highlands needs to be strictly controlled. The many chapters presented in this book as well as experiences from elsewhere have shown that various development activities can be sustainable when carried out with sustainable measures and control, both in terms of structural measures as well as non-structural measures. This book examines the major environmental issues and challenges in Cameron Highlands and looks at ways in which they can be managed in a sustainable manner. Sustainable development should be the long term goal of all stakeholders in Cameron Highlands, ensuring development as well as conservation.

In Chapter 1, Kumaran and Ainuddin give a good introduction to the baseline environmental conditions in Cameron Highlands, highlighting forests, water and the climate of the area. The authors go on to document the rich flora and fauna of the area as well as the uniquely cool climate. They also identified the area as an important water catchment. Alarmingly, they also highlighted the fact that protection of the area had been removed via the Degazettement Notification No 66 of 1962. In Chapter 2, Chan Ngai Weng reconfirms the status of Cameron Highlands an environmentally sensitive area where development is rapidly causing many problems. The author laments on the general poor control over environmental attributes, even though they possess significant economic values for tourism, agriculture, housing and other economic activities. He documents the negative impacts of environmental hazards that has occurred over the years that has resulted in economic losses as well as loss of lives and injury. In order to minimize

such losses, he calls for a balance between development and environmental protection. In Chapter 3, Leong Chow Peng examines a current topic that has caused great concerns among the global community in the 21<sup>st</sup> century – that of global warming. She examines the global scenario as well as the local climate of Cameron Highlands. She found that temperatures in the area have indeed increased but rainfall fluctuations are not conclusive. She recommends that human activities need to adapt to climate change so that losses could be minimized. In Chapter 4, Chan Ngai Weng, Suriati Ghazali and Norizan Md Nor continue the climate argument by looking at urban heat islands in Cameron Highlands. They found that the rapid development of the major urban centers and the increase in built-up areas, increase in human population, increase in number of vehicles and other human activities have all contributed to the occurrence of urban heat islands in the area. They recommend that land use change should be controlled and clearing of forest be strictly prohibited. Controlling the number of vehicles is also another option.

In Chapter 5, Julian Clifton looks at the core business of Cameron Highlands, that of sustaining the tourism industry. He reiterates the unique climatic and environmental attractiveness of the area both for local as well as for foreign tourists, but notes that these attractions are threatened by degradation. He notices that the unique culture as well as the jungle skills of the orang asli are not capitalised by the authorities to further develop tourism. In addition, the immense potential of the area for ecotourism is not developed. He recommends that all stakeholders need to be involved for the tourism industry to become sustainable. Capacity of local stakeholders also need to be increased. Finally, he proposes that gazetting Cameron Highlands as a National Park may prove to be advantageous. Chris Barrow then gives an indepth account of agriculture in Cameron Highlands in Chapter 6, concluding that current practices are environmentally damaging putting the area “at risk”. This confirms what Chan has documented in Chapter 2. Barrow goes on to suggest viable alternatives of sustainable agriculture, including the involvement of orang asli. Taking the agriculture issue further, Ghulam Hashim and Aini Hayati Abdul Rahaman do a detail examination of soil erosion and water pollution the Cameron Highlands in relation to agricultural practices in Chapter 7. They confirm that soil erosion, nutrient pollution and sedimentation are high. Nevertheless, their experience and studies conducted in MARDI have demonstrated that soil erosion, nutrient pollution and sedimentation can be controlled via sustainable agricultural practices that take into consideration natural topographic features, timing of operations, type of crops, and other conservation techniques. Finally, they conclude that partnership between the land users and the government is imperative for successful control of erosion, water pollution and sedimentation.

In Chapter 8, Lim Hin Fui, Woon Weng Chuen and Mohd Parid Mamat examine how orang asli can be integrated into ecotourism. They confirm what Julian Clifton had mentioned in Chapter 5 regarding the untapped potentials of the orang asli in this vital sector. The authors conclude that the active involvement of Orang Asli’s in ecotourism may be achieved with government and private sector investment in putting up basic facilities and providing proper training to the Orang Asli. Tour operators could assist by popularising Orang Asli culture by bringing tourists to visit villages. On the other hand, the Orang Asli need to acquire language and communication skills besides having a sense of time management and commitment. Acquirement of additional knowledge on flora and fauna is essential. The involvement in ecotourism development is expected to uplift their living standards with better income compared to their current income. In Chapter 9, Suriati Ghazali, Chan Ngai Weng and Norizan Md Nor again confirm the findings of Lim et al. They conclude that ecotourism development in Cameron Highlands has both positive and negative economic and socio-cultural impacts on the orang asli. Some of the positive impacts include income generation and employment opportunities, infrastructure development and the improvement of social services, telecommunication and access to electricity. However, the real economic impact is rather small and most of the Orang Asli are at the margin of ecotourism development. As a social group, they are delighted with the arrival of tourists but at the same time they perceived that they gain little from them. Another negative impact involves the degradation of forests and polluted rivers that have affected the well being of orang asli communities. In Chapter 10, Yee Shan Kon and Chan Ngai Weng give an overview of the prospects and challenges of the tourism sector in Cameron Highlands.

They argued for the need for more promotion of tourism in an integrated and sustained manner. The role of the newly formed Cameron Highlands Tourism Development Association (CHTDA) is elaborated in detail. The authors propose that inaccurate and bad press should be strictly controlled as this affects tourism adversely. Tourism also needs more products and better-qualified guides. They also touched on the possibility of a visitation fee and allowing orang asli to play a greater role.

In Chapter 11, Vijendra Daniel talks about the role of environmental awareness, education and monitoring, specifically touching on the role of non-governmental organisations (NGOs) such as the Regional Environmental Awareness Cameron Highlands (REACH). He reconfirms the environmental degradation that has occurred in Cameron Highlands over the years as mentioned by many of the other authors in other chapters. NGOs are important in creating environmental awareness and education as well as in monitoring environmental degradation. NGOs can work with all stakeholders, particularly the government, towards the preservation, restoration and maintenance of Cameron Highlands as an environmentally sustainable agriculture and hill resort within a permanent nature reserve.

Chapters 12, 13 and 14 examine measures and techniques that can be employed to reduce hazards and at the same time conserve the environment and its attributes. In Chapter 12, Leong Kwok Wing and Chan Ngai Weng discuss the use of bioengineering erosion control techniques for sustainable construction in Cameron Highlands. The authors present soil erosion control technologies developed in north America and Europe with the application of bioengineering to heal scarped slopes for sustainable development in tropical environment. They demonstrate that slope rehabilitation and re-vegetation via a “before and after” scenarios at various locations in Cameron Highlands have proven to be effective. They emphasise that sustainable construction and re-vegetation can be carried out with the use of indigenous species of vegetation. The authors give a detail description on bioengineering techniques with the use of erosion control and permanent turf reinforcement mattresses with soil nailing, with consideration of “timing” to effectively control erosion at source to reduce downstream sedimentation. In Chapter 13, Tew Kia Hui and Faisal Hj Ali document the severity of soil erosion in Cameron Highlands due to accelerated rate of land development both in the public and commercial sectors. The authors argue that this problem will persist and worsen unless proper planning and management of land utilisation is adopted at the early stage of any proposed land development. They argue that more definitive guidelines and stringent monitoring and enforcement of land development are required. The authors are convinced that with the application of this new locally developed system, trademarked under EWARNS® (Early Warning And Risk Navigation Systems) as well as an in-depth understanding of the Best Management Practices on erosion and sediment control, it would be beneficial to the knowledge-based community in moving a step closer towards a better understanding of soil erosion issues to ensure a more sound and sustainable development in future. In Chapter 14, Tew Kia Hui and Azman Abu Bakar further the argument of the need to control soil erosion (and landslides) in high risks areas such as Cameron Highlands. Again, the authors warn about the need to control the accelerated rate of land development in both the agricultural and property development sectors. The chapter focuses on soil erosion and sedimentation assessment, control and monitoring plans for agricultural projects in Cameron Highlands. A case study - Proposed High-Tech Hydroponic Farming on Lots 1587 & 1592, Part of Blue Valley Estate, Mukim Hulu Telom, Cameron Highlands, was showcased with the appropriate methodology of assessment, proposed control measures and monitoring plans that could be adopted for future agricultural projects in Cameron Highlands and other highland areas in Malaysia. The authors argue that such assessment and monitoring is crucial in order that potential risk areas be identified first even before carrying out earthworks/land clearing so that an Erosion and Sediment Control Plan could be developed to plan out the staging of earthworks for the entire project area. The chapter concludes with the message that in-depth understanding of the Best Management Practices on erosion and sediment control within an agricultural project is imperative in order to move closer towards a better understanding of soil erosion issues and to ensure sound and sustainable agricultural development in Cameron Highlands.

Chapter 15 summarises the conclusions and recommendations of the book. This is largely based on the final conclusions and recommendations of the seminar on “Sustainable Development of Cameron Highlands: Issues and Challenges” held from 11-12 December 2004 at the Hotel Rosa Pasadena in Brinchang, Cameron Highlands. The first and foremost conclusion is that Cameron Highlands is an environmentally and ecologically sensitive area that has suffered environmental degradation due to rapid development in various sectors. The area is also vulnerable and exposed to current and future development pressures due to its protection status being removed. Hence, the most important and immediate action that needs to be taken by the authorities is to offer the area protection via the Gazettement of a National Park in Cameron Highlands. The chapter also recommends the expedition in the preparation of the Cameron Highlands Structure Plan. The Majlis Daerah Cameron Highlands is in the process of preparing the Master Plan but it is not finished yet. The process needs to be speeded up and the plan put in place to guide development. Another important recommendation is eco-audit for planning purposes in all sectors. Currently, there is no eco-audit for the major sectors of development such as tourism, agriculture and housing. Due to its function as a water catchment area, Cameron Highlands is recommended to remain so in the maintenance of good and clean water quality of its rivers. In recent years, due to many reasons, the quality of river water in Cameron Highlands has deteriorated alarmingly. The chapter also recommends the advocacy of good agricultural practices. This is necessary, as agriculture has often been blamed for the degradation of land and environment in Cameron Highlands. This is predominantly due to the traditional practices of excavating hill slopes and farming on exposed land. A further recommendation is in the area of tourism. Cameron Highlands is one of the top tourist destinations in the country. Hence, it is imperative that the tourism sector be sustainable in the long run. More importantly, what attracts the tourists must not be destroyed or degraded to such an extent that tourists are no longer attracted. Already, it has been shown that the climate is now warmer than it was several decades ago. The natural assets and attributes of Cameron Highlands need to be preserved in order that tourism can remain sustainable. The chapter also recommends that awareness and education programme be increased for all stakeholders as deterioration of the environment and its quality in Cameron Highlands cannot be blamed squarely on one sector or any group of persons. All stakeholders are responsible. Hence, awareness and education should be extended to all. The chapter also recommends interdepartmental coordination (Land and District Office, MDCH, JKR, DOE, Forestry Department, Water Supply Department, etc) and greater enforcement and monitoring (DOE, MCDH, Health Department, NGOs, etc). More frequent monitoring and stricter enforcement by the authorities need to be carried out.

**Chan Ngai Weng**  
Seminar Convenor and Editor  
Universiti Sains Malaysia

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The Editor would like to point out that the views and facts presented in this book are solely those of the individual writers. They are in no way representative of the views of the British Council, Universiti Sains Malaysia, the Editor or any other party that contributed to the publication of this book.

Chan Ngai Weng, Professor  
*School of Humanities*  
*Universiti Sains Malaysia*  
*11800 Penang, Malaysia*  
*Tel: 6-04-6533888 X 3829*  
*Fax: 6-04-6563707*  
*Email: nwchan@usm.my*

## CHAPTER 1

# FORESTS, WATER AND CLIMATE OF CAMERON HIGHLANDS

Kumaran, S.<sup>a,b</sup> and Ainuddin, A.N.<sup>a</sup>

<sup>a</sup>Faculty of Forestry, Universiti Putra Malaysia, 43400 Serdang, Selangor.

<sup>b</sup>WWF-Malaysia, 49 Jalan SS23/15, 47400 Petaling Jaya, Selangor.

Email: [skumaran@wwf.org.my](mailto:skumaran@wwf.org.my), [ainuddin@forr.upm.edu.my](mailto:ainuddin@forr.upm.edu.my)

### Abstract

*Cameron Highlands is one of Malaysia's most popular hill stations. It is well known for its cool weather, hill cottages and tea plantations. The purpose of this chapter is to draw attention to the various forests types within Cameron Highlands with its special significance for biological diversity and important water resources. The climate of Cameron Highlands is discussed in light with the various threats and challenges that this habitat faces and also considering the limited degree of protection afforded to this unique hill station.*

### 1.1 Geographical location

Cameron Highlands is the smallest district in the state of Pahang Darul Makmur, Malaysia and shares its borders with the state of Kelantan and Perak, in the north and west, respectively. It is located on the Main Range (Banjaran Titiwangsa) between 4°20'N – 4°37'N and 101°20' – 101°36'E. The district of Cameron Highlands with an estimated area of 71,218ha is mountainous, ranging from 300m at the river valleys on the eastern boundary to 2110m (G. Irau) on the western boundary. The highest point accessible by road in Peninsular Malaysia, G. Brinchang (2031m), is one of the major peaks in Cameron Highlands, apart from G. Swettenham (1961m), G. Siku (1916m), G. Berembun (1840m), G. Cantik (1802m) and G. Jasar (1704m). An estimated 75% of the district is located above 1000m elevations.

### 1.2 Forests

Tropical forests form the prevailing natural ecosystem within and around the district of Cameron Highlands. The distribution of the various forest types is as follows: Lowland Dipterocarp Forest (LDF) and Hill Dipterocarp Forest (HDF) occur at 100 to 300m elevation and 300 to 750m respectively such as those contained in forest reserves in Ulu Telom; Upper Dipterocarp Forest (UDF) occurs at elevation ranging from 750m to 1200m such as the forest areas at Ringlet; Lower Montane Forest (LMF) occurs at 1200m to 1500m elevation range such as the forested areas close to Brinchang and Tanah Rata towns; Upper Montane Forest (UMF) occurs at elevation greater than 1500m such as mountain peaks and ridge-tops on G. Brinchang, G. Jasar, G. Perdah and G. Irau.

#### 1.2.1 Legal status

Historically, Cameron Highlands district was declared a reserve for deer in 1958 and in 1962 (Gazette Notification 442) protection was extended to all animals and birds. However, on 15 February 1962 (Degazettement Notification No 66) the protected area status of Cameron Highlands was legally struck

off. This means that at one stroke, the protected montane area (defined as areas above 900m elevation<sup>1</sup>) for Peninsular Malaysia is reduced by 80%! (Davison, 1996).

Forests occupy approximately 50,778ha of the Cameron Highlands district, of which 76% are in the Permanent Forest Estate (PFE) and the remaining in stateland forest (Forestry Department Pahang, 2001). The PFE is made up of thirteen permanent forest reserves (Table 1.1).

Table 1.1. Forest reserves within the Cameron Highlands District\*

Forest Reserve (FR)	Area (ha)	Forest type	Significant features
Batu Gangan FR	914.50	LDF, HDF	Water catchment and soil protection
Bertam FR	1,105.60	LDF	Rich in dipterocarps
Bukit Bujang FR	8,578.90	LDF, HDF	Water catchment
Bukit Jerut FR	7,940.70	HDF	Water catchment and soil protection
G. Siku FR	1,060.00	HDF, Montane	Endemic and rare flora; water catchment
Mentigi FR	990.68	HDF, Montane	Endemic and rare flora; water catchment
Ringlet FR	590.00	HDF, Montane	Rare and endangered flora; water catchment
Sg. Kial FR	893.00	LDF	River reserve for soil protection and catchment
Sg. Terla FR	1,926.70	LDF	Water catchment
Sg. Wi FR	11,417.60	LDF	Rich in dipterocarps
Ulu Bertam FR	739.00	Montane	Endemic and rare flora; water catchment
Ulu Ichat FR	291.00	Montane	Endemic and rare flora; water catchment
Ulu Lemoi FR	2,324.00	LDF	Rich in dipterocarps
<b>Total</b>	<b>38,771.68</b>		

\*As of 31 Dec 2000. Source: Forestry Department Peninsular Malaysia (2001); Forestry Department Pahang (2001); Economic Planning Unit (1993).

Over the years, the forest cover in the district of Cameron Highlands have declined drastically owing to a number of activities, agriculture being the primary cause followed by urbanization such as property development, infrastructure development such as road construction, water supply pipeline, etc. For example, the two sub-catchments, i.e. Upper Telom and Upper Bertam where much of the established locations of human encroachments activities occur, the forest cover measured at 95% in 1947 has now reduced to only 51% in 2003 (Table 1.2).

### 1.2.2 Flora and Fauna

Relatively few plant and animal species span the complete range of altitudinal forest cover. Biological diversity is characterized by altitudinal zonation and show exclusivity to particular vegetation zones on the highlands (Lim and Muul, 1978). This leads to the assumption that plants and animals in the highlands have evolved physical, physiological and behavioral adaptations to cope with the adverse conditions at high altitudes.

The cool and moist montane rain forests generally tend to host smaller and much less diverse group of plants and animals compared to the lowland rain forests. This lower productivity<sup>2</sup> in the highlands could only be attributed to the lower carrying capacity of the montane forests compared to the more productive

<sup>1</sup> Montane forests occurs generally on elevation above 900m in Peninsular Malaysia, where changes in forest structure become prominent, vascular and non-vascular epiphytes become abundant and canopy height reduces to about 15-33m (lower montane forests) and 1.5-18m (upper montane forests) Whitmore (1984)

<sup>2</sup> Defined as lower count of total plant-animal biomass per hectare.

lowland forests. This supports the argument put forward by Wells, *et. al.* (1979) and Wells (1985) that steep land boundary can be important limit to lowland species.

Table 1.2. Summary of land use in two catchments in Cameron Highlands

Land use types	Upper Telom and Upper Bertam catchments (ha)						
	1947*	1966**	1974**	1982 <sup>#</sup>	1990 <sup>#</sup>	1997 <sup>#</sup>	2003 <sup>@</sup>
Forests	16,185.8	13,373	13,071	12,483	12,371	10599	8702
Grassland, shrub forest & shifting cultivation	Unknown	1,342.2	1,082.4	848	817.8	1,560.7	1,340.3
Market gardening & mixed agriculture	291.3	407	653.5	1,595.4	1,743.4	3,048.6	5,035
Tea & orchards	469	1,524.7	1,853.4	1,661.4	1,631.2	1,290.3	1,067
Residential/estate, buildings & associated areas	Unknown	356.7	315.5	435.7	447.6	505.7	788.4
Mining	None	2	3.2	1	0.6	0.6	13.1
Agriculture experimental station	37.5	42.4	44.9	38	41.2	39.6	40
Water body	None	Not recorded	44.9	44.8	44	45	74
Clear/open land	115.4	13.7	38	Not recorded	11.1	17.3	47.6
<b>Total</b>	<b>17,099</b>	<b>17,048</b>	<b>17,107</b>	<b>17,108</b>	<b>17,108</b>	<b>17,107</b>	<b>17,107</b>

\*Land use map published by the Department of Survey

\*\*Wong, I.F.T. (1974) The Present Land Use of Peninsular Malaysia

<sup>#</sup>Land use map by the Department of Agriculture

<sup>@</sup>Extracted from Cameron Highlands Structure Plan Study (1995 – 2020)

Every mountain area is distinctly different, not only in its flora and fauna but also in geology, soil, stability, etc (Burgess, 1969; Burkill & Holttum, 1923; Kiew, 1998; Kitayama, 1995; Soepadmo, 1971; Stone, 1981; Steenis, 1964). Current botanical accounts indicate that the summit regions of G. Berembun, G. Brinchang and G. Perdah are floristically outstanding due to the combined effects of past geological history, phytogeographical relationships and edaphic as well as climatic factors operating in a particular mountain. These three locations are proposed as prime flora conservation areas for Cameron Highlands (WWF-Malaysia, 2001).

Perumal and Lo (1998) published an initial checklist of highland plant species. At present it denotes the most comprehensive and recent consolidation of floristic information documented to-date. It must be noted that the figures in this checklist are a gross underestimate of the total number of species found in Cameron Highlands. The checklist of plants for Cameron Highlands is still non-exhaustive as much of the botanical work in the highlands have revolved around seed plants while much of the non-seed plants have been somewhat neglected. The authors caution that there could be possibilities of inaccuracy in the documentation due to taxonomic nomenclature inconsistency.

The forests of Cameron Highlands hosts 727 plant species, of which Dicotyledon make up 53.4% of the total plant species followed by Monocotyledon and Fern and Fern Allies at 34.7% and 11.8% respectively. The Gymnosperm group has one species recorded in Cameron Highlands. An estimated 23.8% of Peninsular Malaysia's total highland plant species of the four plant groups considered are known to occur in Cameron Highlands.

Of the 727 species, 61.2% (445 species) are found strictly in the highlands or "highland specialists", denoting that they occur exclusively in the highlands. A high level of endemism characterizes the flora of Cameron Highlands. Of the total recorded plant species, 145 endemic species have been recorded in Cameron Highlands. This includes 84 species of Dicotyledon, 49 species of Monocotyledon and 12 species of Fern and Fern Allies (Table 1.3). Not surprising, the highest number of endemic species (32) is in the family Orchidaceae (orchids) from the Monocotyledons (Perumal and Lo, 1998), which thrive well in high humidity environment, being epiphytic.

Table 1.3. Endemism and rarity among plant species found in Cameron Highlands

Plant group	No. of endemic species	No. of rare species	No. of endemic and rare species
Dicotyledon	84 (57.9%)	44 (84.6%)	14 (87.5%)
Monocotyledon	49 (33.8%)	5 (9.6%)	1 (6.25%)
Ferns and fern allies	12 (8.3%)	3 (5.8%)	1 (6.25%)
Gymnosperm	0 (0%)	0 (0%)	0 (0%)
<b>Total</b>	<b>145 (100%)</b>	<b>52 (100%)</b>	<b>16 (100%)</b>

Source: Perumal & Lo (1998)

Faunal distribution is limited by similar factors to that of floral dispersal, particularly in the highlands, i.e. adverse climate, shortage of food (or nutrients) and lack of shelter. Animals are more susceptible to shortage of food and lack of shelter than plants. In the (upper) montane environment, the lower canopy height provides fewer forest strata for animals to exploit suitable niches compared to the towering giants of the lowland rainforests. Montane forests have less fruiting trees and are dominated by oaks and laurels that are exploited by small mammals and birds.

The fauna profile of Cameron Highlands denotes that a total of 56 mammal, 199 bird, 58 reptile and 14 amphibian species have been recorded (Medway, 1983; Jeyarajasingam and Pearson, 1999; Lim *et al.*, 2002). These numbers amounts to 26%, 31%, 27% and 16% respectively, of the fauna for each taxa found in Peninsular Malaysia. Cameron Highlands is the refuge for several faunal species that are endemic to Peninsular Malaysia. They are the Malayan Mountain Spiny Rat, Mountain Peacock Pheasant, Malayan Whistling Thrush, Malaysian Hill-partridge, Smedley's keelback, Malayan mountain keelback, Williamson's reed snake, Butler's world snake, Malayan mountain reed snake and Tweedie's reed snake.

Cameron Highlands also give shelter to the Serow (*Capricornis sumatrensis*), Mountain Peacock-Pheasant (*Polyplectron inopinatum*) and Malayan Whistling-Thrush (*Myophonus robinsoni*) listed as an endangered<sup>3</sup> species according to the IUCN Red List of Threatened Species (Ballie, *et al.*, 2004).

<sup>3</sup> A taxon is Endangered when the best available evidence indicates that it meets one of the criteria listed (A to E) and it is therefore considered to be facing a very high risk of extinction in the wild as defined by the criteria listed by IUCN.

One rare vertebrate skink species (*Lygosoma miodactylum*) and two strictly montane species, the Pygmy fruit bat (*Aetholops alecto*) and Short-tailed mole (*Talpa micrura*) (Medway, 1983) seek refuge in Cameron Highlands.

### 1.3 Water resources

These forests situated in the head waters of catchments receive abundant rainfall and are able to strip and retain moisture from clouds that are vital for abundant, clean and predictable water supplies in many areas, particularly in the lowlands and especially during dry seasons. Cameron Highlands district is the headwater catchment for Sungai Pahang and Sungai Perak. Three main rivers drain Cameron Highlands, viz. Bertam, Telom, and Lemoi. At the moment, an estimated 5.8 million litres per day (MLD) of water is abstracted at several water intake points from rivers originating from montane forests in Cameron Highlands for drinking water supply.

Cloud interception of montane forests is common but studies of this phenomenon in Malaysian cloud forests are rare. Montane cloud forests, vital and unique habitats for innumerable endangered species and important water sources for lowland farmers, rural communities and cities, are under increasing threat of destruction. Bruijnzeel, *et al.* (1993) found evidence that about 9% of the total precipitation came from cloud interception on G. Silam, an isolated mountain in eastern Sabah for 6 weeks in dry season. Early results of measurements taken on G. Brinchang (2031m) over 10 months (Nov '03 – Aug '04) showed cloud water interception of 135mm (9% of rainfall) with a high variability on a monthly basis between 2% to 19% (Kumaran, *et al.*, 2004). Longer-term results are forthcoming and may be useful for water resources management in tapping cloud water, particularly during dry season.

In other parts of the world for example, the cloud forests of La Tigra National Park in Honduras provide over 40% of the water for the 850,000 people living in the capital, Tegucigalpa. All of the water used by the Tanzanian capital, Dar Es Salaam, during the dry season for drinking and powering hydroelectricity originates in the cloud forests of the Uluguru Mountains (see also Chapter 2).

### 1.4 Climate

It is a well-known fact that temperature is inversely related to altitude, i.e. with increasing altitude, temperature drops. The temperature at any particular location in the highlands can be predicted by reducing the value measured at a nearby lowland station by a rate, which is dependent on the altitude of the highland station. Commonly, reduction rates of 0.549°C, 0.613°C and 0.711°C per 100m increase in altitude can be used to give reasonable temperature estimates of the minimum, mean and maximum temperatures respectively of a station in the highlands. Further, the Main Range mountain mass has a strong influence on the climate causing considerable orographic rainfall and cloud water interception especially on the rain-bearing windward Southwestern and Northeastern sides of the mountain.

Cameron Highlands has a meteorological station with long term record of a full range of weather and climate data. The difference in elevation of the highlands often results in a much lower temperature, higher relative humidity and a lower solar radiation and this is reflected in the long-term records here.

The average temperature recorded at Tanah Rata is about 18°C while the mean minimum temperature is about 15°C. The mean maximum is around 22°C. These temperatures fluctuate little from month to month while the daily deviation is between 5 to 7°C.

Despite the fact that Cameron Highlands is situated in the highlands, time series of the mean maximum and minimum annual temperatures for Tanah Rata plotted for the period 1965 – 2002 indicate that the temperatures have been steadily increasing since the mid 1970's parallel with rise in global temperature

(Figure 1.1). The 24-hour mean temperature had either a small increasing or no trend for the period prior to 1975, but have been increasing gradually since. The warmest year was 1998 and temperatures in 2002 was the second highest in record. This trend was similar for the whole country. The steady increase in temperature at Tanah Rata could be partly or entirely caused by global “greenhouse” warming effect. However, it must be noted that it is not possible yet to quantify the relative contributions of the various factors, viz. deforestation, urbanization and greenhouse gasses to local temperature changes.

The Meteorological Station at Tanah Rata recorded as much as 3153mm in 1956 to as low as 1969mm annual rainfall in 1986 with 13 – 26 rain days/month. The wettest period is from October to November with rainfall of about 350mm per month while the driest months are between January and February with about 100mm rainfall per month. However, short “dry spells” are felt in the months of June and July, coinciding with low rainfall. Compounded by hill clearing, irregular and uncontrolled development and hundreds of illegal pipe connections, acute water shortage is leading to disruption of water supplies and sometimes even rationing of drinking water supplies in some parts of the district. Relative humidity remains high at 75 – 85% due to the altitude and high incidence of mist and cloud formation, giving the lowest figures for mean sunshine hours (3.5 – 5.5 hours/day) and mean evaporation (1.5 – 2.0mm/day) in Peninsular Malaysia (Figure 1.2 and Figure 1.3).

### 1.5 Threats

The high level of floral and faunal diversity of Cameron Highlands, combined with its high amounts of rainfall and cloud interception are subject to anthropogenic disturbances such as forest encroachment by farms, unsustainable and uncontrolled farming practices, unsustainable road construction, warmer temperature, landslides and soil erosion due to land clearing, eventual habitat destruction and species loss.

Despite various strengths of the hill resort, such as the availability of local development plans, good access, good administrative and service facilities, rich biological diversity and existence of nature trails, the weaknesses seem to outweigh the strong points inherent in Cameron Highlands.

Some of the weaknesses are incongruent development such as building heights that are incompatible with the environment, Temporary Occupation License (TOL) land which hampers long term agricultural tenure and security resulting in poor agricultural practices, which in turn have caused soil erosion leading to severe siltation of rivers.

There are weaknesses in the Cameron Highlands Local Plan which needs to be reviewed critically taking into consideration the population needs and demands, zoning of the built environment to protect the skyline from grossly built structures.

The agriculture sector has been identified as one of the main contributing factors to environmental degradation through the use of pesticides, fertilizers and unsustainable agricultural practices.

There is also insufficient site-specific information biological diversity although there are reasonable amount of information relating to the total biodiversity in Cameron Highlands. The consequence of this is that development decisions are not based on accurate, complete and recent information on biological diversity particularly of areas/habitats that are ecologically sensitive from the biodiversity context. This could lead to habitat degradation and eventually species extinction!

Cameron Highlands no longer enjoys a protected area status and much of its land area overlaps with forest reserves. There are also weakness in management and enforcement due to lack of capacity to monitor and enforce regulations and guidelines by the relevant Local Authorities.

Threat of water shortage whenever there is a “dry season” is becoming more widespread, despite Cameron Highlands situated in the headwater catchments. This could be partly due to the fact that the district is situated on higher ground where the water catchment areas are smaller, and partly due to illegal tapping of water, mainly by farmers.

## 1.6 Conclusion

This chapter highlights that the high biological diversity in the various forest types of Cameron Highlands are under considerable threat of being reduced due to deforestation and conversion of forests to other land use. The current legal status accorded to the forests in Cameron Highlands is marginal for long-term ecological integrity and habitat viability, considering the mounting imminent threats. Cameron Highlands’ water catchments situated in the headwaters (“water towers”) have a dual role: trapping rain and cloud water. Early results indicated that cloud water interception in the mountainous regions might be a viable option for cloud water harvesting. The long-term temperature profile indicates a gradual increasing trend, which may have serious detrimental effects on biological diversity, sustainable tourism and highland agriculture.

## Acknowledgement

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## Bibliography

- Ballie, J.E.M., Hilton-Taylor, C. and Stuart, S.N. (eds) 2004. *2004 IUCN Red List of Threatened Species. A Global Species Assessment*. IUCN, Gland, Switzerland and Cambridge, UK.
- Buijnzeel, L.A., M.J. Waterloo, J. Proctor, A.T. Kuiters and B. Kotterink. 1993. Hydrological observations in montane rain forests on Gunung Silam, Sabah, Malaysia, with special reference to the Massenerhebung’ effect. *Journal of Ecology* 81: 145-167.
- Burgess, P.F. 1969. Ecological factors in hill and mountain forests of the States of Malaya. *Malayan Nature Journal* 22: 119-128.
- Burkill, I.H. and Holttum, R.E. 1923. A botanical reconnaissance upon the Main Range of the Peninsula at Fraser’s Hill. *Gardens’ Bulletin of Straits Settlements* 3: 19-110.
- Davison, G.W.H. 1996. *Land use Planning for the Highlands: Protected Area in the Malaysian Mountains*. Report produced under Project MYS 333/95, World Wide Fund for Nature Malaysia, Petaling Jaya. 20pp.
- Economic Planning Unit. 1993. *Malaysian National Conservation Strategy: Towards Sustainable Development. Vol. 3: Critical Areas*. Economic Planning Unit, Kuala Lumpur.
- Forestry Department Pahang 2001. *Laporan Tahunan*.
- Forestry Department Peninsular Malaysia 2001. *Laporan Tahunan*.
- Jeyarajasingam, A. and Pearson, A. 1999. *A field guide to the birds of West Malaysia and Singapore*. Oxford University Press Inc., New York. 460pp.

- Kiew, R. 1998. *The seed plant flora of Fraser's Hill, Peninsular Malaysia: with special reference to its conservation status*. Research Pamphlet No. 121. Kuala Lumpur: Forest Research Institute Malaysia.
- Kitayama, K. 1995. Biophysical conditions of the Montane Cloud Forests of Mount Kinabalu, Sabah, Malaysia. In: *Tropical Montane Cloud Forests*, eds. L.S. Hamilton, J.O. Juvik and F.N. Scatena, 183-197. Springer-Verlag, New York.
- Kumaran, S., Perumal, B., Davison, G., Ainuddin, A.N. and Lee, M.S. 2004. Tropical Montane Cloud Forests in Malaysia: Current state of knowledge. Presented at "Mountains in the Mist: Science for Conserving and Managing Tropical Montane Cloud Forest", 2<sup>nd</sup> International Symposium, Waimea, Hawaii 27 July - 1 August 2004.
- Lim, B.L. and Muul, I. 1978. Small mammals. In: *Kinabalu, Summit of Borneo, Sabah Society Monograph*. (eds) Luping, D.M. Chin Wen and E.R. Dindsley. The Sabah Society, Kota Kinabalu. Pp 403 - 458.
- Lim, K.K.P., Leong, T.M. and Lim, B.L. 2002. Herpetofaunal records from Cameron Highlands, Peninsular Malaysia. *Journal of Wildlife and Parks* 20: 49-57.
- Medway, Lord. 1983. *The wild mammals of Malaya (Peninsular Malaysia) and Singapore*. 3rd edition. Oxford University Press, Kuala Lumpur.
- Perumal, B. & F.S.J. Lo 1998. *Recorded Mountain Trees of Peninsular Malaysia - A Checklist*. Report produced under Project MYS 276/93 & MYS 339/96, World Wide Fund for Nature Malaysia, Petaling Jaya.
- Soepadmo, E. 1971. Plants and vegetations along the path from Tahan to Gunung Tahan. *Malayan Nature Journal* 24(3&4): 118-124.
- Steenis, C.G.G.J. Van. 1964. Plant geography of the mountain flora of Mount Kinabalu. *Proceedings of the Royal Society London Series (B)* 161: 7-38.
- Stone, B.J. 1981. The Summit Flora of Gunung Ulu Kali (Pahang, Malaysia). *Federation Museum Journal Volume 26(1) New Series*.
- Wells, D.R. 1985. The forest avifauna of western Malesia and its conservation. In: *Conservation of Tropical Forest Birds*, eds. A.W. Diamond & T.E. Lovejoy, 213-232. ICBP, Cambridge.
- Wells, D.R., Hails, C.J. and Hails, A.J. 1979. *A study of the birds of Gunung Mulu National Park, Sarawak, with special emphasis on those of lowland forests*. Royal Geographical Society Gunung Mulu Expedition.
- WWF-Malaysia 2001. *Study on the Development of Hill Stations - Final Report Volume 1: Cameron Highlands, Genting Highlands, Fraser's Hill*. Report prepared for Economic Planning Unit, Prime Minister's Department.

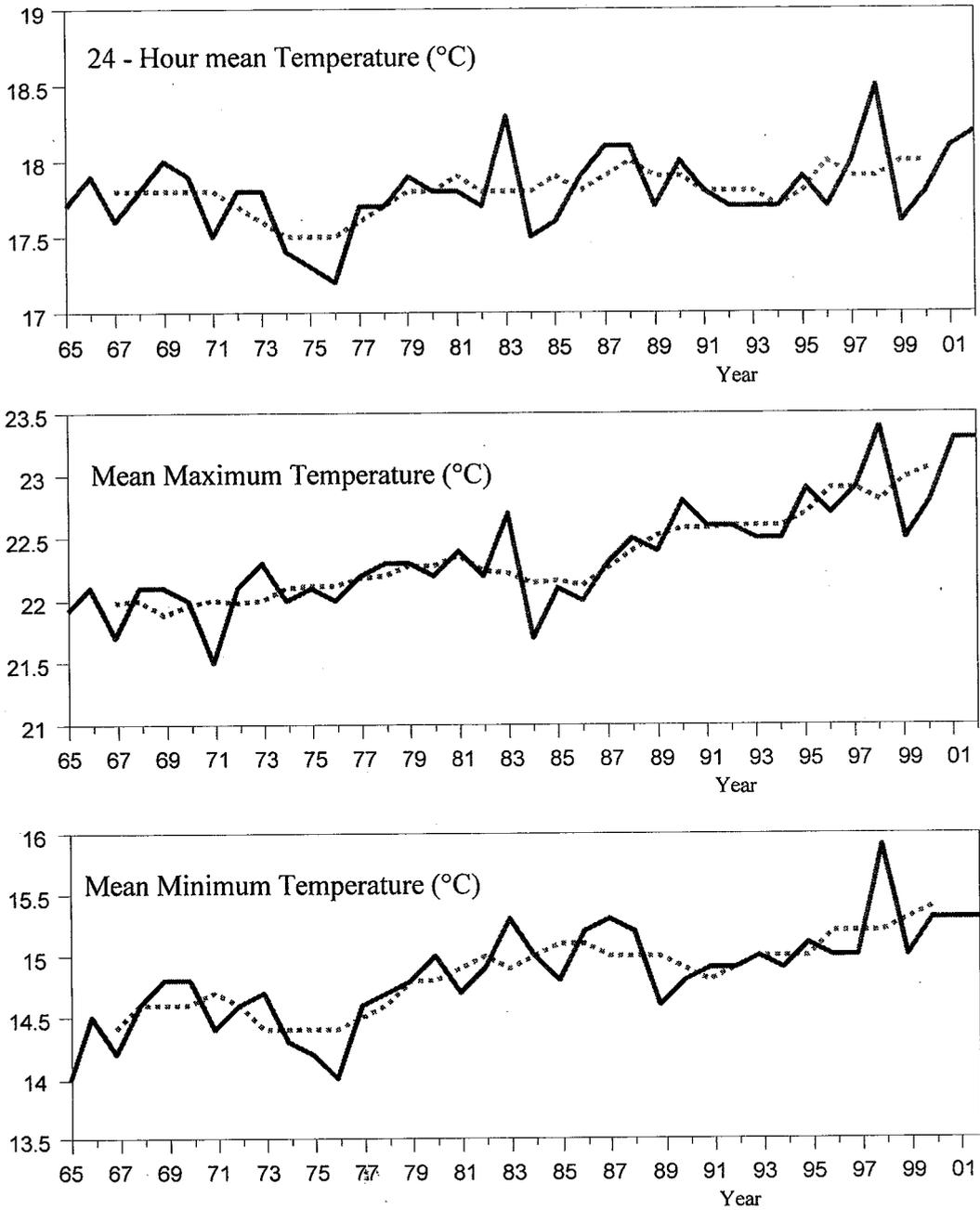


Figure 1.1. Temperature profile of Cameron Highlands (Tanah Rata)

**Annual Values** —————  
**5 yr moving average** .....

For 24 - Hour Mean Temperature, the data are from the Cameron Highlands (Tanah Rata) Station from 1965 to 1983 and the Cameron Highlands Main Meteorological Station from 1983 to 2002 (Source: Malaysian Meteorological Services)



Figure 1.2. Mean daily evaporation rate (mm/day) for 2022

Source: Malaysian Meterological Services

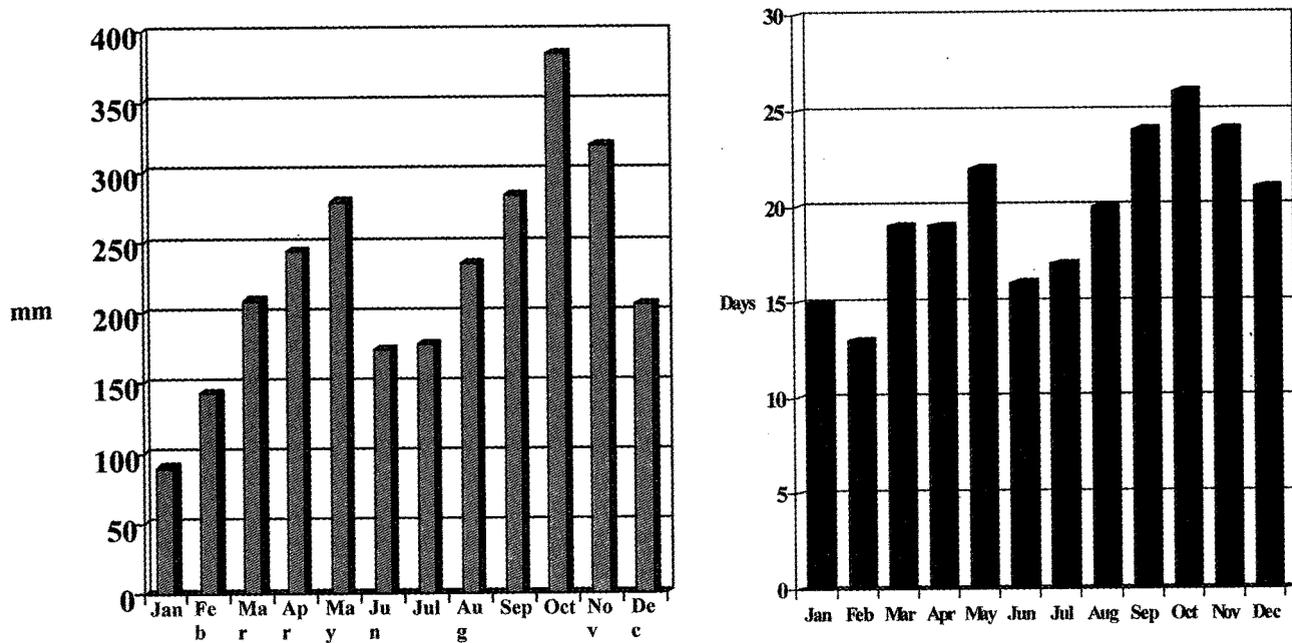


Figure 1.3. Rainfall and rain days at Cameron Highlands (2002)  
 (Source: Malaysian Meteorological Services)

## CHAPTER 2

# STRIKING A BALANCE BETWEEN DEVELOPMENT AND ENVIRONMENTAL PROTECTION IN CAMERON HIGHLANDS

Chan Ngai Weng  
Professor  
School of Humanities  
Universiti Sains Malaysia, 11800 USM Penang, Malaysia  
Email: [nwchan@usm.my](mailto:nwchan@usm.my)

### Abstract

*Cameron Highlands is one of the major tourist destinations in Malaysia. At the same time, it is also one of the significant agricultural areas producing not only for the domestic market but also for export. Geographically, the area is located on the highland "spine" of Peninsular Malaysia with largely steep slopes and hill peaks, and is hence classified as environmentally and ecologically sensitive. However, it remains one of few areas with a cool climatic regime in a hot equatorial country. Historically, Cameron Highlands was discovered by the British colonialists who found life in the hot and humid lowlands "unbearable". The area was initially developed as a sanatorium but later became a popular highland resort. Tea was subsequently introduced and became a major product of the area, even until today. Subsequently, vegetable and flower farming became popular and the area was rapidly developed. Over the years, as a result of rapid development, Cameron Highlands has undergone phenomenal changes over the last half-century or so. Some of these changes have brought economic benefits but they have also resulted in negative impacts such as environmental hazards and disasters. Rapid development in the areas of agriculture, tourism, urbanization and more recently housing and infrastructure (highways) has brought negative effects on the once pristine environment. Still, development pressures are mounting as more and more areas are coming under increasing threat from uncontrolled clearing of forests, extraction of forest resources, opening of farms, new highways and housing schemes, extraction of medicinal plants and other forest products for sale, construction, and the vagaries of climatic change. Due to their high altitude and isolated locality, degradation of the mountains is difficult to monitor and often go unnoticed. The remoteness of the area makes enforcement difficult and haphazard development over the years has led to a multitude of environmental problems as pressures from tourism, construction development, pollution, deforestation and climate changes are eroding the landscape of these vital ecological mountain ranges, leading to deforestation, destruction of water catchments, soil erosion and landslides, water shortages and pollution, sedimentation of waterways and reservoirs, and downstream flooding. In terms of human society the impacts have also been felt, especially loss of life, injury, damage to infrastructure and farms, crop loss and income reduction due to landslides. This chapter examines the major environmental issues and looks at ways in which they can be managed in a more sustainable manner.*

### 2.1 Introduction

In hot tropical countries, the cooler climate of hills has attracted some development in terms of tourism resorts and agriculture. This has been the case for many hill resorts in Malaysia such as Cameron Highlands, Fraser's Hill, Genting Highlands, Bukit Larut, Penang Hill and others. Cameron Highlands has often been described as an "Ideal Spot For Recuperation" as it was initially opened up by the British as a sanatorium (Khor, 2003). Cameron Highlands is a popular holiday retreat for Europeans and Malaysians in the country (Figure 2.1). In the past, development of hill resorts such as Cameron Highlands did not bring about significant negative effects, as development in the difficult terrain was

slow. Increasingly, however, highlands have experienced development due to construction of new highways, dams, logging, mining, agriculture and other developments. These activities have brought about significant impacts to both physical as well as social environment (Chan, 1997a).

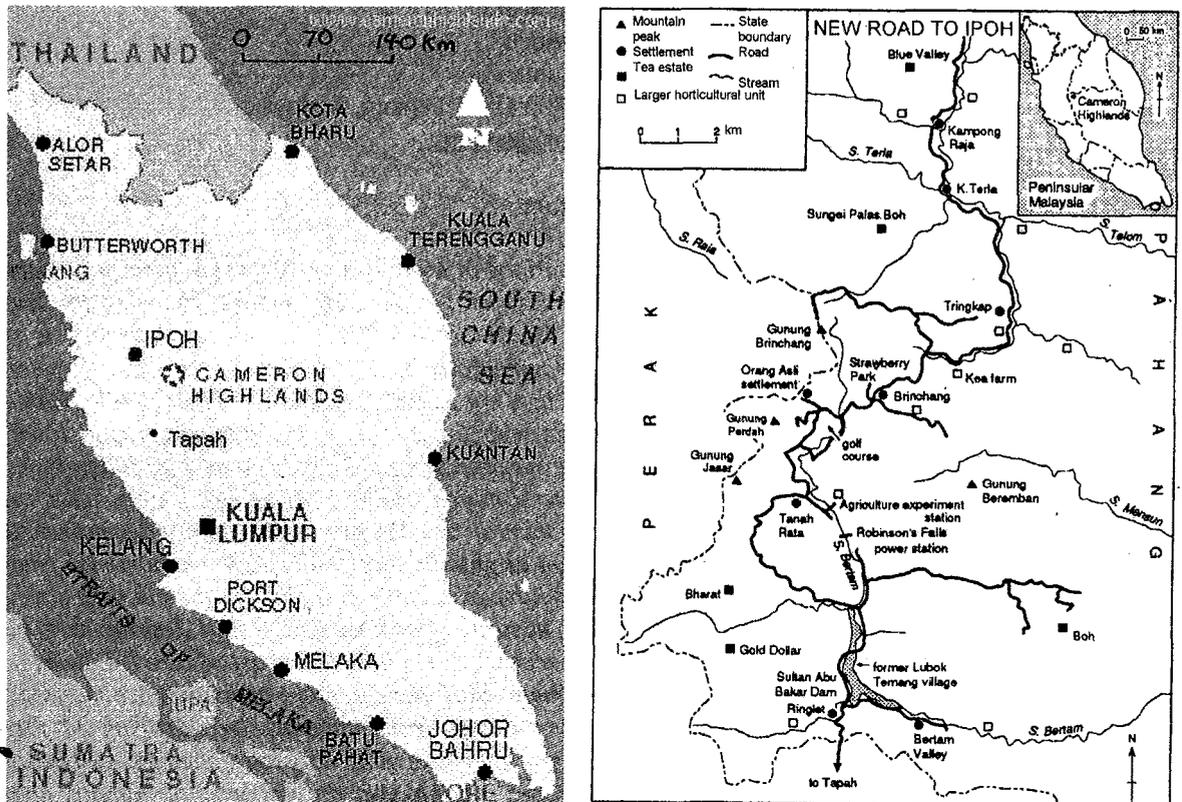
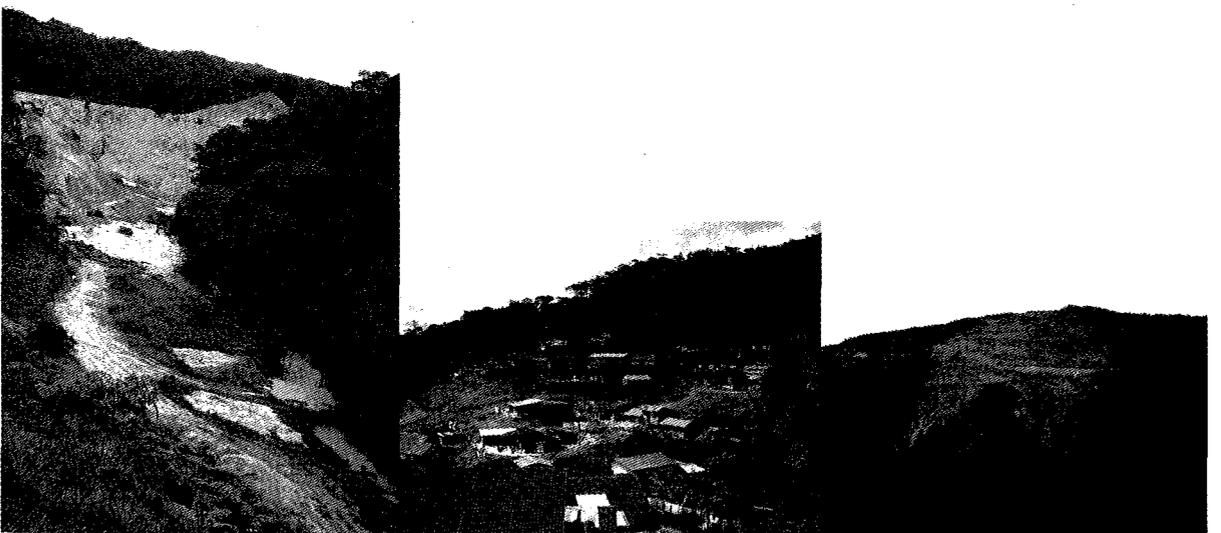


Figure 2.1: Location of Cameron Highlands in Peninsular Malaysia (Source: <http://www.world66.com/asia/southeastasia/malaysia/cameronhighlands> and from Barrow Chapter 6).

Historically, Cameron Highlands, was discovered by the British surveyor William Cameron in 1885. The area was initially used as a retreat because of its cool climate and fresh air (Photograph 2.1 Left), but the Post-Independence Period from 1957 to 1973 saw phenomenal land use change from virgin forest to agriculture crops, tea plantations (Photograph 2.1 Right) and vegetables farms, housing schemes, roads, logging, resettlement of Orang Asli and other infrastructure developments (Photograph 2.2). From 1974 to 1990, it was rapid urbanization, logging, power plants, more tea estates, livestock farming, small-scale industries, agriculture, highway construction, and tourism developments. From 1990 to the present day, it was a period of most rapid development in Cameron Highlands. Cameron Highlands was aggressively promoted as a major tourist attraction. In order to realize Cameron Highlands' potentials as a major tourist resort, many hotels have been built, and infrastructure constructed. Many highways are currently being built or planned to improve accessibility. All these developments have led to environmental degradation, threatening the highlands.



Photograph 2.1: Left - Pristine rainforests on the lower elevations and montane forests on higher elevations produce a cool attractive climate. Right – Forest have made way for tea plantations, which not only provide income and jobs but are also a major tourist attraction in Cameron Highlands.



Photograph 2.2: Left - Land clearance for farming, housing, highways, dams and others have caused deforestation leading to negative environmental problems such as soil erosion, landslides, sedimentation of rivers, water pollution, increasing temperatures, and general environmental degradation, all of which threaten the sustainability of Cameron Highlands. Middle – Large tracts of forests are cleared for new villages like this Orang Asli settlement of Sungai Ruil near Tanah Rata. Right – In order to improve accessibility, new highways such as this Simpang Pulai-Kampung Raja highway connects the city of Ipoh in Perak to Cameron Highlands in Pahang. As this photograph shows, building highways entail clearing large tracts of forests and cutting of steep slopes. Many new highways are currently being built to connect Cameron Highlands to Gua Musang in Kelantan State and another new highway to Pahang State.

## 2.2 Negative Impacts on Environment and People

Increasingly, highlands have become a prominent target in the country's quest for development. The most obvious industry, which actively encourages hill development, is the tourism industry, often regarded as one of the pillars on which the Malaysian economy will depend on in the future. As such, tourism is one of the main thrusts of Malaysia's economic development strategies to draw in tourist dollars (Lim and Lee, 1992). Since the 1980s, many hill resorts have been rapidly developed, often without careful consideration about the carrying capacities of these sensitive areas. Furthermore, rapid development in all sectors, notably in industry, commerce, construction, agriculture and infrastructure and urbanisation has led to greater demand for land. Currently, smaller States which have limited land resources such as Penang, the Federal Capital and prominent highland areas are experiencing rapid development. Many of these areas are now being developed and degraded, and because highland areas usually coincide with water catchment areas, the destruction of the former can have severe irreversible environmental effects on the latter. Malaysia's ambitious Vision 2020 objective of becoming a fully developed nation by the year 2020 will come with a price if its highlands (a valuable natural heritage) are destroyed.

The story of Cameron Highlands is a prominent case whereby development needs to be carefully balanced with environmental protection. Cameron Highlands is currently still remotely tucked away serenely amidst the clouds at elevations of between 1,500 and 1,829 meters above sea level. The area is politically under Pahang's jurisdiction but the influence of the Chinese (mostly farmers) from Perak is predominant. Cameron Highlands was first discovered by the British surveyor, William Cameron in 1885 when he led an expedition up the Titiwangsa Range. It was first opened as a hill station. During the British colonial rule, Cameron Highlands was nicknamed "Little England" as the architecture as well as the environment resembled the countryside in England. As such, the area was a favourite get-away amongst the British. Even today, there are many old English country inns, chalets, and Victorian-styled government rest houses along the main roads. To many, the cool and unpolluted mountain air and panoramic green terraced slopes and mist-covered forests make the area an ideal holiday resort. Over the years, Cameron Highlands has developed into a favourite tourist resort, both for local as well as foreign tourists. During the British era, Cameron Highlands was used as a hill resort (due to the cooler climate) but the area has been mostly developed for highland agriculture (vegetables and flowers) after independence until today. It is also known as the "Green Bowl" of the country, supplying the local as well as international market (mostly Singapore) with cabbages, tomatoes, lettuces, green peppers and other highland vegetables. Hillsides and slopes are now planted with tea plants in large tracts of tea plantations. The lucrative vegetable and flower trade has also blossomed as large tracts of highlands in the area have been cleared for vegetable and flower cultivation. In addition, the many townships of Ringlet, Tanah Rata, Brinchang, Tringkap and Kampung Raja are rapidly urbanizing with Tanah Rata and Brinchang being major tourist resorts - the cool and fresh air in the highlands being an attractive retreat for city dwellers seeking respite from the heat, noise and pollution of the cities. In addition, ecotourism has great potentials in Cameron Highlands and the dense montane forests and fresh mountain air make this mountain top gateway extremely attractive.

Highlands are extremely fragile and environmentally-sensitive areas. Research has shown that the degradation of hill land can have serious irreversible effects on its immediate environment as well as the surrounding environment downstream (Lim and Lee, 1992). Hill land is environmentally sensitive because of the steepness of the terrain, the uniqueness of its micro climate, the intensity of its rainfall and the sensitivity of its rare wildlife (both fauna and flora) to such changes. Any significant development can affect and change the sensitive hill environment. In many parts of Malaysia, especially the large urban areas and the highland resorts, increasing land pressure, high housing and tourist demand and the general greed amongst irresponsible developers have seen lush green hills being turned into exposed "desertlike" wasteland. Combined with the intensive development of hill slopes and hill land for agriculture, recreation, highway building, dam construction, and other human land uses, all of which contribute significantly to adverse

environmental effects, the toll on hill development is heavy not only on the environment but also inevitably on human society as well. Highland development can lead to environmental degradation often culminating in environmental hazards and disasters (Chan, 2000) (Table 2.1).

Table 2.1: Landslide Occurrences and Losses in Cameron Highlands

Date	Location	Death	Number Injured	Number Relocated	Loss (RM)
29.5.91	Tapah-Cameron Highlands Road	0	0	0	Thousands stranded
30.5.91	Tapah-Cameron Highlands Road	0	0	0	Thousands stranded
8.12.94	Tanah Rata	2 (5 missing)	0	3000	Tens of Thousands
6-7.12.94	Cameron Highlands	9	0	0	NA
24.10.95	Tringkap, Cameron Highlands	1	0	0	NA
1.11.95	Tapah-Cameron Highlands Road	0	0	0	Thousands stranded
Dec 95	Cameron Highlands	7	0	0	Thousands
21.6.96	Km52.8 Tapah-Cameron Highlands Road	0	0	0	Thousands stranded
09.10.96	Kuala Terla, Cameron Highlands	3	2	0	NA
18.10.96	Tanah Rata, Cameron Highlands	0	0	16 families	NA
6.12.99	Tapah-Cameron Highlands	1	0	0	NA
6.1.2000	Kg Raja, Cameron Highlands	6	5	15000	Hundreds of thousands
8.1.2000	Taman Tringkap Puncak, Cameron Highlands	0	0	0	Road Damaged
17.1.2003	Puncak Arabella, Cameron Highlands	0	0	0	Slope Collapsed
24.2.2004	Tapah-Ringlet Road	0	0	0	Slope Collapsed Road closed for 1 week causing loss of vegetable products that could not be transported out

NA – Not Available

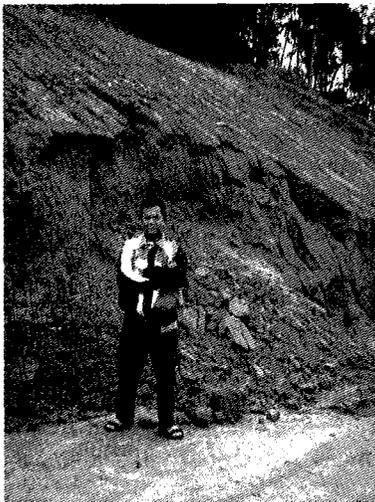
(Source: Government Departments and Newspapers)

In “Highlands Under Attack”, Sabaratnam (NST, 08/11/2001) documents the plight of many residents who have to put up with the threat of landslides and mud-flows and the ordeal of trying to wash mud out of the family house in Cameron Highlands. Many residents have had their houses in the area for more than 35 years and such hazards have never happened before. Another classic example of the disturbance to nature resulting in landslides is that of the Simpang Pulai-Kg Raja Road which has been delayed for many years due to landslides (NST, 08/10/2002). In “Highlands of Shame”, Salleh Buang (NST, 15/02/2003) described the sorry state of the environment in Cameron Highlands. In another article titled “Rape of Cameron Highlands will resume when outcry subsides”, Mimi Syed Yusof (NST, 30/10/2000) deduced that the environmental degradation in Cameron Highlands remains unsolved. The author showed that over the years the highland has seen various types of development, and although many were for the benefit of the people, they often involved opening large tracts of forested land which often resulted in environmental degradation. Yet again, it was maintained that the view from Gunung Brinchang in Cameron Highlands was breathtaking but punctured with scars in the form of land clearing and erosion due to rapid development (Malay Mail, 7/9/2000). The Berita Harian (17/1/2000) reported that hill cutting was to be blamed for Cameron Highlands landslides. Hill-cutting activities by farmers to make way for agriculture is the prime reason behind the recent landslide in Cameron Highlands, Work Minister Datuk Seri S. Samy Vellu said yesterday. He said that Cameron farmers had been guilty in cutting the hills and clearing them for economic activities without following the proper procedures to check soil erosions or stability of the land. Tackling the roots of highland erosion is needed to control environmental hazards (NST, 19/11/1996) Water pollution, including the presence of e.coli in water, has also been frequently reported in the press (The Star, November 10, 2004; Sunday Star, Sunday November 28, 2004; see also Chapter 7).

### 2.3 Effects on Scenery, Land Use and Topography

The land use of Cameron Highlands, previously almost entirely made up of permanent forests reserves of various types has changed dramatically over the years. Our survey of the area revealed that there are many scars (due to landslides) (Photograph 2.3). Consequently, there has been a loss of scenic landscape, which is a valuable attraction for tourism as well as for aesthetic reasons. It is also expected that the topography of the project area, currently comprised of mostly mountainous regions with steep slopes, narrow peaks and ridges and many hills with slopes between 6 – 40 degrees, will change. The building of new highways and roads (main trunk as well as farm roads), likely to follow the hill slopes, will cut into the slopes and change the gradient. This can be in two ways: first, slope cutting will reduce the gradient; and second, if the slopes are not protected, accelerated soil erosion and a significant number of land slips and landslides will occur along these exposed roads (Photograph 2.4). This will further reduce the gradient of many slopes. Deforestation on low land can cause erosion and sedimentation problems but not landslides. However, when it is carried out in hilly areas, especially steep slopes more than 20 degrees, it can be a catalyst to erosion and landslides. Slopes that are between 20 - 30 degrees are classified by the Department of Environment as “Dangerous” and those above 30 degrees are deemed “Critical”. In many areas in Cameron Highlands, more than 23.3 % of the area has slopes more than 25 degrees and another 51% have slopes between 12 – 25 degrees. It is estimated that only about 10 % of the area have slopes less than 6 degrees. This emphasizes the high potential of the Cameron Highland area to soil erosion and landslides. A soil erosion map produced by SMHB, Ranhill and Perunding Zaaba (1999:7-58) classified most of the Cameron Highlands under the “Very High Risk” class with soil loss above 150 t/ha/yr.

Although controlled deforestation with immediate replanting can curb erosion and landslides, it can weaken slopes and bring about landslides when it is carried out at a rapid non-sustainable rate. Deforestation is closely related to hill development as hills are usually densely forested before they are developed. Wan Ruslan Ismail (1995) has shown that deforestation can lead to increase in runoff and erosion. Douglas (1999) found that soil erosion and sedimentation are serious problems in Malaysia largely caused by deforestation. It often leads to landslides. In Malaysia, studies have shown that erosion rates are extremely high because of the copious and intensive rainfall. More significantly, the difference between erosion rates in forested and exposed catchments are great. In an exposed surface, the erosion rate would be much higher. In another study, Goh (1978) discovered that sediment transport between a forested catchment and a semi-developed catchment was 50-300 times greater in the latter. In Malaysia, the wet equatorial climate generates great potentials for accelerated erosion, often leading to landslides. In the TNB Sdn Bhd (2001) report, it was reported that under forested conditions, the average rate of soil erosion amounts to 550,000 m<sup>3</sup> for 1997 and this is predicted to increase with more and more areas being opened for agriculture and other purposes.



Photograph 2.3: A landslide along the Tapah-Cameron Highlands road.



Photograph 2.4: Exposed land in a typical vegetable farm in Tringkap generates high volumes of soil erosion which end up polluting streams. Landslides are also frequent in farms

## 2.4 Climate Change

Studies have shown that forested areas, by virtue of the shade and cooling effects of the trees as well as the transfer of heat from forest canopy to the atmosphere via evapotranspiration, will typically reduce temperatures by a degree or two, depending on the type and density of the forest (Chan and Wan Ruslan Ismail, 2000). Deforestation on hills changes the climate of highland areas. In 1991, a study on the Penang Hill ecosystem revealed that the micro-climate has been affected by over-clearing of forest and housing and other developments (including illegal squatting) (Chan, 1991). Studies by Ho (1992) and the Friends of Penang Hill (1991) also indicate that climatic elements can be significantly modified as a result of degradation of the hill environment. In relation to this, the extinction of many unique species of the flora, especially the top canopy of the trees that reach above 50 metres, can significantly alter the micro climate in the forest. Leong (1992:30) has documented evidence that extensive developments on Cameron Highlands with the replacement of forests with paved roads, buildings and other high solar absorptive materials have raised the mean temperatures of the hill resort. In some areas, it has been reported that the local temperatures have increased by as much as 4 °C (Sham Sani, 1985). Sham Sani (1993:55-64) has also demonstrated that expansion of cities such as Kuala Lumpur at the expense of forests and vegetation can create "urban heat islands" that are several degrees hotter than peripheral forested areas. (see also Chapter 4)

## 2.5 Disturbed Hydrological Regime

One of the more severe effects resulting from deforestation in relation to the change in the micro climate is not so much in the temperature, although this will reduce the attractiveness of the place as a resort, but rather the reduction and destruction of the vital function of these highland forests as "cloud forests". To many water researchers and forestry experts, including Kumaran and Ainuddin in Chapter 1, one of the main functions of hill forests is their ability to capture moisture in the air, or what is known as "horizontal precipitation" (Salleh Mohd. Nor, 1992:2). This terminology is applied to moisture entering the forest ecosystem via condensation of atmospheric vapour on to leaves, grass and other vegetative surfaces. Depending on the location, cloud forests may be commonly found in Cameron Highlands, Fraser's Hill, Genting Highlands (the Chinese name for Genting Highlands is literally "Top of the Clouds"), Gunung Belumat, Gunung Tapis, and the highlands of East Malaysia along the Tama Abu, Kapuas Hulu, Trusmadi and Brassey ranges. The Cameron Highlands permanent forest reserves are also included as hill forests and they also serve the same function in trapping moisture. These highland forests experience a unique microclimate in that temperatures are always low and humidities extremely high. As a result, there is always a layer of mist, fog or cloud surrounding these forests. According to Stadmuller (1986), cloud forests in the humid tropics are covered with clouds or mist most of the time, and besides absorbing the usual rainfall they also receive additional moisture in the form of condensation of water droplets in the air. As humidities are high and temperatures low, these are conditions very conducive for the transformation of water vapour into water droplets.

Notwithstanding climatic and local differences, studies carried out on hill forests indicate that the volume of horizontal precipitation can sometimes even exceed the total volume of normal rainfall. This is especially so during the dry months of the year. For example, Vogelmann (1973) has demonstrated that horizontal precipitation in the humid tropics can be as high as between 300 mm to more than 900 mm per annum. When compared with the normal rainfall, it can be translated into as much as between 7 % (during the wet season) to more than 100 % (during the dry season). Elsewhere, Juvik and Ekern (1978) has also shown that horizontal precipitation can amount to more than ten times the normal rainfall during the dry season. Consequently, destroying hill forests can result in the loss of a huge amount of water resources. Without the trees, much of the moisture in the air will remain there until the normal rainfall process occurs. More significantly, however, is the fact that without the dense forest, whatever moisture in the atmosphere is then subject to the wind system which then carries the moisture and deposit it elsewhere, or return it to the ocean untapped. A deforested area will not be able to hold and retain the moisture, both in the air and in the soil. In the case of logging, even opening up 20 % of the canopy can significantly reduce horizontal capture of

moisture by the trees. This will reduce the amount of horizontal water capture by forests in the water catchment of dams in the area and affect the forests' capacity to trap such moisture during the dry season when there is little rain.

The scientific literature confirms that tropical rainforests play a vital role in local climate regulation by their interaction with water cycles. Hence, it is a fact that rainforests affect local weather but they have also been shown to have a significant effect on global weather. The albedo or reflectiveness of a forested surface is low, i.e. absorbance of sunshine is high. According to Myers (1997):

*...Much of the energy that converts surface moisture into water vapour comes from the sun's radiational heating of the land surface. The energy thus depends on surface albedo, or relevant degree of reflectant "shininess" of the land surface. In turn, the albedo depends on the vegetation, which absorbs more heat than does bare soil. Over thick vegetation, vigorous thermal currents take moisture (provided by the same plant cover) up into the atmosphere, where it condenses as rain. Because of its influence on convection patterns and wind currents, and hence on rainfall regimes, the albedo effect constitutes a basic factor in controlling climate.*

The loss of forest vegetative cover means less heat absorption translating to less moisture being taken up into the atmosphere. In the long run, this demonstrates why deforested regions experience a decline in rainfall. Hence, in addition to the drop in horizontal moisture capture also contributes to a decline in rainfall as forest cover is decreased after forest opening. The scientific literature shows that hill forests increase the humidity of the immediate and surrounding area through transpiration. This process adds to local rainfall. For example, it has been reported that 50-80% of the moisture in the Amazon rainforest of Brazil remains in the ecosystem water cycle whereby moisture is transpired and evaporated from forest into the atmosphere, condensing to form rain clouds before returning to the forest and land surface as rain. After deforestation, significantly less moisture is evapotranspired into the atmosphere (depending on the rate of forest clearance) resulting in the formation of fewer rain clouds. This is what happened to Penang island when more than three-quarters of its forests are lost (Chan, 1997b). Subsequently there is a decline in rainfall, as manifested in all four water catchment areas on the island. In a way, rainfall amount varies inversely with the rate of deforestation, i.e. the greater the deforestation the lower the rainfall. Given the scenario that more and more forests will be cleared for future land use, Penang's rainfall is expected to keep decreasing. Elsewhere, the Madagascar of today is largely a red, treeless desert after generations of severe deforestation. As rainfall decrease, so will river flows decline jeopardising water supply. When river levels fall, low flows become more frequent and pollutants become more concentrated. Hence, not only will smaller amounts of water reach intake points, poorer quality water reaches treatment plants. This will also affect agricultural and food supply. Land use change from forests to secondary forest and shrubs, or worse to urban areas, can severely reduce rainfall patterns. Colombia, once second in the world with freshwater reserves, has fallen to 24th due to its extensive deforestation over the past 30 years. In Malaysia, excessive deforestation around Kuala Lumpur, combined with the dry conditions created by el Niño, triggered strict water rationing in 1998 and for the first time the city had to import water.

The Director-General of the Drainage and Irrigation Department Malaysia, Dato' Ir Haji Keizrul Abdullah has warned that many states in the country are prone to water deficits (Keizrul bin Abdullah, 2000:3). Penang island has already suffered the fate of decreasing rainfall due to forest loss. Cameron Highlands will suffer the same fate of decreasing rainfall if it progressively chops down its forests. Already, the micro-climate is changing and the Sg Bertam basin has experienced a reduction in annual rainfall as reflected by a downward annual rainfall trend from 1948 to 1997 (TNB Sdn Bhd, 2001). With more expansion from agriculture and other human land uses, more forests are set to be cleared and more areas will suffer decreasing rainfall trends. Cameron Highlands will become more and more vulnerable to water stress in the near future. When the dry period hits, soils will tend to dry out (during periods of negative water balance when the rate of evapotranspiration exceeds rainfall). These periods of water stress or dry spells will become more frequent.

Even the normal dry spells towards the end of the year (usually December) until March will intensify and stretch longer and become more severe.

It is a misconception that by virtue of its high altitude, Cameron Highlands will never flood. It must be noted that there are many low-lying areas within the highlands. In fact, when it rains over long periods, many parts of Kg Raja, Tringkap and Tanah Rata have been known to flood regularly. What is most significant is that of downstream flooding. Rapid development, deforestation, siltation of rivers, and general environmental degradation (mainly urbanisation) have all contributed to disturbed hydrological systems leading to increased incidence and magnitudes of flooding in Cameron Highland. Rapid urbanisation and urban sprawl translates to the change from a natural surface (with vegetation and porous surface) to an artificial surface (often void of vegetation and almost completely impermeable). All these changes have significantly altered the hydrology of many areas, leading to decreased infiltration, little rain water uptake by vegetation, severe erosion, accelerated runoff, decrease in lag time (the time taken for rain drops to reach the river), siltation and sedimentation of rivers which reduces their capacities, and ultimately increased frequencies and magnitudes of flooding. The Cameron Highland area has undergone phenomenal change, both in urbanization, agriculture and tourism development. Many rivers' capacity have been reduced as a result of siltation and physical development on its banks which restricts changes in its morphology.

Floods are caused by a combination of natural events such as depression-type monsoon storms, thunderstorms and high tides, and human use systems fostering environmental degradation. Depression-type monsoon storms are of a few days duration and are generally of low intensity but because they are widespread in extent, they cause severe damage to large catchments. Such storms usually occur during the Southwest Monsoon Season or just before the onset of the Northeast Monsoon Season. During the inter-monsoon season, convectional thunderstorms which normally occur in the afternoons, are of much shorter duration of between two to five hours. However, the rainfall intensities during thunderstorms are very high. Modeling of flood flows in the Tanah Rata area (a forested hill cleared for housing), showed that the development of this area was responsible for exacerbating flooding. As a result, flood risk has increased and residents living in low-lying areas in the vicinity of the area became more exposed and highly vulnerable to flooding. While thunderstorms have also been responsible for the occurrence of floods, rapid forest clearance and development of hilly areas have been cited by many as the main cause of flash floods (Chan, 1995).

## 2.6 Soil Erosion and Landslides

Hill land development can also give rise to severe soil erosion which then pollutes surface water quality through sedimentation. Likewise, landslides and mudslides also deteriorate the quality of surface waters. Developing hill land usually results in exposing the land surface to the mercy of the weather elements. In Malaysia, the equatorial humid climate generates heavy rainfall of high intensities, often more than a hundred millimetres per hour and are therefore highly erosive (Jackson, 1977). Chan and Wan Ruslan Ismail (1997) have similarly found that the erosivity of the rainfall is high, leading to high rates of soil erosion and subsequent pollution of water quality. Forest and other vegetative cover can give protection to the land surface from rain splash erosion, runoff erosion and landslides. The Friends of Penang Hill (1991) have also found that erosion rates are enhanced by hill land development. Similarly, in a seminar on hill development, the Malayan Nature Society found that soil erosion has been accelerated by hill development (Lim and Lee, 1992). In Chapter 7, the authors have documented high rates of soil erosion and their effects in Cameron Highlands.

Chan (1996) has shown that the rate of soil loss is alarmingly high in steep and hilly areas in the equatorial region. This is because of the high erosivity of the high intensity rainfall as well as the steep slopes. Based on the Universal Soil Loss Equation (USLE), it was found that exposed hill slopes (in the Penang Hill area) with an average slope of 30 degrees can give rise to a 50-fold increase in surface runoff and a soil loss of between 700 to more than 10,000 tonnes/ha/year. The Department of Environment Malaysia classifies soil erosion

rates as follows: (1) low erosion - < 80 tonnes/ha/year; (2) severe erosion - 80 to 150 tonnes/ha/year; and (3) very severe erosion - > 150 tonnes/ha/year. Based on the above classification, it can be seen that the potential soil loss in hill slopes in Malaysia can be extremely high. Even though the above soil loss calculations is based on a worse case scenario (i.e. assuming all vegetation are cleared), it cannot be denied that many hill slopes in urban areas under land pressure (e.g. in Cameron Highlands), have very little vegetation left. As such, the soil loss of at least 350 tonnes/ha/year is still at least twice above the very severe category. For example, farms in Cameron Highlands where it is estimated that about 30 % of the slopes have been cleared of vegetation, would typically generate an erosion rate of between 100 to 330 tonnes/ha/year.

Wan Abdullah (2002) found that erosion rates in open cultivation (vegetable) areas in Cameron Highlands are  $40 \text{ t/ha/yr}^{-1}$  but areas under plastic covered cultivation experience soil loss at about  $1.4 \text{ t/ha/yr}^{-1}$ . This is an increase of more than 28 times. For virgin jungle, the annual soil loss is only between  $0.19 \text{ t/ha/yr}^{-1}$  to  $0.24 \text{ t/ha/yr}^{-1}$ . Soil loss data collected between June 1995 and June 1996 on Penang island and computed based on the Universal Soil Loss Equation produced a soil loss of about  $19,000 \text{ t/ha/yr}^{-1}$  in freshly deforested land with slopes between 20 to 30 degrees. Given the high intensity of equatorial rainfall in Malaysia, the steep terrain and the resulting high rate of soil loss, landslides are the inevitably results. In comparison, soil loss in a forested catchment in the Air Itam water catchment in the Penang hills is only about 0.01 to  $1.3 \text{ t/ha/yr}^{-1}$ . Vegetable farming on hill slopes (Photograph 2.5) which recorded a soil loss of between 30 to  $90 \text{ t/ha/yr}^{-1}$  is already regarded by the authorities with concern. Soil loss of  $> 10 \text{ t/ha/yr}^{-1}$  is considered high.



Photograph 2.5: Vegetable farming is a major source of income to local communities as well as an attraction to tourists, but unsustainable farming methods have degraded the land and caused environmental problems..

## 2.7 Integrated River Basin Management (IRBM)

Currently, the development process is haphazard and is based on sectoral development, meaning each sector is developed (by the relevant authority) without much consultation from others. Consequently, in the case of river basins that cut across state boundaries, it becomes problematic. Even when a river basin is wholly located within one state, the large number of agencies involved in river and water management has given rise to disputes and conflicts (Keizrul bin Abdullah, 2002). Hence, it is envisaged that there is a need for Integrated River Basin Management (IRBM) to ensure co-ordinated management of rivers, water resources, forestry and other resources in the natural environment within a river basin (air, water, land, flora and fauna) so that management decisions taken by different agencies are not conflicting. In the case of Cameron Highlands, when the environment is sensitive to development, it is imperative that IRBM be practised. To support IRBM, there should also be gazettment of National or State parks to ensure forests do not get logged or cleared for development. IRBM will also ensure that Tourism Malaysia work together with other agencies so that their objectives and activities are not conflicting or mutually damaging. IRBM also ensures that local communities such as orang asli are involved in the development process and not left behind.

## 2.8 Involvement of Local Communities and NGOs in Highland Conservation

One of the main reasons why the environment has degraded so much in Cameron Highlands is because few farmers in the area practise sustainable farming methods. For example, pesticides have been used extensively and farming methods over-expose the soils to erosion and landslides. Cameron Highland farmers need to be trained on more suitable ways to carry out agriculture activities or they will continue to damage their surroundings. In this respect, NGOs such as The Society for Regional Environmental Awareness of Cameron Highlands (REACH) (see Chapter 11), Malaysian Nature Society (MNS), World Wide Fund for Nature Malaysia (WWF) and others have helped educate farmers and residents about sustainable farming methods (see Chapters 6 and 7) and general environmental awareness and conservation issues in the highlands. Currently, majority of the farmers are inexperienced in highland farming and used heavy machinery to flatten the land for their crop growing. This sort of lowland farming methods are not suitable for highlands. REACH has conducted short-term courses on various aspects of farming for the benefit of these farmers to ensure they adopt the right method and conserve the land. In these courses, the farmers are taught flower planting, hydroponics, vegetable farming and big plantation maintenance techniques. NGOs can also facilitate talks by government agencies on how to use pesticides, fertilisers and insecticides. Farmers need to be educated on the consequences of their actions (which also affect they themselves and their families). REACH emphasizes to the farmers on the dos and don'ts of farming. Cameron Highlands has a population of 30,000 and 70% are in the agriculture sector where the major issues are waste management, water shortage and land clearing. Conservation efforts in Cameron Highlands recently received a RM1.1mil boost from the Royal Danish Embassy through the Danish International Development Assistance (Danida). The funds are for a three-year project starting in October 2003, which would focus on reducing the threat to quality of life and the livelihood of the local communities and to the biodiversity of Cameron Highlands. The World Wide Fund for Nature (WWF) Malaysia executive director, Datuk Dr Mikail Kavanagh Abdullah, noted that there was an urgent need to conserve Cameron Highlands (Sunday Star, Sunday, July 20, 2003). Elsewhere, the MNS routinely conducts awareness camps school children, members of nature clubs from schools in Cameron Highlands. These camps are aimed at educating students about the functions of two different ecosystems - highlands and lowlands - to learn and understand the uniqueness of each ecosystem. It also emphasised their interdependence in sustaining the country's water supply. Students took part in activities such as trekking in the lowlands and mangrove forests, listening to talks on highland ecology and climate change, and going for a solo night walk in the forest (Sunday Star, 10 August 2003). All these activities go a long way towards greater environmental conservation in Cameron Highlands.

## 2.9 Conclusion

Rapid development in Cameron Highlands due to logging, urbanization, agriculture and infrastructure development (roads and highways) have contributed to environmental degradation. Control for highland development is not effective largely due to poor enforcement and the inconsistent policies between federal and state governments. It is precisely because of this inconsistency that the federal government has ordered a study of control measures and development regulations for highlands. Due to widespread problems and the role of the mass media in highlighting the issues, development in the Cameron Highlands area is currently "controlled". Expansion of urban areas and townships need to be strictly controlled due to these areas being classified as environmentally sensitive areas (ESAs) (Photograph 2.6). This study has shown that illegal development, mostly by farmers have also contributed to environmental hazards. There is also the problem of illegal squatting and farming, attributed as the main reasons for the destruction and degradation of hill land in Cameron Highlands. Forest clearance should be strictly controlled in Cameron Highlands because of its fragile, steep and hazardous environment. Agriculture should be controlled right from approval of Temporary Occupational Licence to land clearing, farming practices and use of fertilizers and insecticides. Macro EIA should be applied instead of the normal preliminary and detailed EIA. This is because the preliminary and detailed EIA only focus on the area being developed and not the adjacent or downstream areas. Obviously, the effects of logging in an upstream area is mostly felt in the downstream areas, but the preliminary and detailed EIA do not cover effects outside the area of development. There is no requirement for an EIA to cover environmental effects outside the area being considered. As such, downstream as well as adjacent effects to boundary areas are not considered. This can lead to environmental degradation of downstream and adjacent areas, even if the immediate area does not experience the effects. Currently there is legislation requiring the developer to conduct macro EIAs. It is up to the State to decide whether or not a project needs a macro EIA. Development master plans of all States should also allow for Federal Government to provide its inputs in an effort to prevent incidents like landslides and mudslides. Apparently, the necessary amendments would be made soon and the various Menteri Besar had agreed that in future, the Federal Government would be involved in the drafting of development master plans for the States, with inputs from the various ministries like the Works Ministry and the Ministry of Environment. Because of the highly environmentally sensitive nature of Cameron Highlands, the best option for development should be ecotourism. Its rich biodiversity, cool refreshing climate and natural surroundings and magnificent scenery and trekking trails are tourism products that can be developed for ecotourism. While it is impossible to stop agriculture or tourism, these two activities should be strictly controlled to ensure they are developed sustainably. Farming should be environmentally friendly using terracing, rain-covers, rainfall harvesting roofs, mulching, etc. Organic farming should be encouraged. Cameron Highlands, by virtue of its hilliness and fragility, should be a model for sustainable development. It should not be a model for critics to show the world of how badly development has gone wrong.



Photograph 2.6: The three researchers, from left Dr Julian Clifton (University of Portsmouth), Prof Dr Chan Ngai Weng (Universiti Sains Malaysia) and Dr Chris Barrow (University of Wales, Swansea) at the township of Ringlet.

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## Bibliography

*Berita Harian*, Various issues.

Chiew, H. (2002) Mountains in peril (*The Star*, Tuesday, August 20, 2002)

Chan, N. W. (1991) The Climate of Penang Island. *Kajian Malaysia* IX (1), June, 62-86.

Chan, N. W. (1995) *A Contextual Analysis of Flood Hazard Management in Peninsular Malaysia*, Unpublished Ph.D. thesis, Middlesex University (UK).

Chan, N. W. (1996) Vulnerability of Urban Areas to floods. *The Star*, 26 January 1996, 4-6.

Chan, N. W. (1997a) Environmental Effects of Rapid Development and Urbanisation: The Case of Hill Development and Land Reclamation in Penang. Paper presented in "*Chemistry and Technological Development in Environmental Management*", 23-25 October 1997, Universiti Sains Malaysia, Penang.

Chan, N. W. (1997b) Chapter 4.3 Water Resources. In DCT Consultancy Services Sdn Bhd (December 1997) *Penang Environmental Conservation Strategy - Interim Report*. Report prepared for the Penang State Government, Pulau Pinang, 4-31 to 4-48.

Chan, N. W. (2000) Chapter 6 - Degradation of High Land Areas in Malaysia: Effects on Water Resources. In *Tanah Air Ku: Land Issues in Malaysia*. Consumers' Association of Penang, Penang, 66-86.

Chan, N. W. and Wan Ruslan Ismail (1997) Impak Manusia Terhadap Unsur-Unsur Kitaran Hidrologi Di Malaysia. *Ilmu Alam* 23, May, 41 - 58.

Chan, N. W. and Wan Ruslan Ismail (2000) "*The Geography, Climate and Hydrology of Pantai Acheh Forest Reserve*". Paper presented at the State Seminar – "Pantai Acheh Forest Reserve: The Case for a State Park". 23 – 24 September 2000, Universiti Sains Malaysia, Pulau Pinang.

Douglas, I. (1999) Sediment: A Major River management Issue. In Chan N W (Editor) *Rivers: Towards Sustainable Development*. Penerbit USM, 15-24.

Friends of Penang Hill (1991) *Penang Hill: The need to save our natural heritage*, FOPH, Penang.

Goh, K. C. (1978) Human Interference with the Malaysian tropical rainforest: its hydrological and erosional implications with reference to Endau-Rompin. *Malaysian Naturalist* 4 (2), 16-21.

Ho, S. C. (1992) *Environmental Characteristics and Diversity of the Flora and Fauna of Penang Hill*. Universiti Sains Malaysia Short-term Research Project Report, Penang.

Jackson, I. J. (1977) *Climate, water and agriculture in the tropics*. Longman, New York.

Juvik, J. O. and Ekern, P. C. (1978) *A climatology of mountain fog on Maluna Lona, Hawaii Island*. Water Resources Research Centre, University of Hawaii, Technical Report No. 118.

Keizrul bin Abdullah (2000) "*The Beris Dam Resettlement Programme*". Paper submitted and presented to the World Commission on Dams at the Commission East/South-East Asia Regional Consultation, Hanoi, 26-27 February 2000.

Keizrul bin Abdullah (2002) Integrated River Basin Management. In Chan N W (Ed) *Rivers: Towards Sustainable Development*. Penerbit Universiti Sains Malaysia, Pulau Pinang, 3-14.

Khor, J.K. (2003) "Ideal Spot For Recuperation", *The Star*, 4 August 2003.

Leong, Y. K. (1992) Conservation and Development of Cameron Highlands. In Lim, R. P. and Lee, S. W. (eds) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur, 20-32.

Lim, R. P. and Lee, S. W. (eds) (1992) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur.

*Malay Mail*, Various issues.

Myers, N. (1997) "The world's forests and their ecosystem services," in G.C. Daily (Ed) *Nature's Services - Societal Dependence on Natural Ecosystems*, Washington D.C.: Island Press.

*NST*, Various issues.

Salleh Mohd. Nor (1982) The Hills must be Protected. In Lim, R. P. and Lee, S. W. (eds) (1992) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur, 1-5.

Sham Sani (1985) *Environmental Impact Assessment Study for the proposed Fantasy Hills Development at Bukit Fraser, Pahang: Microclimate effects*. Engineering Resources Incorporated Sdn. Bhd., Kuala Lumpur.

Sham Sani (1993) Environment and Development in Malaysia: Changing Concerns and Approaches. *Centre for Environmental Studies at ISIS Malaysia, Kuala Lumpur*.

Stadmuller, T. (1986) Cloud forest in the humid tropics. The United nations University.

SMHB, Ranhill and Perunding Zaaba (1999) *Kajian Sumber Air Negara 2000 – 2050 (Semenanjung Malaysia), State Report Volume 9 – Kedah*. Kuala Lumpur.

*The Star and Sunday Star*, Various issues.

TNB Sdn Bhd (2001) *TNB 995/7 The Development of Catchment Monitoring and Management for Pergau and Cameron Highlands Batang Padang Using GIS*. TNB Sdn Bhd, Bangi.

Vogelmann, H.W.(1973) Fog precipitation in the cloud forests of eastern Mexico. *Bio-science* 23 (2): 96-100.

Wan Abdullah (2002) Agro-Pollution of water Resources Under Intensive Agricultural Systems in Cameron Highlands – An Integrated Study. In Chan N W (Ed) *Rivers: Towards Sustainable Development*. Penerbit Universiti Sains Malaysia, Pulau Pinang, 87-93.

Wan Ruslan Ismail (1995) The impact of hill land clearance and urbanisation on hydrology and geomorphology of rivers in Pulau Pinang. Unpublished PhD thesis, the University of Manchester.

## CHAPTER 3

# GLOBAL WARMING: HAS THERE BEEN A CHANGE IN THE CLIMATE OF CAMERON HIGHLANDS?

Leong Chow Peng  
Malaysian Meteorological Service, Jalan Sultan  
46667 Petaling Jaya, Selangor, Malaysia  
Tel: 6(03) 79678000; Fax: 6(03) 79550964  
Email: [mms@kjc.gov.my](mailto:mms@kjc.gov.my)

### 3.1 Introduction

Rapid growth over the past few decades, whilst raising the GNP and incomes, has taken a toll on the environment in Malaysia. This has been all too evident in the frequent occurrences of massive slope collapse along highways, landslides, increased incidence and severity of floods in many parts of the country, water shortages during the dry periods, and recent cases of drinking water contamination. In particular, concern over adverse environmental effects of climate change has mounted in recent times. Scientists believe that global warming could be pushing the earth's climate faster towards sudden dramatic shifts, as have occurred many times in the past.

Malaysia is in a region identified as potentially vulnerable to the impacts of climate change. The highland areas are particularly susceptible to climate extremes. Cameron Highlands is a well-known highland resort famed for its cool pleasant climate, beautiful flower gardens, and the variety of fruits and vegetables that flourish at its hillside farms. The economy in the highlands is largely driven by agricultural and tourism related activities. In this chapter, the meteorological and air quality data recorded at the Malaysian Meteorological Service (MMS) climate station at Tanah Rata since the 1930s are used to study temperature, rainfall and air quality trends. An attempt is made to relate climate patterns with global trends.

### 3.2 The Global Scenario

Climate is very much related to many human activities. The crops grown and agricultural practices, the trees that flourish, the renewable energy potential, heating and cooling needs, the water available and required, earnings from tourism, recurrence of devastating floods and droughts, and many of the diseases that occur, are all affected by the climate.

Climate varies naturally on all time scales from hundreds of millions of years to a few years as revealed by paleo-climate data and instrumented observations. Studies indicate that previous climate change may have resulted due to some natural causes. These include volcanic emissions, sun-related changes (e.g. 11-year solar cycles), variation in the tilt of the earth, precession of the earth's axis, and changes in shape of the orbit of the earth. During the last million years, we have experienced variations of climate including the ice ages and periods when the temperatures were higher than at present.

Why is there then the present concern on climate change? The present patterns of economic activity have developed over the past thousand years in a period of relatively stable global climate. In the last few decades, it has become evident that our environment and security is now being threatened by global warming due to increasing greenhouse gases concentrations in the atmosphere, namely carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and chlorofluorocarbons (CFCs). Without very drastic

preventive action, this is projected to transform the world's agriculture, change and move the forests hundreds of kilometres, create new deserts and see the greening of some existing dry lands. Sea level will rise and hundreds of millions of people on low lying coasts will be seeking higher ground. In short, climate change could threaten a nation's economic potential.

The observed trends that provide evidence of a warming world are:

- CO<sub>2</sub> content of the atmosphere has been increasing;
- the amount of CO<sub>2</sub> estimated at 600 billion tonnes at the middle of the last century now stands at 740 billion tonnes, an increase of 25%;
- burning of fossil fuels alone accounts for an injection of 6 billion tonnes of carbon per year; deforestation and land clearance contribute 1 billion tonnes;
- other greenhouse gases such as methane, nitrous oxides, chlorofluorocarbons, surface ozone have all shown increasing trends; and
- there was an increasing trend in the mean global temperature

As a result of these trends, the World Meteorological Organization (WMO), in collaboration with the United Nations Environment Programme (UNEP) and the International Council of Scientific Unions (ICSU), organized an assessment Conference of some 100 leading scientists in Villach in 1985. The conclusion was that "while some warming of climate appears inevitable due to past actions, the rate and degree of future warming could be profoundly affected by government policies on energy conservation, wiser use of fossil fuels, and controlling the emission of some greenhouse gases". In November 1988, WMO working with UNEP set up the Intergovernmental Panel on Climate Change (IPCC) to give authoritative advice on Science, Impacts & Adaptation, and Policy Options.

The IPCC produces an Assessment Report every six years and so far three such Reports have been prepared. The Assessment Reports so far conclude that unless atmospheric concentrations of greenhouse gases are stabilized, the consequences will be enormous and is going to affect every aspect of our lives; our ecosystems, our economies and livelihood. Stabilization of greenhouse gases concentrations in the atmosphere demand a major effort from the world's governments and society. The international community is tackling this challenge through the United Nations Framework Convention on Climate Change (UNFCCC). The Convention which entered into force in March 2004 commits its 190 Parties to the Convention to limit their emissions, develop strategies for climate change adaptation, and cooperate on research and technology. It also requires developed countries to take measures aimed at returning their emissions to 1990 levels. The Convention's Kyoto Protocol, adopted in December 1997, is a landmark in providing the framework of global measures to tackle the issue of climate change in the 21<sup>st</sup> century. It introduces three powerful and promising mechanisms in the market namely Emissions Trading, Joint Implementation and Clean Development Mechanism. The Protocol, although ratified by 121 Parties including all the Asian countries, has not entered into force, and this has remained a major hurdle to effective global action until the recent announcement that Russia has decided to ratify the Protocol. Countries are now putting pressure to the United States to follow Russia's lead.

### 3.3 Projected Impacts

The developing countries are the most vulnerable to the impacts of climate change. Some of the devastation that may lie ahead can already be seen in the increased incidence of drought, floods and extreme weather events that many regions are already experiencing.

The IPCC Third Assessment Report concluded that, based on the results from the global climate models, it is likely that in the future:

- The globally averaged surface temperature will increase by 1.4 to 5.8C over the period 1990 to 2100.

- Globally averaged water vapour, evaporation and precipitation will increase but at the regional scale both increases and decreases in precipitation are possible. There is also strong correlation between precipitation inter-annual variability and mean precipitation.
- There is insufficient information to assess changes in some extreme phenomena in particular very small-scale phenomena such as thunderstorms, tornadoes, hail and lightning that cannot be simulated in the global models.
- Sea surface temperatures in central and eastern equatorial Pacific will warm more than the western equatorial Pacific resulting in a corresponding mean eastward shift of precipitation.
- Glaciers and ice caps will continue their widespread retreat in the 21<sup>st</sup> century and Northern Hemisphere snow cover and sea ice are projected to decrease further.
- Global level sea level rise for the period 1990 to 2100 will be in the range 0.09 to 0.88 m.

Malaysia has compiled its national Greenhouse Gas Emissions Inventory for carbon dioxide, methane and nitrous oxide for five categories of activities namely, energy, industrial process, agriculture, land use change and forestry, and waste. Initial calculations indicate that the energy sector is the greatest emitter of carbon dioxide, while the landfill and wastewater treatments are both the greatest emitters of methane.

So far, Malaysia has not run its own Global Climate Models (GCMs). Climate change scenarios derived from GCMs run by other meteorological centres are used as a guide to determine a range of values for future changes in temperature and temperature under a 2 x CO<sub>2</sub> atmosphere as shown in Table 3.1. Generally, the temperature changes will range from +0.7°C to +2.6°C, while rainfall changes will range from -30% to +30%. No consistent relationship has been found between changes in temperature and changes in rainfall. In view of the large uncertainties and low confidence of the model outputs for regional-scale climate scenarios, a range of values were used to assess the impacts of climate change in the country.

A sea level rise of 15-95 cm in 100 years is adopted for the assessment of the impact of sea level rise on coastal resources. Impacts on water resources were very much estimated due to the inherent uncertainties of the GCMs. They include an analysis of flooding, erosion and sedimentation, and water availability. Climate change will have a great impact on water availability as it has been found that for every 1°C increase in temperature there is an increase in potential evapotranspiration of between 3 to 9% and about 90 mm additional loss of moisture per annum. The corresponding reductions in runoff under five different scenarios are shown in Table 3.2.

### **3.4 Results from Climate and Air Quality Monitoring at Cameron Highlands**

The following is a summary of temperature, rainfall and air quality trends as monitored at the MMS Climate Station at Tanah Rata, Cameron Highlands during the period 1930 to 2003:

#### **3.4.1 Temperature**

Temperature decreases with altitude. In general, the average temperature drops by about 0.6°C for every 100 m rise in altitude. The time series of the annual average, annual mean maximum and annual mean minimum temperatures are shown in Figures 3.1, 3.2 and 3.3. The annual average temperature appears to be decreasing from 1965 to 1976. From 1976 onwards, the temperature has a slight but steady increasing trend. The whole set of data shows a slightly warming trend of 0.7°C per 100 years. The warming is more evident during the early mornings. The rate of increase of the annual mean minimum temperature which occurs just before dawn is 3.3°C per 100 years.

The temperature trend recorded at Cameron Highlands is quite similar to the mean global temperature pattern. The earth's temperature remains about constant from 1965 till 1975 after which it has a clear

warming trend. This tends to suggest that warming at Cameron Highlands may at least partly be explained by similar factors that warm the world. Another possible cause of the warming is urbanization or development of an area which creates an “urban heat island effect”. This effect has been well documented in many publications where city centres have been observed to be warmer in the early morning by a few degrees Celcius compared to the countryside.

Unfortunately, the information and data that is presently available is insufficient for scientists to quantify accurately the relative contributions of urbanization and greenhouse gases warming in Cameron Highlands.

### **3.4.2 Rainfall**

Figure 3.4 shows the time series of annual total rainfall measured at Tanah Rata. Typical of a tropical location, there is a large variation between years. Values range from slightly above 2000 mm to more than 3000 mm. There is a slightly decreasing trend observed in the rainfall trend but this trend is not statistically significant.

The number of days with rainfall more than 25 mm in Tanah Rata is shown in Figure 3.5. Figure 3.6 shows the number of days with rainfall more than 50 mm. The graphs indicate that although the annual rainfall has not increased during this period, the number of days with intense rainfall seems to have increased in the last 20 years.

### **3.4.3 Greenhouse Gases Concentrations**

Presently, MMS does not have a long-term programme to monitor the concentrations of all the greenhouse gases at Cameron Highlands. Since 2002, the department is collaborating with scientists from the National Institute of Agro Environmental Sciences (NIAES) in Japan to conduct ad-hoc flask sampling for greenhouse gases. It will take many years before trends of the gases concentrations can be established. Although continuous carbon dioxide concentration measurements are not conducted in Cameron Highlands, MMS has a Global Atmosphere Watch station at Lahad Datu, in Sabah that conducts carbon dioxide monitoring from a 100 metre high tower.

### **3.4.4 Aerosol Load**

Anthropogenic aerosols in the upper atmosphere derived from fossil fuel and biomass burning, can reflect solar radiation, which leads to a negative radiative forcing and a cooling tendency in the climate system. Measurements of aerosol concentrations in Cameron Highlands have so far not detected an increasing trend although incidences of high concentrations have been recorded coinciding with the outbreaks of transboundary haze due to forest fires occurring in neighbouring Indonesia (Figure 3.7).

## **3.5 Suggested Strategies to Mitigate the Impacts of Climate Change in Cameron Highlands**

Many sectors will be affected if climate change occurs in Cameron Highlands. These include agriculture and forestry, natural terrestrial ecosystems, hydrology and water resources, human settlements, energy and industry. In particular, climate change will impact the two major economic activities, agriculture and tourism. Climate change is likely to lead to greater extremes of drying and heavy rainfall and increase risk of droughts that occur with El Nino events.

### 3.5.1 Agriculture

Vegetable and fruit production and floriculture are extensive activities in Cameron Highlands. Climate change results in stress on the plant production capacities. However, the problems posed can be managed by introduction of new strategies such as controlling the crop environment and selection of plant species that can adjust to changing climate conditions. Maximum and efficient usage of water resources should also be developed to ensure adequate water supply for the crops during the dry season. Integrated pest management and bio-control procedures should be strengthened to deal with increased incidences of pests and diseases.

### 3.5.2 Tourism

A large number of tourists visit the highlands every year as they are attracted by the cool weather and beautiful, clean natural environment. To maintain its attraction as a premier holiday resort, it is important to ensure that activities at Cameron Highlands continue to give importance to preserving the natural environment including ensuring that its hill slopes are not subject to erosion, the air quality remains good and its water resources are uncontaminated. Studies on erosion and sedimentation rates indicate that a large proportion of the total annual load is produced during a few large storms which consequently pose a high risk of slope failures of riverbanks and hills, faster rate of sedimentation and more extensive loss of soil nutrients. Results of monitoring by MMS also indicated that the acidity of rainwater has been on the increase.

With the growing population during the peak holiday seasons, careful planning and management of water resources is important, particularly to minimise the impacts during El Nino episodes when water resource is scarce.

### 3.6 Conclusions

This study provides new insights on the climate in Cameron Highlands and future trends. The following conclusions can be made from the assessment of available data and information:

- On average, the annual mean, minimum and maximum temperatures show an increasing trend. This could be partially attributed to the urban heat island effect but climate change is a possibility.
- Rainfall amounts show a slight increase but this change is not significant. The number of days with rainfall greater than 25 mm and 50 mm has increased in the last 20 years.
- There are weaknesses in the current models and therefore the projections of emissions and impacts lack confidence. There is also insufficient data to assess whether there is has been an increase in frequency of the small-scale extreme weather events, such as droughts, storms and floods.
- Aerosol concentrations have been fairly constant with sharp increases occurring during transboundary haze pollution events.
- Although climate change will affect the whole community, it will be mostly felt by the agricultural and tourism sectors in the highlands. Adaptation measures need to be taken with regard to vegetable and fruit farming and floriculture.

- Water resource management should be strengthened in view of expected increase in rainfall variability which can increase soil erosion causing landslides.
- Long-term systematic observations at national and regional levels are crucial for the monitoring of climate and its changes.

## **Bibliography**

*ASEAN Compendium of Climatic Statistics 2004*, ASEAN Sub-Committee on Meteorology and Geophysics

Chan, A.K. and Jailan S. (1993). *Climate Patterns in the Highlands of Malaysia*. Paper presented at the Workshop on the Preparation of Guidelines for Agricultural Activities in Steepland, July 1993, Cameron Highlands

IPCC (2001): *Climate Change 2001: The Scientific Basis*. Intergovernmental Panel of Climate Change. Cambridge University Press, Cambridge.

*Malaysia National Communications* submitted to the United Nations Framework Convention on Climate Change. Ministry of Science, Technology and the Environment

Figure 3.1: Annual Mean Temperature at Cameron Highlands

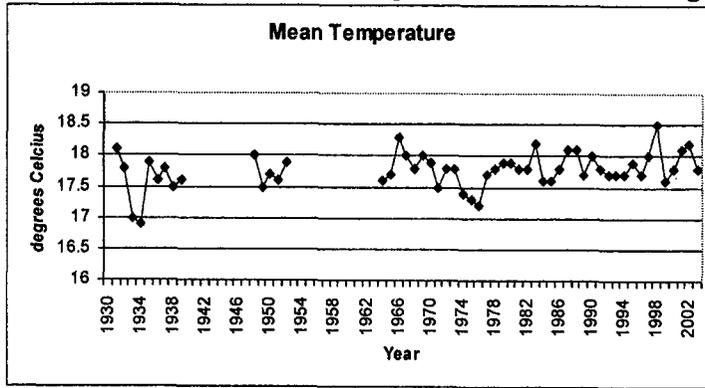


Figure 3.2: Annual Minimum Temperature at Cameron Highlands

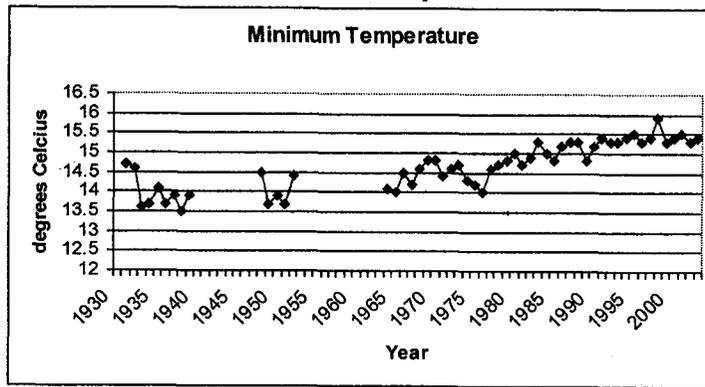


Figure 3.3: Annual Maximum Temperature at Cameron Highlands

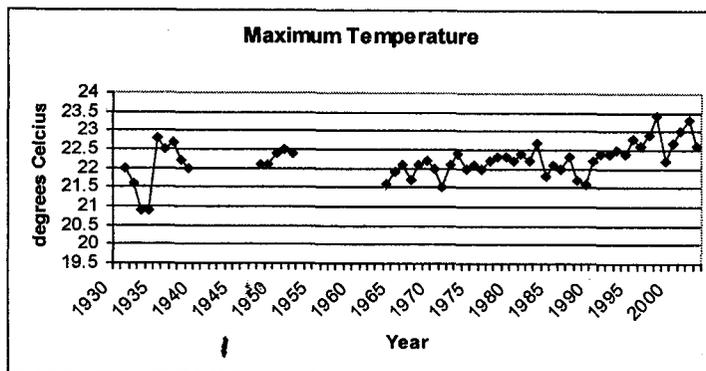


Figure 3.4: Annual Rainfall at Cameron Highlands

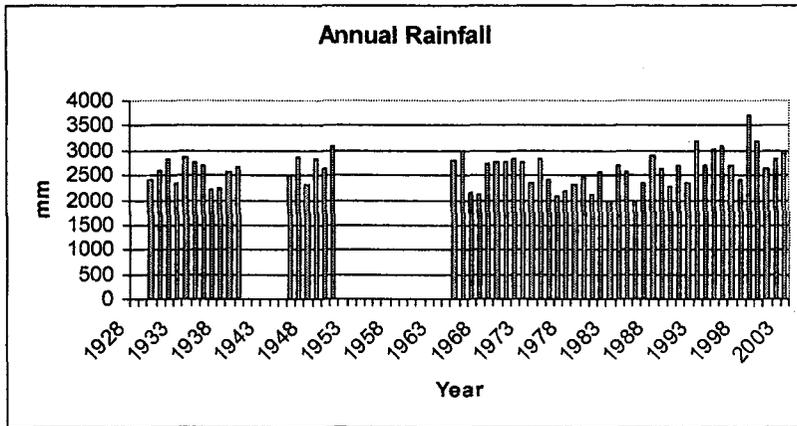


Figure 3.5: Number of Days with Rainfall Greater Than 25mm

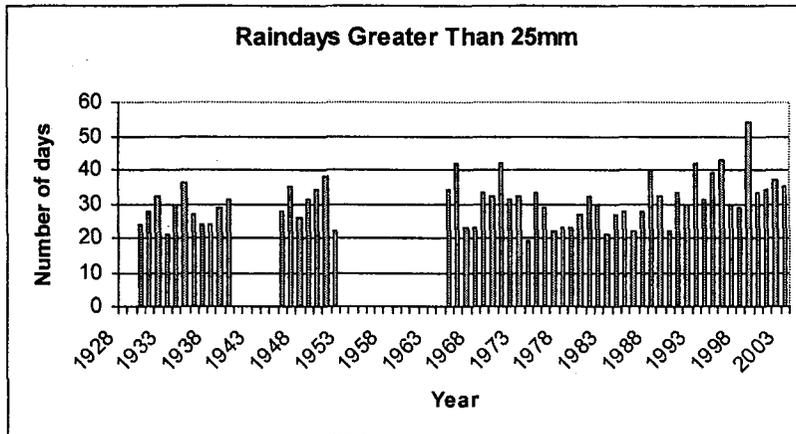


Figure 3.6: Number of Days with Rainfall Greater Than 50mm

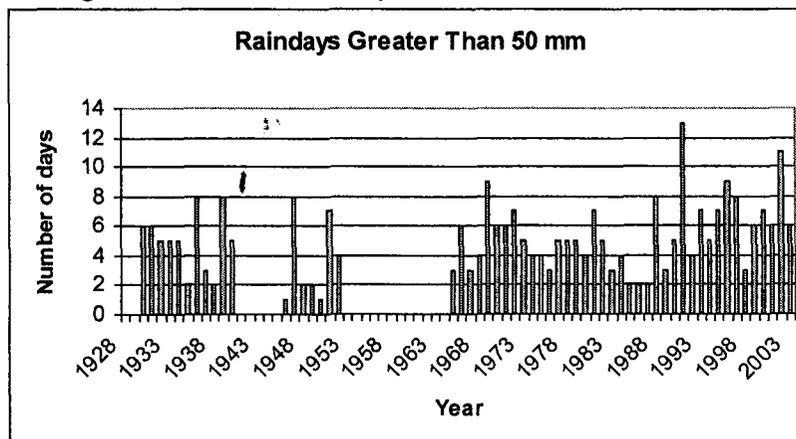


Figure 3.7: Aerosol Concentrations at Cameron Highlands

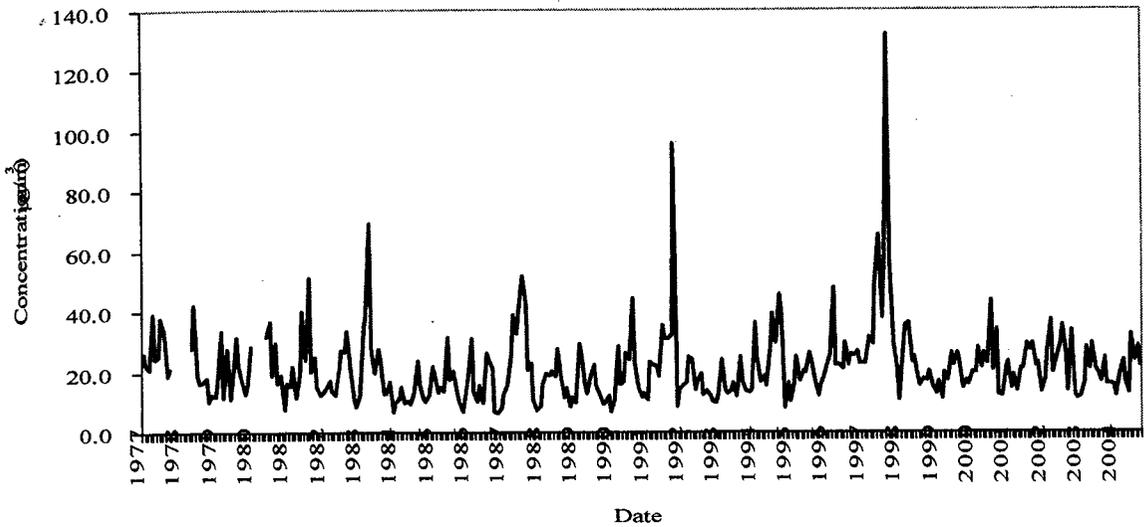


Table 3.1: Projected Climate Change Scenarios for Malaysia (from Initial National Communications, July 2000)

Northern Hemisphere Summer			
Year	2020	2040	2060
Changes in Temperature	+0.3 to +1.4°C	+0.4 to +2.4°C	+0.6 to +3.4°C
Changes in Rainfall	-0.4 to +14.0%	-0.7 to +23.0%	-1.0 to +32.0%
Northern Hemisphere Winter			
Changes in Temperature	+0.4 to +1.9°C	+0.7 to +3.2°C	+0.3 to +1.4°C
Changes in Rainfall	-0.4 to +7.0%	-7.0 to +12.0%	-10.0 to +17.0%

Table 3.2: Impacts of Rainfall and Temperature Changes on Runoff (from Initial National Communications, July 2000)

Climate Change Parameter	Magnitude of Change	Reduction in Runoff (%)	
		Wet Months	Dry Months
Temperature	+1°C	1 to 5	1 to 16
Temperature	+3°C	2 to 17	1 to 24
Rainfall	-10%	12 to 31	13 to 38
Rainfall & Temperature	-10% & +1°C	13 to 35	14 to 43
Rainfall and Temperature	-10% & +3°C	13 to 48	17 to 53

## CHAPTER 4

# CLIMATE CHANGE AND HEAT ISLAND EFFECTS IN CAMERON HIGHLANDS

Chan, N W, Suriati Ghazali and Norizan Md Nor  
 Geography Section, Universiti Sains Malaysia, 11800 Penang, Malaysia  
 Te: 6-04-6533888 Ext 3829; Fax: 6-04-6563707  
 Email: [nwchan@usm.my](mailto:nwchan@usm.my)

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### Abstract

*Rapid land use change, most notably expansion of urban areas in recent decades have brought about climate change in Cameron Highlands. In recent years, warming is generally experienced with the appearance of urban heat islands. Although the highland forests still provide a cooler climate regime, the rapidly changing land use is affecting this main tourist attraction. In addition, the forests in Cameron Highlands also act as rich biodiversity reservoirs, carbon sinks, green lungs, water catchments, and are the best forms of natural flood defence. This chapter examines climate change in the local area around Cameron Highlands and concludes that rapid development in Cameron Highlands has profoundly affected the climate of the area. In order to prevent further changes, development in tourism, agriculture, settlement, and other human land uses need to be strictly controlled and managed in a sustainable manner. Laws and regulations relating to development of highlands are clear but enforcement of such laws and regulations in the development of new towns, housing, highways and roads, farms, dams, and other infrastructure has to be strictly enforced. If not, future developments in these areas will continue to impact negatively and bring disastrous consequences on the climate of the area, resulting in hotter temperatures and lower rainfalls. This chapter examines the impacts of rapid land use development in Cameron Highlands and offers some recommendations on their management.*

### 4.1 Introduction

In a detailed analysis of development and its effects on climate in Cameron Highlands, Chan et al. (2003a) have demonstrated that rapid land use change, most notably expansion of urban areas in recent decades have brought about climate change in Cameron Highlands. Barrow et al (2004) have also discussed extensively the negative effects of rapid development on the environment in the area. Climate change has also been highlighted by Leong (2004) and also in Chapter 3. Chan et al (2003a) have shown that in recent years, the warming has been felt simultaneously with the appearance of urban heat islands around the urban areas. Many urban areas such as Tanah Rata, Brinchang, Ringlet, Kg Raja, Tringkap and Kuala Terla experience higher temperatures of between 1-2 degrees Celcius. The increase is most notable during the evenings, especially when night market activities are going on. Rising temperatures are also most profound during holiday seasons with the influx of thousands of vehicles into the towns. The high elevation between 1500 m to more than 2000 m in the Cameron Highlands area and the extensive highland forests still provide a cooler climate regime, but the rapidly changing land use is affecting the temperatures. In addition to higher temperatures, dwindling forests in Cameron Highlands also mean that biodiversity is affected as well as its role as carbon sinks, green lungs, water catchments, natural flood control etc. Results from this study show that the micro climate has changed in the local area around Cameron Highlands and point to the fact that rapid development in Cameron Highlands is the most likely reason for such changes. In order to prevent further changes, development in tourism, agriculture, settlement, and other human land uses need to be strictly controlled and managed in a sustainable manner. Laws and regulations relating to development of highlands are clear but enforcement of such laws and regulations in the development of new towns, housing, highways and roads, farms, dams, and other infrastructure has to be strictly

enforced. If not, future developments in these areas will continue to impact negatively and bring disastrous consequences on the climate of the area, resulting in hotter temperatures and lower rainfalls. Negative impacts of rapid land use development in Cameron Highlands have occurred frequently in recent decades as the land use has changed rapidly over the years, especially in the 1990s where pristine forest have been cleared for agriculture and urban townships (Table 4.1).

Table 4.1: Percentage Land Use Change for Various Land Use Categories in Cameron Highlands

Land Use	1947	1966	1974	1982	1990	1997
Forest	95%	78%	76%	73%	72%	62%
Agriculture	1.7%	2.4%	3.8%	9.3%	10.2%	17.8%
Tea & Orchards	2.7%	8.9%	10.8%	9.7%	9.5%	7.5%
Urban/Housing	0.6%	10.7%	9.4%	8.0%	8.3%	12.7%

(Source: TNB Research Sdn Bhd (1997) *The Development of Catchment Monitoring and Management for Pergau and Cameron Highlands Batang Padanag using GIS*. TNB Research Sdn Bhd, Kajang).

## 4.2 Study Methodology

The current research employs the use of primary and secondary data. Primary data on temperature and humidity was obtained by direct sampling using whirling psychrometers calibrated against instruments at the Malaysian Meteorological Service station in Tanah Rata. Primary data on views on climate change was obtained from structured questionnaire surveys. Secondary climate data and other related data was obtained from government agencies, NGOs, hotels, and other sources. In addition, existing publications on Cameron Highlands and archives from libraries were also used. Data from websites related to Cameron Highlands were also screened for information.

## 4.3 The Literature on Human-induced Climate Change

The literature is littered with known facts that the process of urbanization involving rapid land use change from forested areas to “concrete jungles” will inevitably bring about drastic changes to the climatic environment (Lowry, 1967; Landsberg, 1970; Strahler and Strahler, 2002). On the local front, researchers such as Lim (1980), Sham (1982, 1987 and 1995), Chan et al (2003a), Sin and Chan (2005) and Sin (2005), have also demonstrated the effects of urbanization and land use change on the climate of urban areas. In all the literature, it has been documented that the physical surfaces of cities and other urban areas are almost completely artificial, with rapid population increase and increase in the number of motorized vehicles and industries. All these have contributed to greater levels of air pollution in urban areas which trap both shortwave and longwave radiation. In addition, there are many sources of heat in urban areas. The result of all these combine to make city centers hotter than the surrounding countryside areas. This is the urban heat island effect, which has been detected in the 19<sup>th</sup> century in large European cities (Landsberg, 1970). In the Kuala Lumpur-Petaling Jaya area, the heat island effect is pronounced and well documented (Sham, 1982 and 1987). In Penang Island, one of the most rapidly growing regions in Malaysia, the city of Georgetown was found to exhibit an urban heat island (Lim, 1982). Sin (2005) has further found that heat islands appear during both the wet and dry seasons. Although the difference is not large, varying between 2 to 6 degrees Celcius, the higher temperatures can cause discomfort, greater usage of electricity (air-conditioning) and problems of heat related illnesses. It can also contribute to global warming. In the current study in Cameron Highlands, the chapter examines the reasons for the formation of the heat island phenomenon and suggests recommendations on how best to reduce the effect.

Forests absorb a significant portion of atmospheric carbon dioxide and act as carbon sinks. Hence, clearing forests means reducing such sinks and indirectly increasing atmospheric concentrations of CO<sub>2</sub>. This has the effect of increasing surface temperatures of the affected areas. For example, studies in the Amazon Basin show that decreasing areas of forest due to conversion into pasture and cropland results in increasing concentrations of atmospheric CO<sub>2</sub>. Studies elsewhere using the National Center

for Atmospheric Research GENESIS atmospheric general circulation model, coupled to the Integrated Biosphere Simulator simulations, indicate that deforestation decreases basin-average precipitation by 0.73 mm day<sup>-1</sup> over the basin, as a consequence of the general reduction in vertical motion above the deforested area (although there are some small regions with increased vertical motion). The overall effect of doubled CO<sub>2</sub> concentrations in Amazonia is an increase in basin-average precipitation of 0.28 mm day<sup>-1</sup>. The combined effect of deforestation and doubled CO<sub>2</sub>, including the interactions among the processes, is a decrease in the basin-average precipitation of 0.42 mm day<sup>-1</sup>. While the effects of deforestation and increasing CO<sub>2</sub> concentrations on precipitation tend to counteract one another, both processes work to warm the Amazon Basin. The effect of deforestation and increasing CO<sub>2</sub> concentrations both tend to increase surface temperature, mainly because of decreases in evapotranspiration and the radiative effect of CO<sub>2</sub>. The combined effect of deforestation and double CO<sub>2</sub>, including the interactions among the processes, increases the basin-average temperature by roughly 3.5 °C (Costa and Foley, 2000).

In the Cameron Highlands, a small localized basin, studies have shown that forested areas, by virtue of the shade and cooling effects of the trees as well as the transfer of heat from forest canopy to the atmosphere via evapotranspiration, will typically reduce temperatures by a degree or two, depending on the type and density of the forest (Chan and Wan Ruslan Ismail, 2000). Hence, deforestation on hills changes the climate of highland areas. In 1991, a study on the Penang Hill ecosystem revealed that the micro-climate has been affected by over-clearing of forest and housing and other developments (including illegal squatting) (Chan, 1991). Studies by Friends of Penang Hill (1991) also indicate that climatic elements can be significantly modified as a result of degradation of the hill environment. In relation to this, the extinction of many unique species of the flora, especially the top canopy of the trees that reach above 50 metres, can significantly alter the micro climate in the forest. Leong (1992:30) has documented evidence that extensive developments on Cameron Highlands with the replacement of forests with paved roads, buildings and other high solar absorptive materials have raised the mean temperatures of the hill resort. In some areas, it has been reported that the local temperatures have increased by as much as 4 °C and shown that expansion of cities such as Kuala Lumpur at the expense of forests and vegetation can create "urban heat islands" that are several degrees hotter than peripheral forested areas (Sham, 1985). TNB Research Sdn Bhd (1997) has shown that the mean daily temperature has increased by 1.5 °C at the Habu Power Station and by 0.6 °C at Tanah Rata town over the last 25 years in Cameron Highlands. In this same study, it was shown that rainfall, however, exhibit a reducing trend at an average rate of 4.4 mm/year for the last 50 years.

#### 4.4 Local Experiences on Climate Change

This study also looks at whether people who have lived in the Cameron Highlands for a long time have experienced climate change. Some of the many potential climatic effects of deforestation of an area of rainforest are shown in Table 4.2. In a country dominated by a hot, wet and humid equatorial climate, Cameron Highlands is one of the few areas with a cool climatic regime where residents and tourists can escape to for some respite, especially during the dry, hot and hazy season. Visitors to Cameron Highlands rate the cool temperatures as one of the major attractions. Some of their views posted on the website [http://www.asia-hotels.com/traveltales/tt-Malaysia-Cameron.asp&affiliate\\_no=](http://www.asia-hotels.com/traveltales/tt-Malaysia-Cameron.asp&affiliate_no=) are listed below:

Manfred Wagner (Sunday, August 18, 2002) "*Cameron Highlands is a nice place with cool temperatures*".

Martin Stelbrink (Friday, August 09, 2002) "*If you like tea, landscape views and temperature below 20°C (!!!) it's the destination to go (avoid weekends and public holidays) as many attractions are quite small and could be no fun with millions of other people.*"

Erica Cranmer (Sunday, May 05, 2002) "*Great for a few days break, did a couple of hikes, wandered the towns and enjoyed visits to the various farms. Excellent curry for dinner at Shal's Curry House, which had a menu extensive enough to suit kids too. After Singapore and KL, the cooler temperature came as a welcome break*".

Therese Crespin (Sunday, August 12, 2001) "*The tea plantations are beautiful. The temperature is just nice. It's a great place to have a break (from Singapore)*".

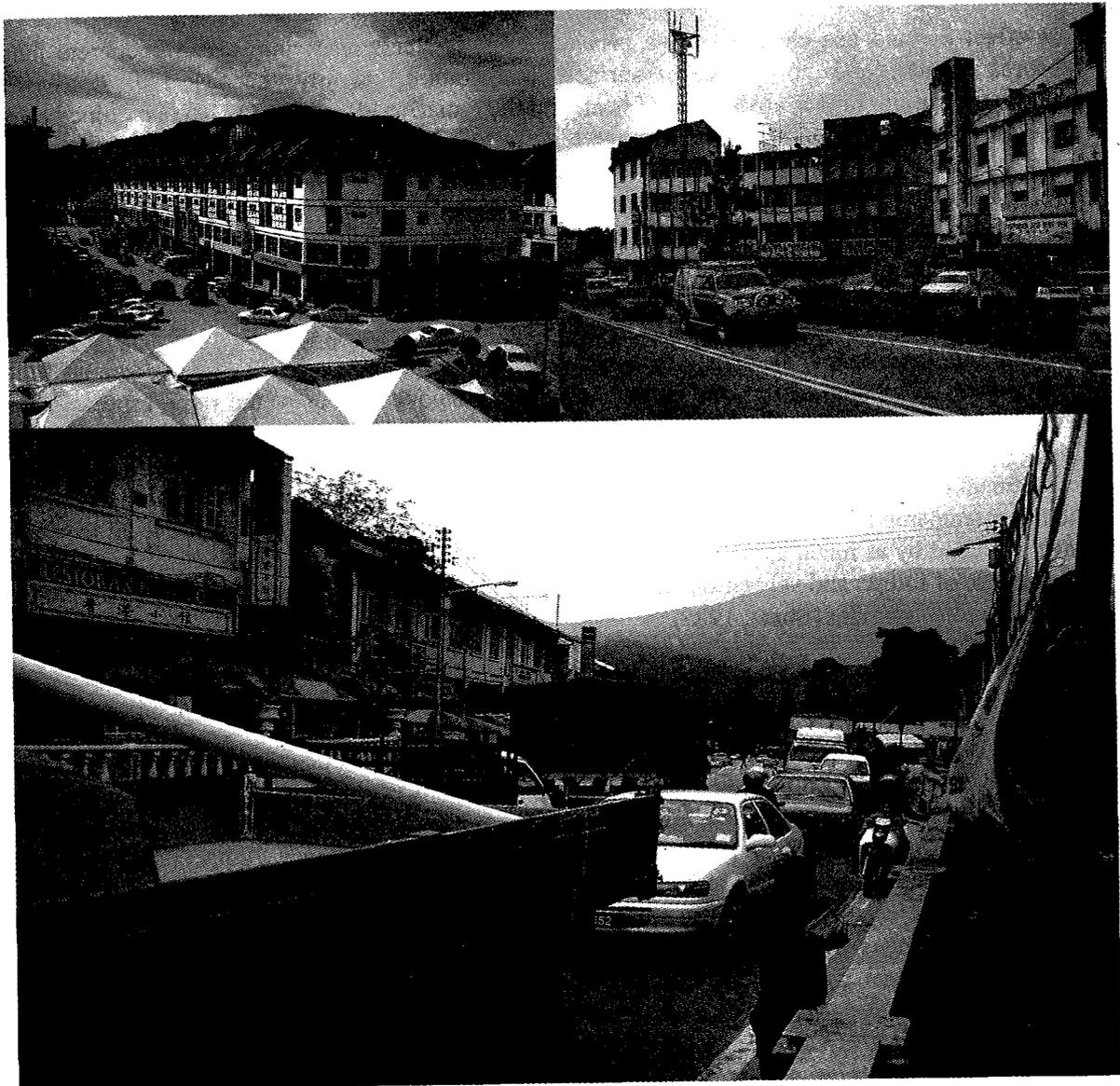
Geoffrey Clarkson (Saturday, February 24, 2001) "*Tanah Rata is a lovely town and the temperature is very cool after the heat of KL*".

Paulene Ling (Sunday, January 28, 2001) "*Cameron Highland is a very scenic place. The drive there is a little exhaustive but it is very worth it to have your own transportation as you can roam around the place.... Temperature is around low 20 ° C in January. And it is advisable to bring along a rain jacket everytime you go out as it might just rain on you unexpectedly (5 mins - 1 hour)*".

Table 4.2: Potential negative effects of deforestation of tropical forest on the climate in Cameron Highlands

- 
- *Increase in Temperature Extremes – Forested areas (especially dense tropical forest) provide shade, hence reducing temperature extremes. In Cameron Highlands, under forest cover, the day temperature may be between 25 - 28 ° C and between 16 – 19 ° C at night. In urban areas without forest cover, temperatures would be much hotter during the day (between 27 – 33 ° C) and slightly colder at night (between 13 – 17 ° C).*
  - *Drying up or dessication of previously moist forest soil. Opening the forest canopy exposes the forest soils to the sun, and when the soil gets baked (also due to the lack of canopy leaves to prevent the moisture from quickly evaporating into the atmosphere), the previously moist soil becomes dry and cracked. This increases evaporation from the ground/soil.*
  - *Decrease in humidity – Both absolute and relative humidities will decline with deforestation. Inside the forest, the relative humidity is constantly high between 90 – 100 % (Hence, saturation is common at night and in the early morning resulting in occurrence of mist and fog). Outside the forest, the values are lower between 80 – 90 %.*
  - *Loss of Transpiration resulting in little water recycling - Moisture from the forest transpires into the atmosphere as clouds and returns to the forest as rain. Deforestation means there is no more transpiration through the forest foliage, and this reduces the incidence of rain. In addition, no forest means no horizontal capture of atmospheric moisture by vegetation.*
  - *Increase in heat concentration - Loss of Transpiration results in heat absorbed from the sun being trapped in the ground/concrete structures/roads etc. Transpired moisture removes heat absorbed from the sun as much as 600 calories for every gram of moisture transpired from the forest. This heat is transferred into the atmosphere. In urban areas, without transpiration, this heat is trapped in the towns resulting in "Urban Heat Islands".*
  - *Contribution to global warming - Rainforests are important in the carbon dioxide exchange process as important "CO<sub>2</sub> sinks". Deforestation may account for as much as 10% of current greenhouse gas emissions. As more CO<sub>2</sub> are released into the atmosphere, more heat gets trapped, adding to a global warming trend.*
  - *Increased Soil Erosion – Trees hold together soil particles via their extensive root systems but deforestation contributes to increased run-off (increased erosivity potential) but reduced protective cover of trees. Generally, the greater the deforestation, steepness of terrain and higher the rainfall, the more serious is the soil erosion.*
-

Over the decades since the mid-20<sup>th</sup> century, Cameron Highlands has undergone profound land use changes (see Table 4.1). This major tourist and farming location has experienced rapid development in the areas of agriculture, tourism, urbanization and more recently housing and infrastructure (highways) (Chan et al, 2003b). More and more areas are coming under increasing threat from uncontrolled clearing of forests, extraction of forest resources, opening of farms, new highways and housing schemes, extraction of forest products for sale, construction, and the vagaries of climatic change. Due to their high altitude isolated locality, degradation of the mountains is difficult to monitor and often go unnoticed. The remoteness of the area makes enforcement difficult and haphazard development over the years has led to a multitude of environmental problems as pressures from tourism, construction development, pollution, deforestation and climate changes are eroding the landscape of these vital ecological mountain ranges, leading to deforestation, destruction of water catchments, soil erosion and landslides, water shortages and pollution, sedimentation of waterways and reservoirs, and downstream flooding. In terms of human society the impacts have also been severe (Chan et al, 2003b). Many of the urban centers such as Tanah Rata, Brinchang and Ringlet are densely built-up with traffic jams most of the time (Photograph 4.1).



Photograph 4.1: Top Left -The main urban centre of Tanah Rata. Top-Right – The rapidly growing urban center of Brinchang. Bottom – Traffic jams in Tanah Rata are a common sight during weekends and public holidays.

According to Mr Liaw, a vegetable farmer aged 80+, "*When I was a child (aged 10), I could remember the mornings in Tringkap were so cold that whenever I breathe, smoke (condensation) came out of my mouth. Now, my grandson who is also ten, only wears a T-shirt in the early mornings as it is so hot!*" Studies have shown that the degradation of highlands can have serious irreversible effects on its immediate environment as well as the surrounding environment downstream (Lim and Lee, 1992). Highlands are environmentally sensitive because of the steepness of the terrain, the uniqueness of its micro climate, the intensity of its rainfall and the sensitivity of its rare wildlife (both fauna and flora) to such changes. Any significant development can affect and change the sensitive hill environment. In Cameron Highlands, increasing land pressure, high density housing, agriculture and tourist demand, and increasing the accessibility have changed lush green hills into exposed and degraded "wastelands".

#### 4.5 Effects on Temperature and Heat Island

The effect of land use change from a pristine forest (reflects heat) into urban "concrete jungles" (absorbs heat) tend to increase surface temperature, mainly because of decreases in evapotranspiration, higher absorption of heat, and the radiative effect of CO<sub>2</sub>. The combined effect of these processes often increases the average temperature by a few degrees. Studies have shown that forested areas, by virtue of the shade and cooling effects of the tress as well as the transfer of heat from forest canopy to the atmosphere via evapotranspiration, will typically reduce temperatures by a degree or two, depending on the type and density of the forest (Chan and Wan Ruslan Ismail, 2000). Deforestation on hills changes the climate of highland areas. In 1991, a study on the Penang Hill ecosystem revealed that the micro-climate has been affected by over-clearing of forest and housing and other developments (including illegal squatting) (Chan, 1991). Studies by Friends of Penang Hill (1991) also indicate that climatic elements can be significantly modified as a result of degradation of the hill environment. In relation to this, the extinction of many unique species of the flora, especially the top canopy of the trees that reach above 50 metres, can significantly alter the micro climate in the forest. Leong (1992:30) has documented evidence that extensive developments on Cameron Highlands with the replacement of forests with paved roads, buildings and other high solar absorptive materials have raised the mean temperatures of the hill resort. In some areas, it has been reported that the local temperatures have increased by as much as 4 °C and demonstrated that expansion of cities such as Kuala Lumpur at the expense of forests and vegetation can create "urban heat islands" that are several degrees hotter than peripheral forested areas (Sham, 1985).

##### 4.5.1 Urbanisation and Heat Island

Urbanisation is a way of life that is unavoidable as more and more people prefer to live in cities for various reasons. Kuala Lumpur is already 100 % urban. This is closely followed by Georgetown and Ipoh, both between 70 – 80 % urban. Due to significant changes in land use and other changes, urban and rural environments differ substantially in their micro-climate (Sham, 1990). These microclimate differences are essentially caused by the transformation of the natural surfaces into artificial surfaces by human activities such as logging, agriculture, mining, housing, highway construction and others. Due to these changes, city centers are usually hotter than their surrounding countrysides (Figure 4.1). When this happens, we call the city center an "Urban Heat Island" (UHI). An UHI is a term climatologists use to define a city area (usually city center) whereby the temperature is significantly higher (usually by a few degrees Celcius) than the outskirts or city periphery. When isolines (lines depicting equal temperatures) are drawn on a map, the city center stands out because of its "Hot Spot" like a heat island surrounded by cooler periphery areas (see Figures 1 and 2). Usually, urban heat islands are more pronounced at night than during the day. The larger the city, the more pronounced is the heat island, i.e. the greater the temperature difference between city centers (heat island) and city outskirts (cool islands). Usually, the urban heat island is strongest at the city center

where population densities are highest, motorized vehicles concentration also highest, and economic activities (such as restaurants, street hawkers, department stores, workshops, etc) are highest. Additionally, in many cities, industrial activity is often also highest. Researchers have identified the heat island effect in almost all the major cities in the world. Often, temperature differences between city and country are as high as 6° Celsius but the range depends on the size of the city and other factors (Chan, 1995).

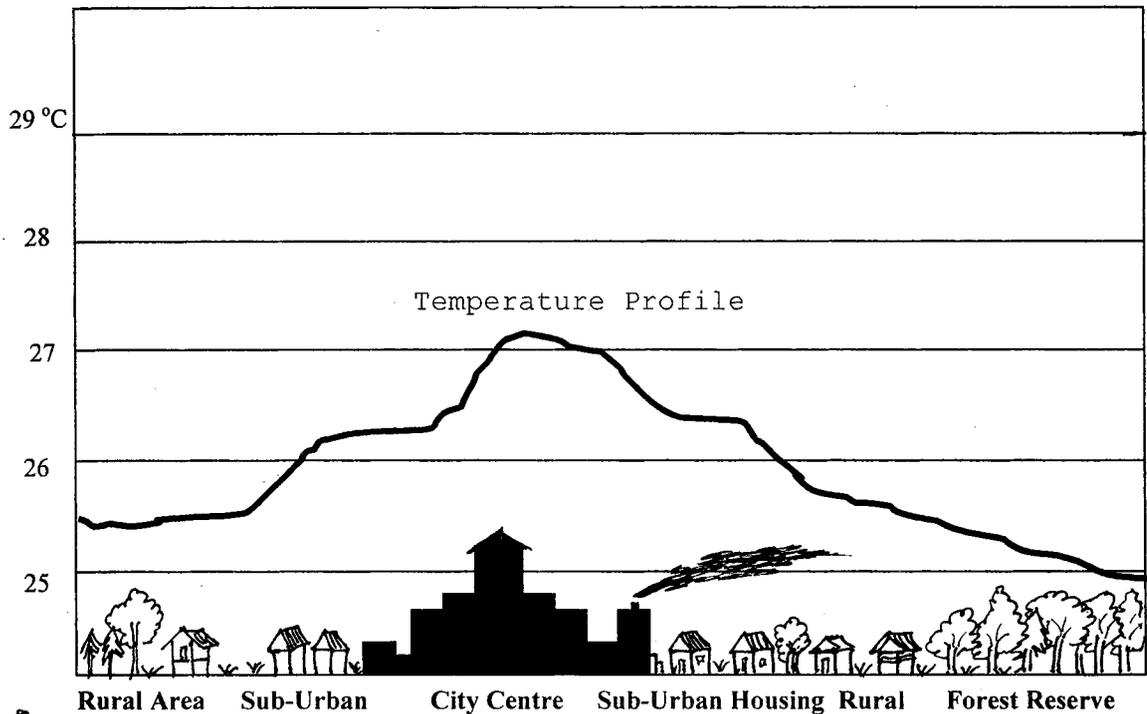


Figure 4.1: Concept of an Urban heat island (Source: Andrasko and Huang, 1992).

In the literature, Luke Howard, one of the early pioneers who studied the concept of UHI had discovered the effect in the early 1820s (Chandler, 1965). Others who followed his footsteps in studying the UHI include Chandler (1965) and Landsberg (1956 & 1981). An alarming discovery was that the city center of London was far hotter than its peripheries, even in the early year of 1818 (Chandler, 1965). Researchers have found that the intensity of the heat island varies directly with population size of cities. With a population of 10,000, the difference in temperature between city center and the outskirts is only 2 °C. However, when the population is 1 million and 10 million, the differences are 8 °C and 12 °C respectively (Aguado and Burt, 1999: 372). This was the case of Vancouver in Canada, which is by no means a mega city. Hence, it is expected that large mega-cities such as London, Mexico City, New York and Tokyo would exhibit heat islands of greater intensities.

In the Cameron Highlands area, with average heights ranging from 1000 to more than 2000 m, the area currently experiences much cooler temperatures than the lowlands. Hence, the area is particularly suitable as hill resorts and tourism. Currently, tourists come from all over the world (including local tourists) to sample the cooler climate in the vicinity of the Cameron Highlands area and the tourist industry is booming. In Cameron Highlands, the temperatures are consistently lower than the plains, with the average monthly temperatures hovering around 18 °C with the daily temperatures range between 12 °C in the early mornings to 26 °C at mid-day. In Tapah in the lowlands, daily temperatures range between 24 °C in the early mornings to 33 °C at mid-day. Because of the inland nature of the project area, i.e. being surrounded on virtually all sides by hills and forests, its climate is rather equable. In the TNB study, it was found that the Mean Daily Temperature has increased by 1.5 °C (Habu Station) and 0.6 °C (Tanah Rata) over the last 25 Years from 1974 to 1997. The Absolute Lowest

Temperature at Tanah Rata shows an increasing trend of  $> 3^{\circ}\text{C}$ . The Mean Minimum Temperature also shows a  $2^{\circ}\text{C}$  warming trend. Finally, the Mean Maximum Temperature also indicates a  $1^{\circ}\text{C}$  upward trend (TNB Research Sdn Bhd, 1997). Deforestation in the Cameron Highlands has resulted in an increase in temperature extremes as forested areas (especially dense tropical forest) provide shade, hence moderating the temperatures. In the forests of Cameron Highlands, the day temperature may be between  $25 - 28^{\circ}\text{C}$  and between  $16 - 19^{\circ}\text{C}$  at night. In urban areas such as Tanah Rata and Brinchang, without forest cover, temperatures would be much hotter during the day (between  $27 - 33^{\circ}\text{C}$ ) and slightly colder at night (between  $13 - 17^{\circ}\text{C}$ ). Reducing forest cover also causes loss of transpiration resulting in little water recycling. Consequently, there is an increase in heat concentration as loss of transpiration results in heat absorbed from the sun being trapped in the ground, concrete structures, roads, etc in the towns. In the forest, transpired moisture removes heat absorbed from the sun as much as 600 calories for every gram of moisture transpired from the forest. This heat is transferred into the atmosphere. In urban areas, without transpiration, this heat is trapped in the towns resulting in "Urban Heat Islands" in Tanah Rata and Brinchang. The increase in temperatures locally also contributes to global warming in two ways: (i) Direct contribution to heating as the mean temperatures of the area has increased; and (ii) The Cameron forests are important in the carbon dioxide exchange process as important "CO<sub>2</sub> sinks". Deforestation may account for as much as 10% of current greenhouse gas emissions. As more CO<sub>2</sub> are released into the atmosphere, more heat gets trapped, adding to a global warming trend.

#### 4.5.2 Heat Islands in the Cameron Highlands

Figure 4.2 shows the distribution of 24 stations selected for a heat island study in Cameron Highlands. Teams of researchers using whirling psychrometers (all calibrated against the Malaysian Meteorological Service instruments in the Tanah Rata weather station) carried out the survey. Three measurements were made on 28 October 2004 – one at 9.00 am in the morning, one at 2.00 pm in the afternoon and one at 9.00 pm in the evening. At each station, three measurements were made and the average value taken. In Figure 4.3, the morning transect of temperatures are shown. It can be seen that the highest temperatures occur in and around the urban centers of Tanah Rata ( $19^{\circ}\text{C}$ ), Brinchang ( $21.5^{\circ}\text{C}$ ), Tringkap ( $19^{\circ}\text{C}$ ), Kg Raja ( $22^{\circ}\text{C}$ ) and Ringlet ( $23^{\circ}\text{C}$ ). It should be noted that Ringlet is the lowest in terms of elevation, the average height being slightly more than 1000 m whereas Tanah Rata and Brinchang averages between 1500 to 2000 m. In the urban areas, both human activities and traffic are heavy during the morning period when people are working, marketing or trading.

In Figure 4.4, the afternoon transect of temperatures are shown. The temperature pattern is more or less similar to the morning pattern. It can be seen that the highest temperatures again occur in and around the urban centers of Tanah Rata ( $22-23^{\circ}\text{C}$ ), Brinchang ( $22^{\circ}\text{C}$ ), Tringkap ( $23-24^{\circ}\text{C}$ ), Kg Raja ( $19-20^{\circ}\text{C}$ ) and Ringlet ( $23^{\circ}\text{C}$ ). In comparison, the Tanah Rata meteorological station managed by the Malaysian Meteorological Service that is located on top of a hill away from the urban area recorded a temperature of  $17.6^{\circ}\text{C}$ . The pattern clearly shows that away from the urban areas, the temperatures are usually 1 degree Celcius lower.

In Figure 4.5, the evening transect of temperatures are shown. It can be seen that the highest temperatures again occur in and around the urban centers of Tanah Rata ( $19^{\circ}\text{C}$ ), Brinchang ( $18.5^{\circ}\text{C}$ ), Tringkap ( $19^{\circ}\text{C}$ ), Kg Raja ( $19^{\circ}\text{C}$ ) and Ringlet ( $19.5^{\circ}\text{C}$ ). Again, the surrounding rural areas that are agriculture or forested show temperatures a notch lower. Figure 4.6 also shows that temperatures at Brinchang town are consistently higher than that of the surrounding forest. Rising temperatures, however, are not only limited to the urban areas. The analysis on mean maximum and mean minimum temperatures over the years at the Tanah Rata meteorological station that is managed by the Malaysian Meteorological Service shows that all the temperature values are increasing. Figure 4.7 illustrates the Highest Maximum Temperature, Lowest Minimum Temperature, the Mean Maximum Temperature and the Mean Minimum Temperature, all of which indicate that temperatures are on the rise.

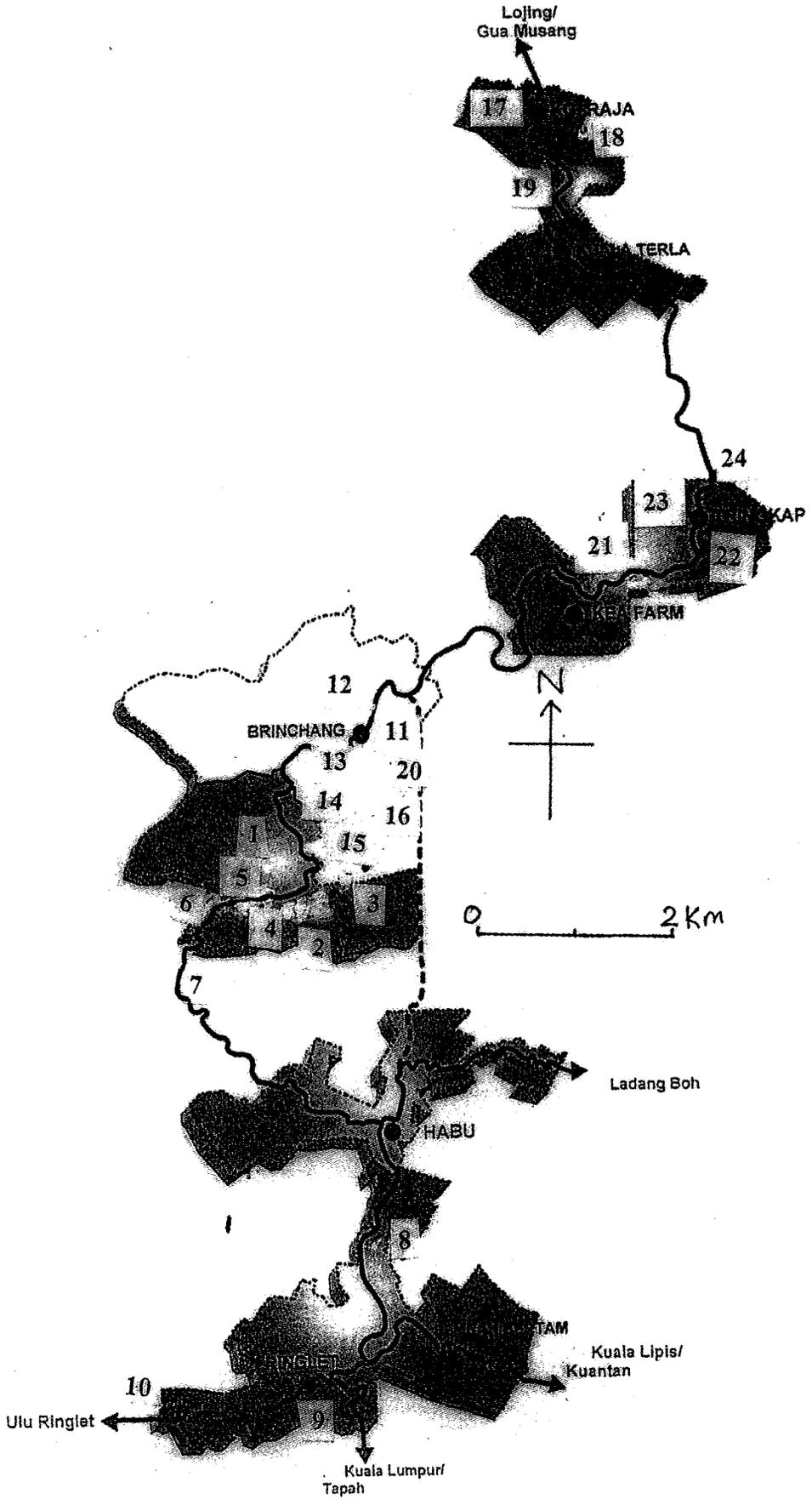


Figure 4.2: Distribution of 24 selected stations for heat island study in Cameron Highlands.



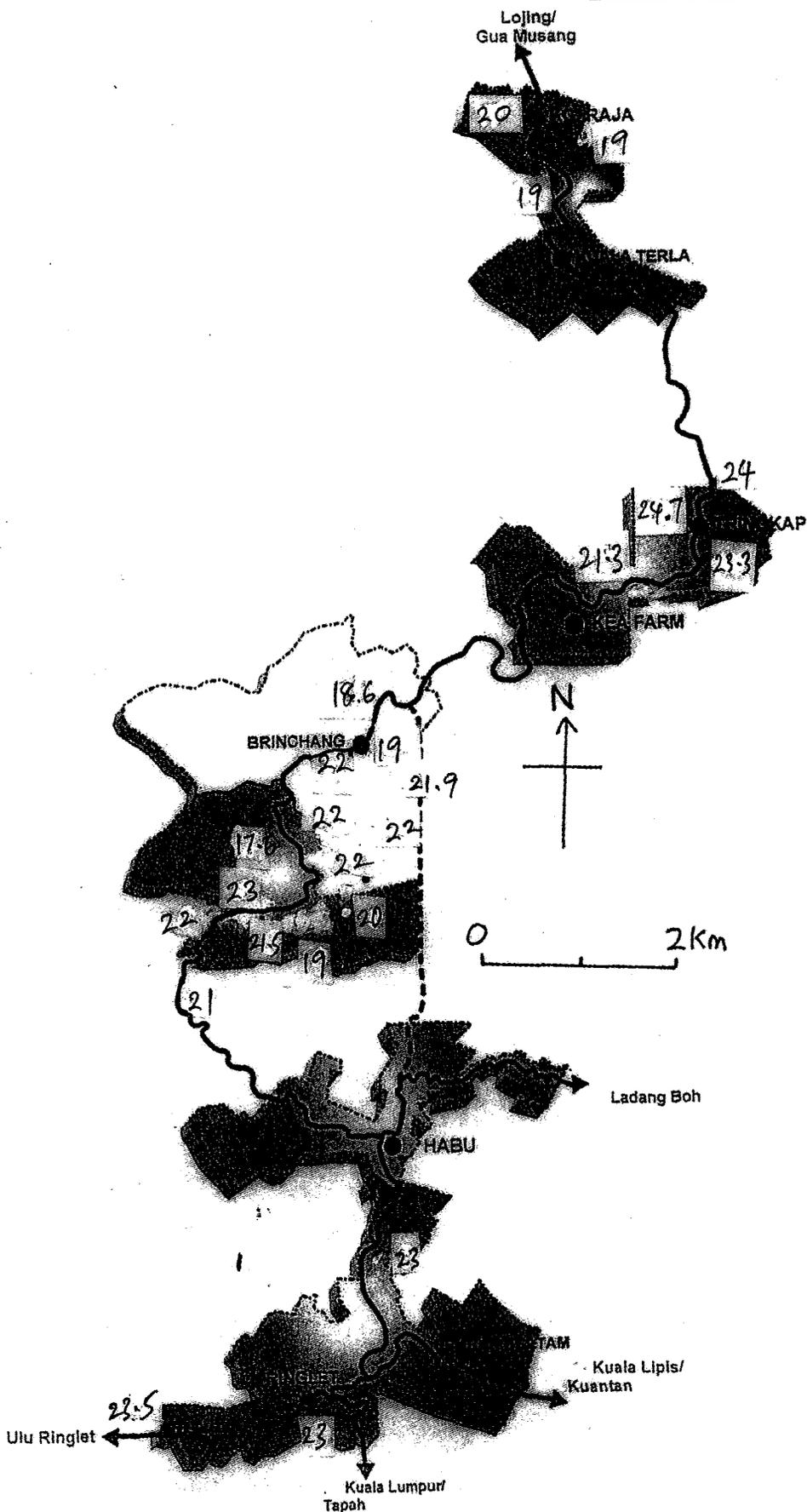


Figure 4.4: Distribution of temperatures at 1400 hours at 24 selected stations for heat island study in Cameron Highlands.

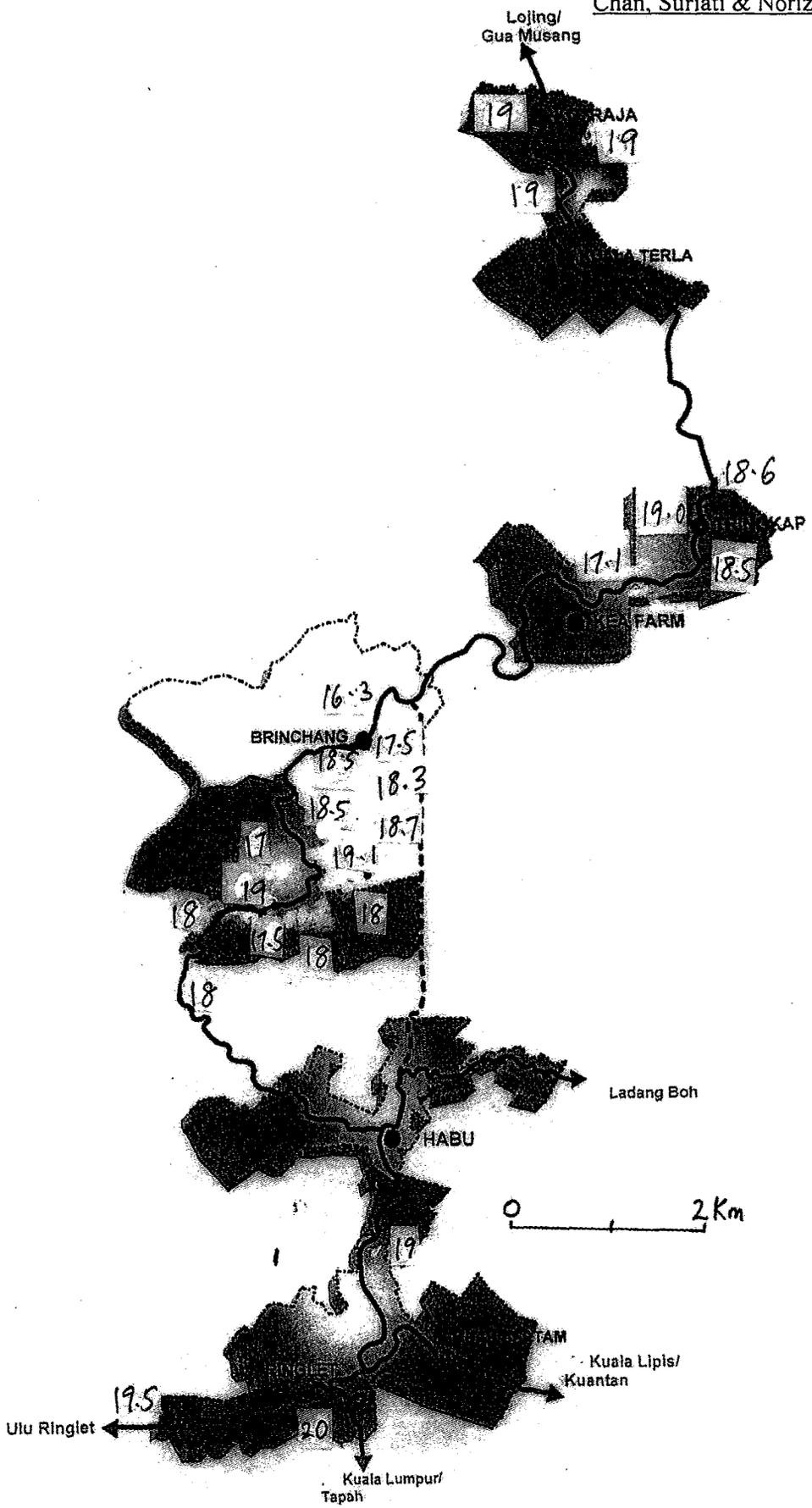


Figure 4.5: Distribution of temperatures at 2100 hours 24 selected stations for heat island study in Cameron Highlands.

Figure 4.6: Distribution of hourly temperatures at Brinchang town and surrounding forest in Cameron Highlands.

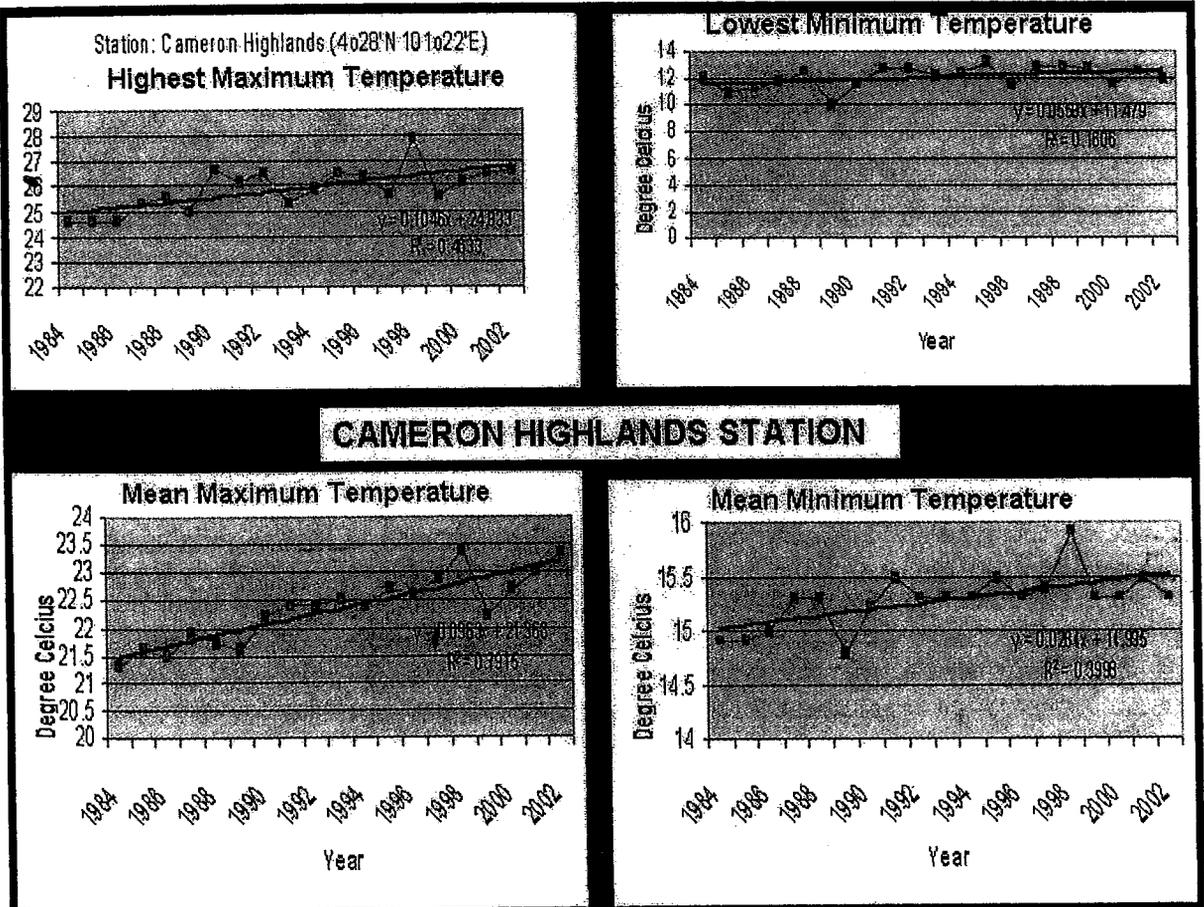
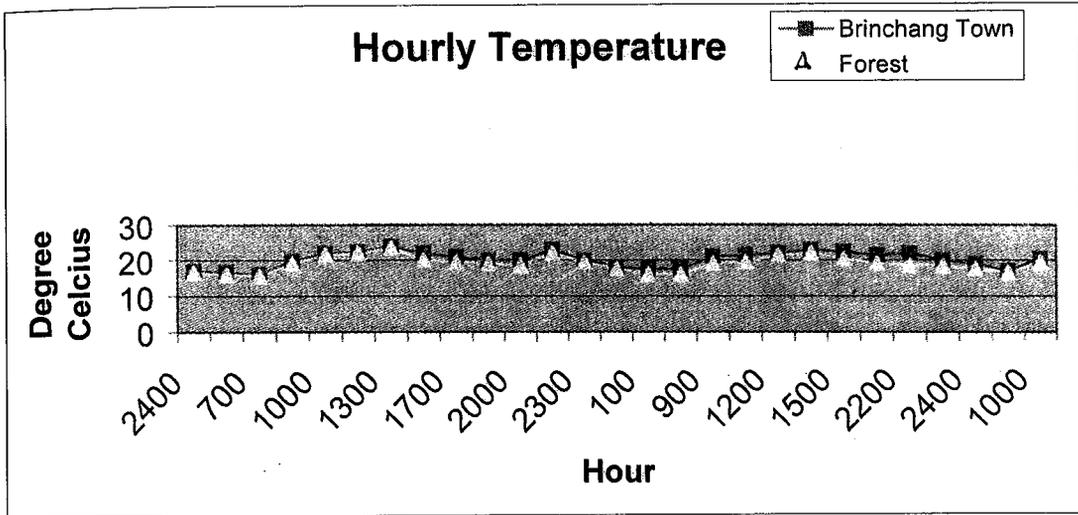


Figure 4.7: Distribution of Highest Maximum Temperatures, Lowest Minimum Temperatures, Mean Maximum Temperatures and Mean Minimum Temperatures at the Tanah Rata Cameron Highlands meteorological station in Cameron Highlands.

#### 4.6 Effects on Humidity

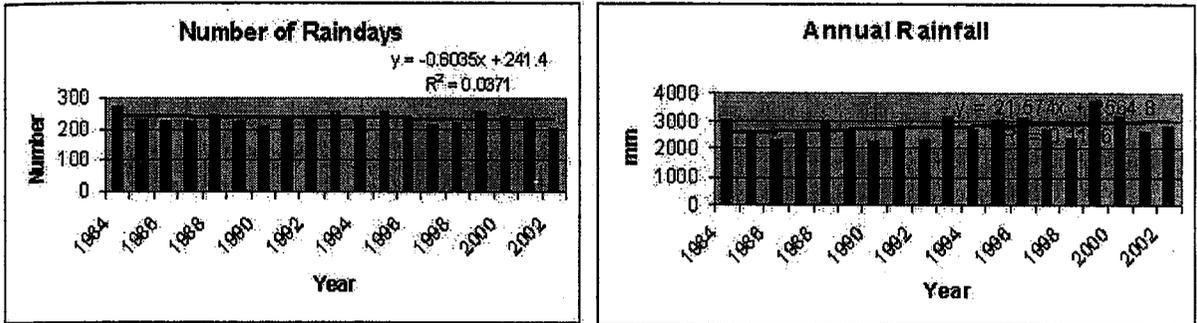
Chan et al (2003b) have shown that forest clearance can result in a decrease in humidity, both absolute and relative. In the Cameron Highlands area, within the forest, the relative humidity is constantly high between 90 – 100 %. Hence, saturation is common at night and in the early morning resulting in occurrence of mist and fog. In comparison, outside the forest in Tanah Rata and Brinchang, the values are lower between 80 – 90 %. In addition, deforestation results in a loss of transpiration resulting in little water recycling. Moisture from the forest transpires into the atmosphere as clouds and returns to the forest as rain. Deforestation means there is no more transpiration through the forest foliage, and this reduces the incidence of fog and rain. In addition, no forest means very little horizontal capture of atmospheric moisture by vegetation. One of the more severe effects resulting from deforestation and opening of the forest canopy in relation to the change in the micro climate is not so much in the temperature, although this will reduce the attractiveness of the place as a resort, but rather the reduction and destruction of the vital function of these highland forests as “cloud forests” (Chan et al, 2003b; see also Chapters 1 and 2). To many water researchers and forestry experts, one of the main functions of hill forests is their ability to capture moisture in the air, or what is known as “horizontal precipitation” (Salleh Mohd. Nor, 1992:2). This terminology is applied to moisture entering the forest ecosystem via condensation of atmospheric vapour on to leaves, grass and other vegetative surfaces. Depending on the location, cloud forests may be commonly found in Cameron Highlands, Fraser’s Hill, Genting Highlands (the Chinese name for Genting Highlands is literally “Top of the Clouds”), Gunung Belumut, Gunung Tapis, and the highlands of East Malaysia along the Iran, Tama Abu, Kapuas Hulu, Trusmadi and Brassey ranges. The Ulu Muda, Bukit Saiong, Bukit Keramat, Chebar Besar, Padang Terap and Pedu permanent forest reserves are also included as hill forests and they also serve the same function in trapping moisture. These highland forests experience a unique microclimate in that temperatures are always low and humidities extremely high. As a result, there is always a layer of mist, fog or cloud surrounding these forests. According to Stadmuller (1986), cloud forests in the humid tropics are covered with clouds or mist most of the time, and besides absorbing the usual rainfall they also receive additional moisture in the form of condensation of water droplets in the air. As humidities are high and temperatures low, these are conditions very conducive for the transformation of water vapour into water droplets.

Furthermore, Chan et al (2003b) also showed that studies carried out on hill forests indicate that the volume of horizontal precipitation can sometimes even exceed the total volume of normal rainfall. This is especially so during the dry months of the year. For example, Vogelmann (1973) has demonstrated that horizontal precipitation in the humid tropics can be as high as between 300 mm to more than 900 mm per annum. When compared with the normal rainfall, it can be translated into as much as between 7 % (during the wet season) to more than 100 % (during the dry season). Elsewhere, Juvik and Ekern (1978) has also shown that horizontal precipitation can amount to more than ten times the normal rainfall during the dry season. Consequently, destroying hill forests can result in the loss of a huge amount of water resources. Without the trees, much of the moisture in the air will remain there until the normal rainfall process occurs or get blown away elsewhere by winds. A deforested area will not be able to hold and retain the moisture, both in the air and in the soil. Reduction of forest canopy, even opening up 20 % of the canopy, can significantly reduce horizontal capture of moisture by the trees. Reduction of the amount of horizontal water capture by forests will reduce the capacity of the water catchment leading to an overall reduction in total water availability. This will further lead to increased vulnerability of an area to water stress during times of drought or prolonged dry periods. Given the fact that Cameron Highlands are increasingly affected by water shortages (especially during peak holiday seasons when water demand is at its peak), more deforestation will exacerbate water problems.

#### 4.7 Effects on Rainfall and Droughts

Mean Rainfall has dropped at a rate of 4.4mm/yr for the last 50 years from about 2,500 mm/yr to about 2280 mm/yr (TNB Research Sdn Bhd, 1997) (Figure 4.8). The scientific literature confirms that tropical

##### CAMERON HIGHLANDS STATION



##### TANAH RATA STATION

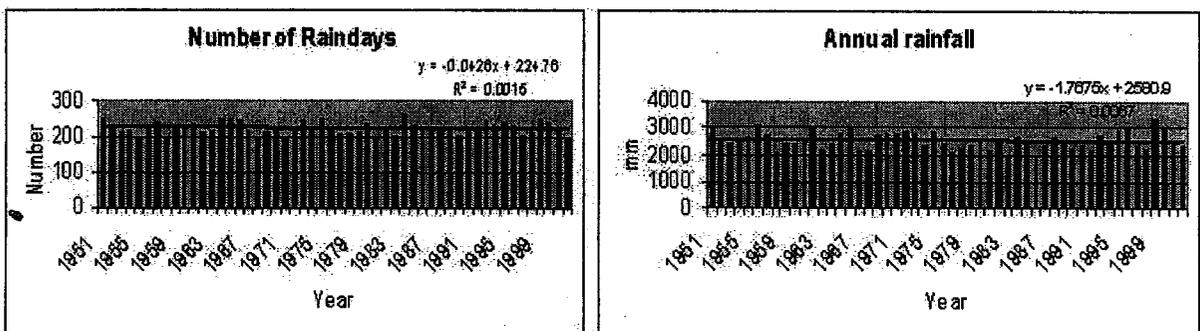


Figure 4.8: Distribution of Number of Rindays and Annual Rainfall at two selected stations in in Cameron Highlands.

rainforests play a vital role in local climate regulation by their interaction with water cycles. Hence, it is a fact that rainforests affect local weather but they have also been shown to have a significant effect on global weather. The albedo or reflectiveness of a surface is low, i.e. absorbance of sunshine is high. According to Myers (1997):

*...Much of the energy that converts surface moisture into water vapour comes from the sun's radiational heating of the land surface. The energy thus depends on surface albedo, or relevant degree of reflectant "shininess" of the land surface. In turn, the albedo depends on the vegetation, which absorbs more heat than does bare soil. Over thick vegetation, vigorous thermal currents take moisture (provided by the same plant cover) up into the atmosphere, where it condenses as rain. Because of its influence on convection patterns and wind currents, and hence on rainfall regimes, the albedo effect constitutes a basic factor in controlling climate.*

Hill forests increase the humidity of the immediate and surrounding area through transpiration. This process adds to local rainfall. For example, it has been reported that 50-80% of the moisture in the Amazon rainforest of Brazil remains in the ecosystem water cycle whereby moisture is transpired and evaporated from forest into the atmosphere, condensing to form rain clouds before returning to the forest and land surface as rain. After deforestation, significantly less moisture is evapotranspired into

the atmosphere (depending on the rate of forest clearance) resulting in the formation of fewer rain clouds. This is what happened to Penang island when more than three-quarters of its forests are lost. Subsequently there is a decline in rainfall, as manifested in all four water catchment areas on the island. In a way, rainfall amount varies inversely with the rate of deforestation, i.e. the greater the deforestation the lower the rainfall. Given the scenario that more and more forests will be cleared for future land use, Penang's rainfall is expected to keep decreasing. The trend of decreasing rainfall will continue. As an example, the Madagascar of today is largely a red, treeless desert after generations of severe deforestation. As rainfall decrease, so will river flows decline jeopardising our water supply. When river levels fall, low flows become more frequent and pollutants become more concentrated. Hence, not only will smaller amounts of water reach our intake points, poorer quality water reaches our house and industry. This will also affect agricultural and food supply. Land use change from forests to secondary forest and shrubs, or worse to urban areas, can severely reduce rainfall patterns. Colombia, once second in the world with freshwater reserves, has fallen to 24th due to its extensive deforestation over the past 30 years and excessive deforestation around Kuala Lumpur, combined with the dry conditions created by el Niño, triggered strict water rationing in 1998 and for the first time the city had to import water.

In another study on the effect of deforestation on runoff, it was determined that increased tree cover could save a great deal of money for municipalities. For example, a medium-size, 3.86-acre residential site, with its 8 % canopy cover, provided a 3 % runoff reduction. If the site's tree canopy were increased to 35 %, runoff reduction would quadruple, to 12.8%; a canopy cover of 45 % would bring that number to 16.1 %. (As a rule, American Forests recommends that cities maintain a 40 % tree cover) ([http://www.forester.net/sw\\_0203\\_trees.html](http://www.forester.net/sw_0203_trees.html), 19May03 1520Hrs).

In terms of acid rain, forests also have a vital influence on rainfall acidity in Malaysia. The Cameron Highlands area has an average rainfall pH 4.8 to 5.2, considered the highest (i.e. least acidic) in the country. In fact, most of the central main range has such high pH values. In comparison, the major cities, especially the Kuala Lumpur-Petaling Jaya-Shah Alam-Klang conurbation (which is also highly industrialized), the Georgetown-Prai area and the Johor Bahru region (near to highly industrialized Singapore) have the lowest pH values, all less than 4.4. These areas are therefore considered experiencing acid rain. Lee and Chan (2002) have also demonstrated that the incidence of acid rain in Cameron Highlands is low compared to that for the industrialized and urban areas of the highly developed west coast of Peninsular Malaysia.

#### **4.8 Effects on Air Quality**

In terms of air pollution, it was found that Cameron Highlands has one of the cleanest air in the country. In fact, clean and fresh air is one of the main attractions of the area. However, during the school holidays and long public holidays, when the area is congested with tourists and vehicles, air pollution in Tanah Rata, Ringlet and Brinchang can be bad. Figure 4.9 shows the SO<sub>2</sub> and NO<sub>2</sub> concentrations in Petaling Jaya and Tanah Rata in 2001 (Source: Malaysian Meteorological Service). It is clear that Tanah Rata still possess extremely good air quality by virtue of the low concentrations of these two pollutants.

In terms of aerosols or Total Suspended Particulates (TSP), i.e. small airborne particulates with diameters less than 100 micrometers, it was also found that the Cameron Highlands area is still very clean with low concentrations. TSP with an aerodynamic diameter of 10 micrometers or less called PM<sub>10</sub> particulates (which are usually of a much greater health concern) is also recorded with low concentrations in Cameron Highlands. In terms of Total Suspended Particulate, measured using High-Volume Air Sampler, the monthly trends in TSP loads shown in Figure 4.10 indicates that Tanah Rata has one of the lowest concentrations in comparison to the cities and towns in the country (Source: Malaysian Meteorological Service).

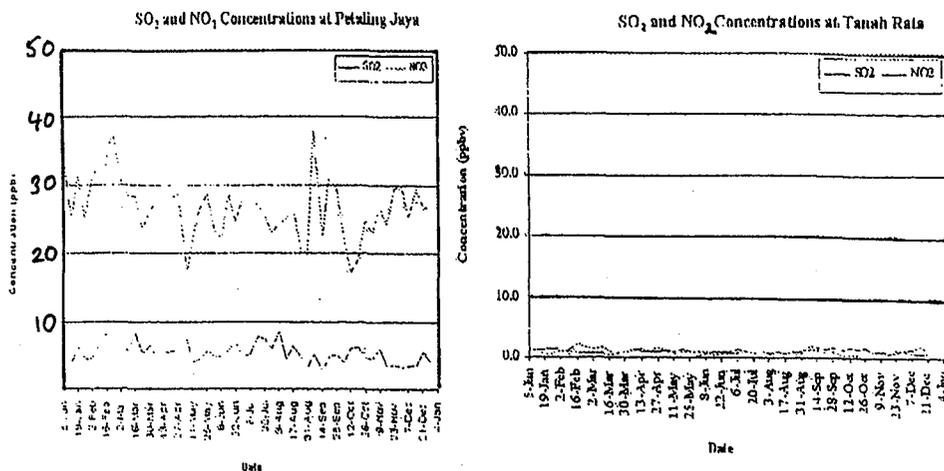


Figure 4.9: SO<sub>2</sub> and NO<sub>2</sub> Concentrations in Petaling Jaya (Selangor) and Tanah Rata (Cameron Highlands) (Source: Malaysian Meteorological Service)

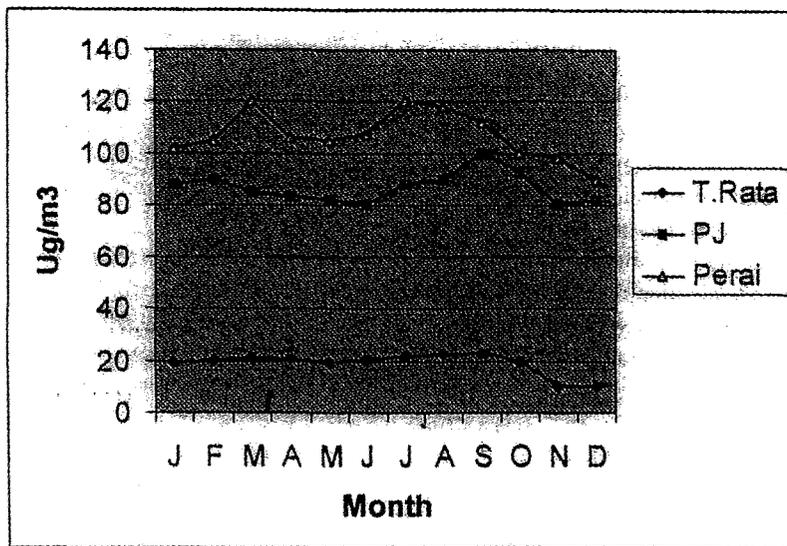


Figure 4.10: Total Suspended Solids for Selected Towns in Malaysia.

#### 4.9 Conclusion

There is little doubt that rapid development in terms of logging, urbanization, agriculture, tourism, housing and infrastructure development has degraded the environment in Cameron Highlands, leading to changes in climatic regime. Unless the authorities take immediate action to protect the forest and its adjacent environs, and in the process conserve its climate regime, then temperatures will keep on rising and rainfall (essential for water resources, agriculture and power generation) will keep dwindling. The Federal Government, via the Ministry of Environment, has drafted the Highland Areas Development Guide specifying the regulations of highland development. It is up to Pahang State to adopt and follow the regulations. The frictions between Federal and State governments need to be solved quickly. More importantly, co-operation and mutual-support between various state and federal agencies (all having an interest in forest and climate) should be the norm. Currently, these agencies have conflicting objectives and often compete against one another, resulting in adverse effects on forestry and the environment. Hence, Pahang should set a good example by maintaining strict enforcement of federal regulations. Perhaps a Pahang State Highland Development Authority needs to be formed to coordinate matters between agencies. In Cameron Highlands, development control is not effective largely due to poor enforcement and the inconsistent policies between federal and Pahang State governments. Illegal development (mostly agriculture and illegal opening of land) has also contributed to environmental hazards such as soil erosion, sedimentation and downstream flooding. Enforcement needs to be strict and swift. In this area, environmental groups such as REACH, WWF and MNS or even the local orang asli can help become scouts or "eyes" of the government. With strict enforcement, Cameron Highlands can be a model for sustainable development, something that the Malaysian Government is supporting and advocating at the international arena. The NGOs should be proactive and at the same time constructive. They must work with the government agencies rather than do lip service by offering token or unconstructive criticism. Government and NGOs should also involve the orang asli in all aspects of development in Cameron Highlands, notably in agriculture, the hotel and other service industry and ecotourism.

Obviously, large scale deforestation should be banned in Cameron Highlands. More importantly, many of the current forest reserves should be gazetted as State or National parks in the form of Taman Negara. National Parks would be the better alternative because of the guaranteed federal financial support. Agriculture, now a viable and lucrative sector, should be strictly controlled right from approval of TOL to land clearing, farming practices and use of fertilizers and insecticides. Here, the use of Macro EIA needs to be applied in all development proposals in the area. Development master plans of Cameron Highlands must allow for inputs from Federal Government. Agriculture must be strictly controlled to ensure it is developed in a sustainable manner with minimal environmental impacts. Farming should be environmentally friendly using terracing, rain-covers, rainfall harvesting roofs, mulching, etc. Now that Malaysian society is highly educated and informed, organic farming is developing a niche. Organic farming should be encouraged via tax incentives and other financial tools. Due to the rich flora and fauna, its cool climate and scenic landscapes, as well as its highly environmentally sensitive nature, the best option for tourism development in Cameron Highlands is not mass tourism but ecotourism. Finally, the concept of using forest (i.e. trees) to conserve its attractive climate must be actively promoted by all government agencies. If not, Cameron Highlands will lose its attractiveness and when that happens, it will lose its clientele of tourists just like many beach resorts in Malaysia have lost theirs (to neighbours Thailand and Indonesia) when their beaches and seas became polluted. Politicians and administrators need to work together with planners (who draw up development plans) and engineers (who do the construction). Foresters also need to team up with engineers and planners to actively promote environmentally-friendly construction and forest conservation as tools in climate management.

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## Bibliography

Andrasko and Huang (1992) *Cooling Our Communities: A Guidebook on Tree Planting and Light-Colored Surfacing*. Washington, D.C.: U.S. EPA Office of Policy Analysis. In D.B. Botkin and E.A. Keller (2003) *Environmental Science*. New York: John Wiley & Sons, Inc., 586.

Barrow, C.J., Clifton, J., Chan, N.W. and Tan, Y.L. (2004) "Sustainable Development in the Cameron Highlands, Malaysia. In Jamaluddin Md. Jahi, Kadir Ariffin, Salmijah Surif and Shaharudin Idrus (Editors) *Facing Changing Conditions. Proceedings of the 2<sup>nd</sup> Bangi World Conference on Environmental Management*. Bangi: Environmental Management Programme, Centre for Graduate Studies Universiti Kebangsaan Malaysia and Environmental Management Society (EMS) Malaysia, 222-234.

Chan, .N. W (1991), The Climate of Penang Island. *Kajian Malaysia* IX (1), June, 62-86.

Chan, N.W. (1995) *Asas Kaji Iklim*. Kuala Lumpur : Dewan Bahasa dan Pustaka.

Chan, N W, Barrow, C, Clifton, J and Kung, H T (2003a) An assessment of climate change in Cameron Highlands. In Jamaluddin Md. Jahi, Ismail Sahid, Kadir Arifin, Mohd Jailani Mohd Nor, Kamaruzzaman Sopian and Md. Pauzi Abdullah (Editors) *Pengurusan Persekitaran 2003*. Bangi: Pusat Pengajian Siswazah UKM, 585-599.

Chan, N W, Clifton, J, Barrow, C, Chang, W.F., Wong, C.F. and Ting, P.L. (2003b) Developmet Issues and Prospects in Cameron Highlands. In Wan Ruslan Ismail, Narimah Samat, Aziz Abdul majid, Moha Asri Abdullah and Anisah Abdullah (Editors) *Society, Space & Environment in a Globalised World: Challenges and Prospects*. Geography Section Universiti Sains Malaysia and National Geographical Association of Malaysia, Penang, 240-251.

Chan, N. W. and Wan Ruslan Ismail (2000) "*The Geography, Climate and Hydrology of Pantai Acheh Forest Reserve*". Paper presented at the State Seminar – "Pantai Acheh Forest Reserve: The Case for a State Park". 23 – 24 September 2000, Universiti Sains Malaysia, Pulau Pinang.

Chandler, T. J. (1965). *The Climate of London*. London : Hutchinson & Co. Ltd.

Costa, M H and Foley, J A (2000) Combined effects of deforestation and doubled atmospheric CO<sub>2</sub> concentrations on the climate of Amazonia. *Journal of Climate* 13(1), 18-34.

Friends of Penang Hill (1991) *Penang Hill: The need to save our natural heritage*, Friends of Penang Hill, Penang.

[http://www.forester.net/sw\\_0203\\_trees.html](http://www.forester.net/sw_0203_trees.html)

Juvik, J. O. and Ekern, P. C. (1978) A climatology of mountain fog on Maluna Lona, Hawaii Island. *Water Resources Research Centre, University of Hawaii, Technical Report* No. 118.

- Landsberg, H.E. (1956) 'The Climate of Towns'. In Thomas, W.L. (ed) *Man's Role in Changing the Face of the Earth*. Chicago, 584-606.
- Landsberg, H.E. (1970) Man-made climatic changes. *Science* Vol 170, 1265-1274.
- Landsberg, H.E. (1981) 'The Urban Climate'. In *International Geophysics Series*. Vol.28. New York : Academic Press, Inc. 1-261.
- Lee O P and Chan N W (2002) Incidence of Acid Rain in Peninsular Malaysia and Its Implications on Surface River Water Resources. In N W Chan (Ed) "*Rivers: Towards Sustainable Development*". Penerbit Universiti Sains Malaysia, Pulau Pinang, 70-80.
- Leong, C.P. (2004) *Global Warming: Has there been a change in the Climate of Cameron Highlands?* Paper presented at the International Seminar on "Sustainable Development of Cameron Highlands: Issues & Challenges", 11-12 December 2004, Brinchang, Cameron Highlands, Malaysia.
- Leong, Y. K. (1992) Conservation and Development of Cameron Highlands. In Lim, R. P. and Lee, S. W. (eds) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur, 20-32.
- Lim, G.E. (1980) Pulau Haba Bandar dan Aplikasinya terhadap Kajian Pencemaran Udara di Georgetown, Pulau Pinang. Bachelor of Arts Graduation Exercise, Geography Department, Universiti Kebangsaan Malaysia, Bangi.
- Lim, R. P. and Lee, S. W. (eds) (1992) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur.
- Lowry, W.P. (1967) The Climate of Cities. *Scientific American* Vol 217, No 2, 15-23.
- Myers, N. (1997) "The world's forests and their ecosystem services," in G.C. Daily (Ed) *Nature's Services - Societal Dependence on Natural Ecosystems*, Washington D.C.: Island Press.
- Salleh Mohd. Nor (1982) The Hills must be Protected. In Lim, R. P. and Lee, S. W. (eds) (1992) *Hill Development: Proceedings of the Seminar*. Malayan Nature Society, Kuala Lumpur, 1-5.
- Sham, S. (1982) *Pembangunan, Iklim Bandar dan Pencemaran Udara*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Sham, S. (1985) *Environmental Impact Assessment Study for the proposed Fantasy Hills Development at Bukit Fraser, Pahang: Microclimate effects*. Engineering Resources Incorporated Sdn. Bhd., Kuala Lumpur.
- Sham, S. (1987) *Urbanization and the Atmospheric Environment in the Low Tropics: Experiences from the Kelang Valley Region Malaysia*. Bangi: Penerbit Universiti Kebangsaan Malaysia.
- Sham, S. (1990) *Pembangunan dan Iklim: Implikasinya Terhadap Perancangan Bandar di Rantau Tropika Rendah*, Syarahan Perdana jawatan Profesor Universiti Kebangsaan Malaysia. Bangi: Penerbit Universiti Kebangsaan Malaysia.
- Sham, S. (1995) *Iklim Mikro: Proses dan Aplikasi*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Sin, H.T.(2005) Fenomena Pulau Haba dan Pembangunan: Satu Kajian Kes di Pulau Pinang. Unpublished M.A. Thesis, Universiti Sains Malaysia, Penang.

Sin, H.T. and Chan, N.W. (2005) "Variasi Reruang dan Masa Fenomena Pulau Haba dan Pulau Sejuk di Pulau Pinang". Paper presented at the National Conference "Environmental Management 2005", 4-5 July 2005, Bangi, Malaysia.

Stadmuller, T. (1986) Cloud forest in the humid tropics. The United nations University.

Strahler, A. and Strahler, A. (2002) *Physical Geography: Science and Systems of the Human Environment*. 2<sup>nd</sup> Edition. New York: John Wiley R Sons, Inc., 120-130..

TNB Research Sdn Bhd (1997) *The Development of Catchment Monitoring and Management for Pergau and Cameron Highlands Batang Padanag using GIS*. TNB Research Sdn Bhd, Kajang.

Vogelmann, H. W. (1973) Fog precipitation in the cloud forests of eastern Mexico. *Bio-science* 23 (2): 96-100.

## CHAPTER 5

# PROMOTING SUSTAINABLE TOURISM IN THE CAMERON HIGHLANDS: AN OVERVIEW OF CURRENT ISSUES AND SOME PROPOSALS

Dr Julian Clifton  
 Department of Geography  
 University of Portsmouth, PO1 3HE  
 United Kingdom  
 Tel: +44 2392 842489; Fax: +44 2392 842512  
 Email: julian.clifton@port.ac.uk

### Abstract

*The significance of tourism as an income-generating activity has been widely recognised, leading to aggressive and diverse initiatives by many countries to secure their place in the international travel market. Ecotourism is one component of the travel sector which has witnessed steady and rapid growth in south east Asia, reflecting the demand for nature-based experiences and the abundant natural resources of the region. The cultural history and the natural surroundings of the hill stations of Malaysia offer a unique ecotourism product yet which are experiencing significant problems associated with planning tourism-related activities and the participation of local communities in this process. This chapter will discuss these issues and present proposals which could ameliorate this situation, leading to a more sustainable form of tourism which could benefit the natural surroundings and the communities which are dependent upon this distinctive and fragile environment.*

### 5.1 Introduction

The rise of tourism as a global activity in the past decade has resulted in it being the world's single biggest industry, generating over £280 billion and supporting an estimated 200 million jobs in 2002 (World Tourism Organisation, 2003). Until the events of September 2001 and the subsequent increased perceived risks associated with air travel and particular destinations, this growth was seen as limited only by the capacity of the airline industry and major airports to cope with the demand whilst meeting stringent safety standards (Table 5.1).

Year	International arrivals (millions)	tourist	% annual change
1996	586		6.2
1997	610		4.1
1998	629		3.1
1999	652		3.7
2000	697		6.9
2001	692		-0.6
2002	703		1.6

Table 5.1. Trends in international tourism. Source: World Tourism Organisation (2003).

However, the availability and diversity of budget or 'no-frills' flight operators, the relatively cheap price of travel to exotic destinations and the affluence of individuals both in Europe and Asia has led to a resumption of growth in more recent years and a renewed optimism within the travel industry. The most recently available data indicates an increasing rate of growth in 2004, with arrivals to Malaysia up by 60% between January and May 2004 in comparison to the same period in 2003 (World Tourism Organisation, 2004).

The tourism product promoted by Malaysia in destination markets such as the UK and Europe plays upon a range of attributes which is designed to appeal to a broad clientele. An emphasis on the pristine quality and diversity of the natural environment is prevalent, although this is given a unique slant through highlighting the mix of cultures as well as the combination of the modern and the exotic in urban centres. It is also apparent that Malaysian tourism draws upon the cultural heritage and links with the UK in order to imply a higher degree of personal safety and ease of communication for British and other English-speaking visitors.

A recent survey of British tourists demonstrated that around a quarter were motivated by desires relating to experiencing the natural environment and indigenous culture (World Tourism Organisation, 2001), both of which are consistent with the generally accepted definition of ecotourism as being 'responsible travel to natural areas that conserves the local environment and improves the well-being of local people' (The International Ecotourism Society, 1993). Furthermore, the 200 ecotour operators in the British survey ranked wilderness areas, viewing wildlife and meeting indigenous people as the three most important elements of an ecotourist trip.

Whilst the overall quality and diversity of Malaysia's natural attractions are undoubted, it is evident that many of the classic tropical marine and rainforest environments could well be experienced elsewhere and in some cases for a lot less expenditure. However, the upland environments of the Cameron Highlands and other Malaysian hill stations remain a unique attraction, blending flora and fauna, climate, agricultural land use and cultural attributes in a relatively small setting which can be readily experienced by visitors. Activities associated with ecotourism in these locations include trekking, watching wildlife, visiting agricultural centres such as tea plantations and honey farms and visiting indigenous Orang Asli villages. Given the particular association of the hill stations with the period of British colonisation of Malaysia, the highlands are particularly favoured destinations with this visitor group. Other highlands leisure activities include golf which is popular amongst Japanese visitors to the region owing to the relative ease and cost of playing golf in this location as opposed to Japan.

## 5.2 Discussion

Given the unique attractions and amenable climate of the hill stations, it is inevitable that development pressure in order to capitalise upon the visitors to these regions will take place. As with many other popular tourist destinations, uncontrolled or inappropriate building of hotels and apartments is common in the highlands, which in turn generates pressure to improve transport links to the region through new road building and widening programmes. The visual and aesthetic quality of the highland environments is frequently spoiled by disposal of domestic and industrial waste by the roadside, whilst agricultural expansion also impairs the visual attributes of the region through increasing soil erosion and adversely affecting water quality. The organisation of tour operations within the Cameron Highlands in particular has been noted to be deficient, with unlicensed tour operators and guides being unwilling<sup>3</sup> or unable to conform with regulations regarding the extraction or disturbance of flora and fauna in the 'virgin jungle reserve' of the highlands (Clifton, Barrow and Chan, 2003).

These issues have their root in poor planning and enforcement of laws relating to highland development which merit explanation before alternative proposals can be put forward. Whilst land use policies are designed at the Federal government level in accordance with national development plans, there is an implicit emphasis in the National Land Capability Classification towards development and exploitation of natural resources. Class V denotes land which cannot be exploited for mining, agriculture or forestry and which hence can be considered for designation as reserves. This is in line with the national drive towards development of the Malaysian national economy which has underpinned successive strategic plans. There is also no recognition of the particularly vulnerable characteristics of the highland environment when development proposals are being considered. As land use decisions are made at the individual State level, policies adopted will vary in their content and form, which is a relevant issue when the environment is particularly vulnerable to adverse effects

of development and in locations where more than one State is involved. It can therefore be seen that all the above factors will result in poorly administered land use activities in the Cameron Highlands, with the inevitable result that development of the Highlands is often inappropriate in design and poorly regulated.

Whilst land use planning in the Malaysian Highlands can be readily identified as being deficient in certain respects, addressing problems relating to tourism development in the Cameron Highlands entails a broader range of issues, particularly when the incorporation of indigenous groups such as the Orang Asli is being considered (Photograph 5.1). The roots of current problems relating to appropriate and equitable inclusion of Orang Asli in land use planning lie in the efforts of the British colonial government to resettle the previously dispersed Orang Asli groups in fixed settlements during the Emergency of the 1950s. This was followed by similar attempts by the Malaysian government to promote the Malay identity, which was characterised by features such as adherence to Islam, speaking Malay and practicing customs generally perceived as being typical of the 'Malay' identity (Nah, 2003). With respect to land use, this resulted in widespread appropriation of Orang Asli land for development purposes, as land use is now a matter for State institutions. Despite legal provision being made under the Aboriginal Peoples Act of 1954 for the designation of land as Orang Asli reserves, the actual record of this is poor, with only 18,587ha or 22% of the total land area requested by the Department of Orang Asli Affairs (JHEOA) being gazetted by 1997 (Seng, 1997). Furthermore, it is estimated that only 0.2% of Orang Asli possess individual ownership rights to their land, meaning that there is considerable uncertainty over future land development and that they are not eligible for subsidies or credits to aid land management (Seng, 1997).



Photograph 5.1: The planned orang asli village of Sg Ruil is a potential tourist attraction for Cultural Tourism but has not been developed and marketed fully.

It can be argued that these underlying factors will influence and determine the extent and willingness of Orang Asli to become involved in any economic or other activity which entails a greater reliance on individuals or institutions associated with the State. Critics of the government's policy towards indigenous groups in Malaysia draw comparisons with the colonial administration's actions and attitudes towards these groups, concluding that there is little evidence of change and that land use policies fail to consider this vital stakeholder group (Kader, 1997; Nicholas, 2000). Furthermore, there is little evidence that visitors to the Cameron Highlands are made aware of the cultural and social aspects of the Orang Asli resident in the highlands. Orang Asli are represented in tourist literature as a curiosity or throwback to pre-modern Malaysian times and visits to Orang Asli settlements are advertised as a side issue relative to activities focused on the natural environment. Due to problems of access to Orang Asli settlements, these visits are focused on a limited number of Orang Asli villages and are conducted in a manner which excludes Orang Asli residents from influencing or benefiting from such tours. Opportunities to benefit from tourism are limited to selling produce at roadside stalls, occasionally receiving gifts from visitors to villages or seasonal and unpredictable low pay employment in roles such as golf caddies.

It can therefore be seen that restrictions to widening participation in tourism and extending the powers and influence of Orang Asli in this respect are limited by historical and current aspects of government policy at the federal and State level, coupled with a form of tourism which serves to exclude Orang Asli from significant or long term benefits. However, there are possible means by which this situation could be ameliorated in certain respects which in the longer term could address some of these issues.

As pointed out above, the Cameron Highlands straddle more than one State and are located distant from the main administrative centre of Pahang. This apparent geographical disadvantage can serve to increase the power and influence of locally-based stakeholders which can result in positive outcomes. The actions of locally-based NGO's such as REACH and WWF in the locality have already demonstrated that results can be achieved through co-ordinating local interest groups with a stake in developing more sustainable forms of tourism and environmental management. Such groups can and should act as a catalyst for the formation of environmental forums which through collective action can demonstrate the extent of shared interests amongst businesses and environmental groups in the Camerons. The combined economic and political influence of such stakeholder groups can be an effective means of uniting previously diverse interests and, through collective action, improve and build upon individual stakeholders' capacity to lobby and press for improved environmental management in the Cameron Highlands. Such forums should include business interests, representatives of the tourism industry, Orang Asli groups as well as environmental and other NGO's and present a united front when campaigning on issues relating to development and other issues affecting the Highlands.

With respect to the problems of land use and State policy affecting the Highlands, it must be remembered that the current designation of the Camerons as a 'virgin jungle reserve' is evidently ineffective and necessitates reappraisal. Management capacity in terms of enforcing the theoretically strict laws regarding natural resources in such reserves is extremely limited and these are frequently ignored when development proposals are submitted. The question as to whether this designation could be enhanced and reinforced with a more effective system of protection needs to be considered. National parks are frequently the keystone in a country's protected area system, with most funds going towards conservation and the promotion of sustainable tourism receiving high priority in these locations. Malaysia's national parks are predominantly located in Sarawak, with only 3 out of the total of 18 being in peninsular Malaysia, none of which are representative of the highland environment. Gazetting the Cameron Highlands as a National Park would doubtless raise the profile of the region, rendering inappropriate development more difficult, whilst also increasing the revenue from tourism and raising local environmental awareness in the process. However, the nature of the highland region in terms of access and vulnerability reduces the physical carrying capacity of the environment, whilst there is no guarantee that increased visitor numbers would necessarily benefit the Orang Asli residents.

Furthermore, designation of National Parks usually reflects the need to manage and conserve natural habitats whilst maintaining income through tourism and promoting sustainable resource usage. The visual qualities of the Cameron Highlands largely result from the influence of human activity, with respect to the clear views afforded by forest clearance for tea cultivation. The unique aesthetic aspects associated with highland tea cultivation itself, in conjunction with the remaining forested areas on higher ground, constitute an environment which has been considerably modified by human activity and represents a 'working landscape' more typical of British national parks than those commonly found in developing countries which tend to focus more on the preservation of pristine environments or natural habitats. British national parks are managed under voluntary agreements with resident farmers and communities, with a balance constantly being sought between the needs of these groups and the demands of visitors, which requires a carefully constructed management approach based on negotiation and compromise rather than enforcement. Needless to say, this necessitates a slow process of building up stakeholder capacity and confidence amongst stakeholders that benefits can be realised from their participation, which will be difficult in the context of the Camerons for the reasons outlined above.

It is not the purpose of this chapter to recommend one course of action or another in this respect, as this decision rests with local stakeholders and State government. However, there is a need to reconsider the appropriate form of land designation in the Highlands in order to address the social and environmental problems facing this area. The process of gazetting a protected area is time consuming and could serve as a pretext for ignoring the real and pressing problems of land use in the Camerons. In the shorter term, therefore, there are actions which can be recommended which can serve to explore the possibilities of re-designation. First and foremost amongst these is the need to fully identify the biological case for conservation, which can be accomplished through increased research activity in the highlands. This need not rely upon federal or State funds, as there are numerous international volunteer conservation organisations which can be invited to establish research into flora, fauna, land issues, indigenous communities and other aspects of the Highlands which could form the foundation of subsequent proposals for re-designation. The presence of such organisations in the Camerons would also serve to raise awareness of the environmental value of the Highlands amongst local communities and, through an increased presence of experts and researchers in the area, reduce the likelihood of deliberate or accidental breaching of rules relating to natural resources.

Another course of action which could be taken following consultation with local stakeholders would be to increase the revenue from visitors to the Highland region, which is currently dominated by tour operators and large hotel chains. Under the 'polluter pays' principle, it would be logical and appropriate to levy visitor fees under a sliding scale which reflects primarily the activities undertaken by visitors to the Camerons. Many authors have highlighted the environmental costs of golf courses, for instance, which directly or indirectly result in loss of environmental quality in terrestrial environments and river courses. Many protected areas operate a visitor fee system according to country of origin, with more affluent foreign visitors being charged more than nationals, whilst repeat visits from both nationals and foreign visitors can be encouraged through imaginative application of a visitor fee system.

A third course of action relates to the need to increase the capacity of local stakeholders to influence land use and tourism policy in the Camerons in a more sustainable manner. If appropriate forums can be established which all stakeholders recognise as being valuable and influential, it follows that these can lead the way in terms of developing appropriate forms of development. It is often found that establishing links with other forums either within the home country or overseas can lead to significant benefits through sharing experiences and knowledge and thereby promoting awareness of the need to manage highland environments in a sensitive manner. The promotion of a 'sustainable tourism' package for the Camerons in partnership with stakeholders is one form of action which can result from co-operation and joint learning between local stakeholders and other, similar, organisations. As the stature and influence of a local stakeholder organisation increases over time, it can also serve as a platform to lobby State government over issues relating to land use planning which are implemented at the State level to the benefit of the Cameron Highlands environment.

### 5.3 Conclusion

This chapter has attempted to outline possible courses of action in the short term that can address the problems of inappropriate land use and tourism development in the Cameron Highlands. These have their root in historical and cultural processes, many of which serve to sideline and restrict the influence of local groups and the Orang Asli in particular, with respect to how the Camerons as an environment are managed. It is proposed that, given the evidently inappropriate virgin jungle reserve designation applying to the Cameron Highlands, consideration be given as to how this can be addressed and used as a basis for more sustainable and sensitive use of natural resources. Whilst designation of a National Park has certain advantages, these should not obscure the problems commonly found in administration of national parks elsewhere in Malaysia and neighbouring countries. However, there are several courses of action which can be adopted in the short term which could result in an increased knowledge of the biodiversity of the Highland environment, increasing the revenue associated with tourism which can fund practical conservation activities and increasing the capacity of local stakeholders to influence management decisions. These are practical and realistic steps which require co-operation and joint action amongst a diverse group of local stakeholders but which can yield evident results and generate support for a more effective system of environmental protection and appropriate forms of development in the Cameron Highlands.

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### Bibliography

- Clifton, J., Barrow, C., Chan, N.W. (2003). Participation to promote sustainable tourism in the Cameron Highlands: problems and possibilities. Seminar on Sustainable Development in the Cameron Highlands, July 2004.
- Kader, M.H. (1997). Land alienation: the need for transparency and accountability. In: Land Issues in Malaysia. Consumers Association of Penang, 12-19.
- Nah, A.L. (2003). Negotiating indigenous identity in postcolonial Malaysia: beyond being 'not quite/not Malay'. *Social Identities* 9 (4), 511-534.
- Nicholas, C. (2000). The Orang Asli and the Contest for Resources. International Work Group for Indigenous Affairs, Copenhagen & Centre for Orang Asli Concerns, Subang Jaya. 285pp.
- Seng, L.H. (1997). The land rights of the Orang Asli. In: Land Issues in Malaysia. Consumers Association of Penang, 170-195.
- The International Ecotourism Society (1993). What is ecotourism? Online at <http://www.ecotourism.org/index2.php?what-is-ecotourism>
- World Tourism Organisation (2001). The British Ecotourism Market. Available online at <http://www.world-tourism.org/cgi-bin/infoshop.storefront/EN/product/1223-1>
- World Tourism Organisation (2003). Tourism Highlights 2003. Available online at [http://www.world-tourism.org/market\\_research/facts/highlights/Highlights.pdf](http://www.world-tourism.org/market_research/facts/highlights/Highlights.pdf)
- World Tourism Organisation (2004). World Tourism Barometer June 2004. Available online at <http://www.world-tourism.org/newsroom/Releases/2004/june/data.htm>

## CHAPTER 6

# SUSTAINABLE AGRICULTURE IN THE CAMERON HIGHLANDS, MALAYSIA

Chris J. Barrow  
Reader

School of Social Sciences & International Development  
University of Wales Swansea  
Swansea SA2 8PP  
United Kingdom  
E-mail [c.j.barrow@swan.ac.uk](mailto:c.j.barrow@swan.ac.uk)

### Abstract

*The Cameron Highlands are 'at risk', especially from environmentally damaging farming, insensitive building, and some forms of tourism development. Present day farming activities are unsustainable and are already degrading, or are soon likely to damage tourism, biodiversity, hydropower generation, and the quality of life of many people in the highlands and in the surrounding lowlands. The impacts of highland development are increasingly felt further afield, especially through the degradation of the water quality and flow regime of streams, which run to surrounding lowlands. Opportunities should be grasped to develop more sensitive agriculture, tourism, forest product extraction, and building strategies.*

*The established farming, tourism, building, and forest product extraction are profitable. Understandably those involved and various institutions will hesitate to initiate changes which could reduce profitability; however, without some reinvestment and control the longer term prospects are for economic decline and serious environmental damage. More awareness of global and regional environmental change is also desirable. Because impacts are felt across broad swathes of the lowlands it is in the interests of the Federal Government and surrounding States to invest in Cameron Highlands improvements. Unfortunately, the lowland 'offsite' impacts are effectively hidden from those causing them, and people in the lowlands have yet to link their welfare with environmental management of highlands. A key step will be to present the full costs (including lowland impacts) in a way that can be compared with the financial benefits of current farming tourism and building.*

*Opportunities must be grasped to prompt better environmental management and to pursue sustainable development. Somehow, those involved in farming, tourism, and forest product extraction have to be encouraged and supported to adopt sustainable, less damaging alternatives (Barrow, in press; Barrow, et al., 2004). One possibility is to encourage 'dovetailing' – integrated development of activities, which are mutually supportive. There appears to be potential for farmers, tourism developers, those concerned with biodiversity conservation, and Orang Asli peoples involved in forest product extraction to work together toward sustainable development.*

### Keywords

Sustainable agricultural development; environmental management; tropical highlands degradation; ecotourism; Malaysia; integrated development; dovetailing.

### 6.1 Introduction

Peninsular Malaysian highland areas and hill resorts, including the Cameron Highlands, Fraser's Hill, Genting Highlands, Bukit Larut, Penang Hill; Maxwell Hill, retain a cover of vulnerable forest, which at lower altitudes have been extensively disturbed. Highland forests are increasingly important refuges for biodiversity and attractive environments for recreation and tourism (Raine, 1995)(Figure 6.1).

Highland forests trap passing cloud, which often would otherwise fail to precipitate; and thus act as an important water catchment for large parts of lowland Malaysia. Cleared of forest cover less precipitation occurs (some estimates suggest a reduction of  $900 \text{ mm y}^{-1}$ ). This means streams flowing to lowlands suffer erratic discharge, higher peak flows, and reduced volume in dry periods, they are also increasingly polluted – all this impacts on lowland agriculture and affects the health and livelihood of large numbers of people through degradation of water supplies (Nooi, 1991; Chan, 2000a; Chan, et al., 2003: 245). South East Asian lowlands are hot, humid and increasingly urban-industrial environments with growing populations that are becoming more affluent; lowlanders welcome highland produce and seek recreational opportunities. Steep slopes with a cover of deeply weathered soils and underlying rock coupled with heavy rainfall mean that landslides and high rates of erosion are a risk. Highland development easily pollutes streams with eroded silt, agrochemicals, excess nutrients and sewage. Damage to forests in the Cameron Highlands is caused by logging (although this is less of a problem than it was), regional air pollution, global environmental change, building, tourism, extraction of forest products like rattan, and above-all, by farming (Barrow, 1980: 11; Wazir-Jahan, 1990). Areas like the Cameron Highlands are current ‘hot spots’, which indicate what could happen over larger areas of Malaysian and other tropical uplands, in coming decades if adequate corrective strategies are not developed soon. Given that sustainable development experience in the Cameron Highlands should be useful elsewhere there is a chance for international support from bodies like the FAO, CGIAR, and similar.

Some of the earliest agricultural development in the Cameron Highlands was the establishment of tea plantations. A few of these have remained in production from the 1920s or earlier and are presently the nearest there is to site-adapted agroforestry or ‘ecofarming’. Around 2800 ha of tea estates have been established, but there has been little recent expansion beyond that. Because it is a perennial crop providing reasonable groundcover and is treated with little or no chemical fertilisers herbicides or pesticides there is relatively limited environmental impact. Some tea land is rejuvenated each year, perhaps as much as 10% of the total, which results in limited soil erosion until the surface is re-vegetated and a little silt may be also washed from terraces and gap-rows (Midmore, et al., 1996a). As well as providing a saleable crop tea estates attract tourists and there is probably potential for further tea-agritourism.

Vegetable, flower and fruit production has expanded since the 1960s and looks poised to grow further (Voon and Khoo, 1980; Shirasaka, 1988; Freeman, 1999). Farming is profitable but is unsustainable and environmentally unfriendly, shedding large amounts of silt (fine sediment eroded from soil surfaces), agrochemicals and surplus nutrients to streams. Most silt is generated when new farms are cut from the forested slopes, although there is some erosion until the cropped surfaces stabilise. Once production is established there are recurrent episodes of serious silt-generation, mainly after harvests (which may be more than once a year), and at times of especially heavy rainfall. Silty streams have seriously reduced the storage capacity of Ringlet Reservoir since the 1970s, damaging hydroelectric generation and causing unsightly landscape impacts, which deters tourists. This has necessitated expensive dredging, and has increased the risk of flood damage along stream courses.

Cameron Highland farms are seldom worked for more than 15 years, which means constant new cuts in valley sides; also, plots are periodically resurfaced with fresh soil dug from slopes - in some cases as frequently as every 22-weeks. Few farmers adopt erosion control techniques like bench-terraces, the most common practice is to grow crops on relatively broad sloping plots. Seldom are crop rows planted along the contour to help reduce erosion, some farmers actually run them up-and-down the sloping plot and the majority simply plant at right angles (across) the slope. There is little use of cover crops or mulch and no planting of erosion controlling vetiver grass or similar live-barriers. Fertility is maintained by adding newly dug soil, chicken manure or chemical fertilisers – these do little to maintain soil humus and nutrients and are easily leached into streams. Fertility enhancement by composting or legume intercropping is rare. So, well-tried and low-cost erosion control and fertiliser reduction methods have been little used (Hashim, 2003). However, virtually all farmers use plastic-sheeting rain shelters (which can reduce nutrient leaching and erosion a little) and sprinkler irrigation to enhance yields, improve crop quality and provide an environment allowing more diverse crops. So,

it appears that reduction of environmental damage and efforts to improve sustainability are not hampered by poverty or lack of suitable techniques. The poor support for sustainable agriculture innovations might be related to one or more of the following: labour shortages, reluctance to reinvest profits, fear that favourable market conditions are short-lived, a failure to accept that current practices are unsustainable, a culture of maximising short term gain without considering the longer term, an attitude that investment in sustainable development benefits others as opposed to the present farmer, a need for better education/extension support, breakdown of social capital, or other factors. Further study is needed to establish what are key factors and how to prompt farmers to innovate.

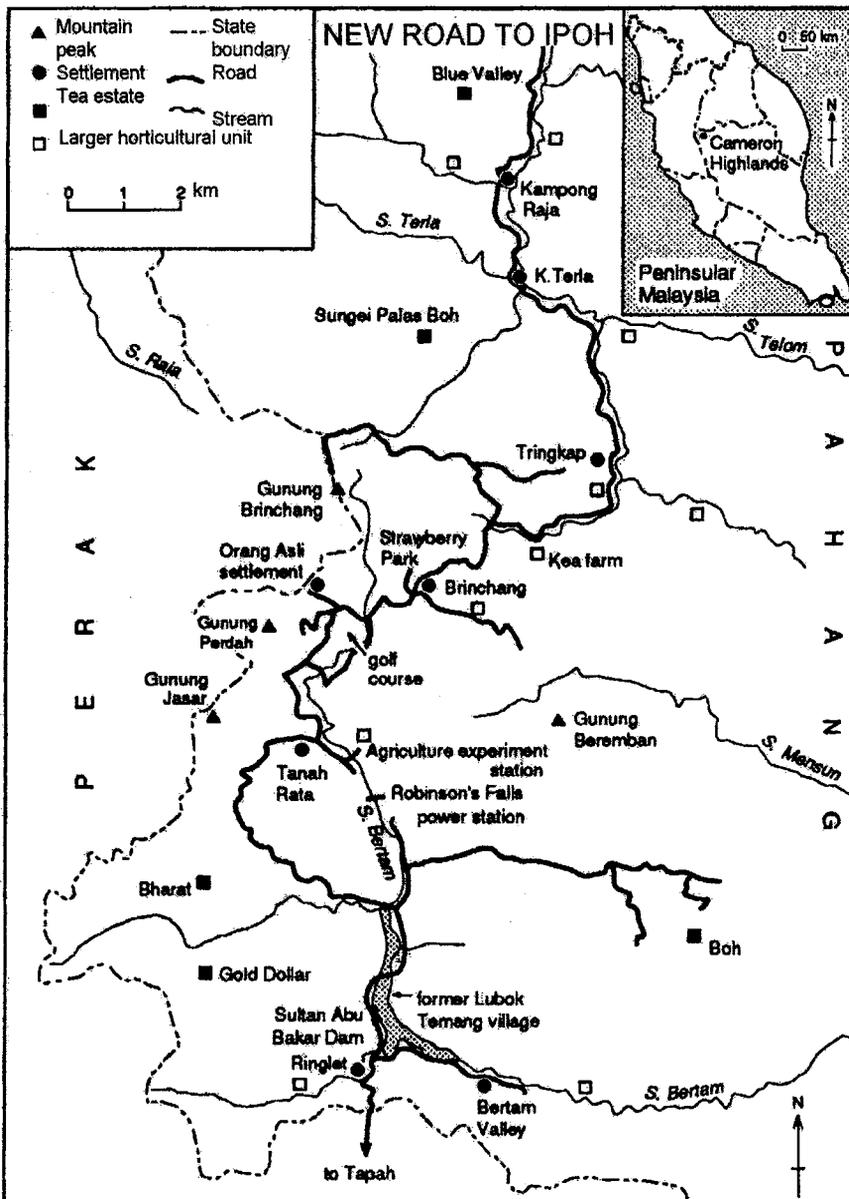


Figure 6.1: Geographical location of Cameron Highlands.

So far, there have been few published studies of sustainable agriculture approaches for the Cameron Highlands (Macken and Ong, 1979; Midmore, et al., 1996b; Taylor, et al., 1993); however, there are excellent agricultural research and extension services available to support improvements. Farming is profitable for the farmers and in 2000 it supplied around 60% of Malaysia's agricultural produce, saving imports and generating considerable export income. Understandably, tightening controls on

farming may not be universally welcomed. A step toward more sustainable development of agriculture and other sectors in the Cameron Highlands will be to present the full costs (including 'off-site' lowland impacts) in a way that can be compared with the financial benefits of current activities (Barnett, et al., 1995: 209).

Currently, Cameron Highlands farmers enjoy relatively *laissez-faire* official controls; in particular, they are allowed to clear land, farm it on license for 15 years, and then clear more. In effect a 15-year cycle of shifting cultivation is supported, rather than encouragement of sustainable production. Insensitive farming, tourism and building have not gone unopposed, a number of NGOs have been formed to try and improve environmental management and local people's well being. These include the Society of Regional Environmental Awareness of Cameron Highlands (REACH) and the Malaysian Nature Society. Citizen awareness is important because pressures on the highland environment look likely to increase again. There is a risk that the new Simpang Pulai-Kg Raja and Gua Musang-Kg Raja highways into the Cameron Highlands will prompt further horticultural development in formerly remote areas and in the future there may be more road development in highland areas which could prompt a wider spread of farming (Heang, 1990). Local roads and tracks to telecommunication installations have already improved access to farm sites, aid forest product extraction and could allow recreational and tourism activities that degrade the environment to an extent impossible in the past. With improved road access there will be more vehicles running at quite high altitude, so it would be wise to monitor traffic emissions, especially ozone - to try and assess whether there is any threat to the flora, fauna and agriculture of the Cameron Highlands.

The Cameron Highlands are partly under the jurisdiction of the State of Pahang, so some administrative offices are several-hours drive away on the eastern side of the peninsula. Produce and tourism mainly leaves and enters from the west, and many of the Cameron Highland farmers and tourism developers have links with Perak, rather than Pahang (Clarkson, 1968). Cameron Highland administrative responsibilities are divided between five State Governments, plus local authorities and Federal Government departments (Oh, 2000: 95). Administrative challenges and a need to co-ordinate development across a number of sectors suggest the need for some sort of highlands regional sustainable development authority with sufficient resources and powers to proactively steer and support integrated development, better environmental management and sustainable development. A model might be the integrated river basin development and integrated watershed development authorities established in various countries since the 1940s. The Cameron Highland offers a valuable opportunity for developing strategies that could be applied over wider areas of Malaysian and other tropical hill areas.

There have already been calls for more co-ordinated, proactive, adaptive and integrated management of Cameron Highland development (Oh, 2000; Government of Malaysia, 2001: 446). A strategic overview is crucial to ensure various efforts do not conflict and, if possible, support each other. For example, an integrated co-ordinating body can ensure tourism itineraries link one activity and site with another to compile a varied, attractive, and longer vacation. It could enable pressure to be removed from sites, which are being degraded and cope with bad weather, seasonal changes, and so on. Such a co-ordinating body could direct some of the profit from farm profits and tourism to support a shift to sustainable agriculture, improved conservation, and better environmental management. The Malaysian Government called for an Intergovernmental Committee on Highlands in 1996, and a Cabinet Committee was established in 2000 to co-ordinate, monitor and ensure sustainable development of hill and island resorts in Malaysia. A study to promote more effective co-ordination, including sustainable development in the Main Range of Peninsular Malaysia was launched in 2000 (Government of Malaysia, 2001: 545), and, in 1996 a National Eco-tourism Plan was drawn-up to provide a framework for the sector (Government of Malaysia, 2001: 441). There is clearly Government desire to reduce environmental impacts associated with highland development (Government of Malaysia, 2001: 520, 521).

## 6.2 Possible Routes to Sustainable Agriculture in the Cameron Highlands

There are obvious ways to reduce the impact of agriculture in the Cameron Highlands. Farmers could be forced or encouraged to sustain production on land they have already cleared if the authorities restricted new clearance and 15-year landholding licenses. At present it is possible to withdraw licenses if a farmer causes pollution, but this has seldom been done. Better monitoring of stream quality and enforcement could help reduce agrochemical and silt pollution. As already noted there are plenty of on-farm soil and water conservation practices, which could be adopted. A way of sweetening any shift to more control over land clearance and farming practices would be to try and develop tourism so as to help the transition to sustainable, but possibly less-profitable, farming and to support biodiversity conservation. Environmentally sound ('green') tourism might offer farmers and those extracting forest products alternative or supplementary livelihoods. There may be opportunities to levy dues on tourists, which can be invested in improving agriculture, conservation, environmental management, and local livelihood generation. Environmentally sensitive agriculture poses less threat to tourism and conservation and may offer opportunities for agritourism and biodiversity conservation. Detailed questionnaire surveys conducted by the author and colleagues between 2003 and 2005 with Cameron Highland visitors and local people, including *Orang Asli*, indicate that most local people and visitors appreciated environmental/biodiversity features and strongly disliked pollution, forest degradation and intrusive building (Clifton, et al., 2003).

The *Orang Asli* (indigenous peoples) in the Cameron Highlands could be more involved in developments, and they can contribute much and would benefit (Passoff, 1991; Foucat, 2002; Chan, et al., 2003). Presently they have limited involvement with commercial agriculture, which seems unlikely to change; however, there is scope for them to be much more active in the tourism sector, especially ecotourism and cultural tourism.

Sustainable development has attracted serious media and academic attention since about 1987, partly as a consequence of the 'Brundtland Report' (Barrow, 1995). There is no single universally acceptable definition of sustainable development, although it is widely recognised: that there are environmental limits to development; that environmental protection and development are interrelated and mutually dependant; that together with environmental care there must be concern for improving livelihoods, especially those of the poor; and that there needs to be intergenerational equity – i.e. people should pass on to future generations at least as good a range of options as they enjoy. Sustainable development shows no sign of going out of fashion, but pursuing it presents huge challenges. It is not enough to find workable techniques, efforts have to be funded and it is important to win the support of all sections of society. Sustainable development depends on establishing (if none are already present) and maintaining appropriate social institutions to support management and help adaptation to future challenges (World Bank, 2003).

Sustainable development is not 'cost-less' it demands trade-offs. In the Cameron Highlands some of the presently enjoyed profits from farming and tourism will have to be reinvested to achieve sustainable development of agriculture and other sectors, effective biodiversity conservation and improved environmental management. A shift to sustainable practices is unlikely to come from the agricultural community without prompting and support. Lowlands surrounding the Camron Highlands will benefit from improvements, so it would make sense for citizens in those areas to make some contribution – something like a federal tax might be investigated, or a levy on visitors to the highlands. Malaysia is pledged to take appropriate action to ensure that future development is sustainable and balanced (Government of Malaysia, 1996: 589; Government of Malaysia, 2001: 545). A Business Council for Sustainable Development in Malaysia was founded in 1992, and there has subsequently (1995) been the establishment of a Business Charter for Sustainable Development. Malaysia thus has a firmly voiced commitment to supporting sustainable development. The challenge is develop and implement sustainable highland strategies without delay.

It is important that those involved in sustainable development can call upon adequate social capital - the arrangements, traditions, and obligations which back-up individuals, families and groups so that

they can survive and to support innovation. If social capital degrades there can be serious problems maintaining environmental and socio-economic conditions, which support sustainable agriculture and sectors 'dovetailing' with it. There are many examples around the world where past sustainable agriculture has given way to poorly productive and environmentally degrading activities through the breakdown of social capital (through internal or external causes). Vast areas of the Andes are covered with abandoned irrigated bench terraces; swathes of Africa were once productive and are now often held to have dried out; however, social rather than environmental change are probably to blame. Village and regional officials may not always perceive loss of social capital, nor be aware of what is beneficial - so studies would be valuable for sustainable development efforts in the Cameron Highlands. Studies of social capital of farming highland communities would be very useful.

With the right support it could be possible to develop agritourism to help tourism diversify, attract longer stay and more affluent visitors, and generate funds to assist farmers to change to sustainable and environmentally friendly approaches (Fennell, et al., 2003). The key is to promote co-operation and integrated development. Various individuals, organisations and businesses can work for sustainable development but activities need to be co-ordinated (Selman, 1996). In the Cameron Highlands farmers and tourism entrepreneurs will have to embrace a paradigm shift and invest some of their profits in environmental management and sustainable development or in the longer term their lifestyles will suffer (Shepherd, 1998).

El Niño events (quasi-periodic climatic variations), acid deposition and global warming pose a growing threat to Malaysia's highland vegetation and farming. Presently there is little danger from forest fire or goat grazing which commonly blights other tropical uplands. However, if conditions become drier as a consequence of global warming and forest loss bush fires may become a threat. Regional air pollution from industrial, domestic and road traffic sources poses a threat to Cameron Highland biodiversity and farming, and may change the rates at which agrochemicals are leached into streams. Improved road access tends to increase the risk of the introduction of problematic exotic flora and fauna. Global warming-related threats of uphill shift of vegetation zones; altered precipitation; new patterns of crop and human disease transmission must also be watched for. Sustainable development must be adaptable and alert to physical threats and to socio-economic changes.

Agricultural produce from the Cameron Highlands is in demand in Malaysian cities and earns visible export income; as mentioned earlier, it would be useful to see the true costs of agriculture, allowing for stream degradation, biodiversity loss, siltation and flood damage, etc. That might improve the chances of convincing lowland citizens and the Government of the benefits of supporting highland areas from tax revenues. Ecological footprint analysis (eco-footprinting) has been used to measure progress toward sustainable development by a number of cities, businesses and various sectors (Gösling, et al., 2002). It would be interesting to apply eco-footprinting to Cameron Highland developments to try and show their overall impact. The Cameron Highlands are a discrete region and the 'off-site' lowland impacts are largely related to stream systems; so, actually conducting eco-footprinting should be relatively easy. Malaysia has institutions capable of undertaking such an exercise.

A form of green tourism - ecotourism - appeared during the 1980s and has spread rapidly - 2002 was declared the UN International Year of Ecotourism. Ecotourism is difficult to presently define<sup>1</sup>; the Ecotourism Society<sup>2</sup> suggested it was "...responsible travel to natural areas which conserves the environment and improves the welfare of local people." Some ecotourism is 'passive' with people essentially just looking, some can be 'active' with visitors paying to participate in agriculture, environmental management, archaeology, and so on. Many farms around UK cities draw the bulk of their income from environmentally friendly agritourism activities. In the Cameron Highlands there is already some horticultural- and agriculture-related agri-tourism, which is relatively environmentally friendly; however, most of it is directed at brief stop visitors. Farm-based tourism and other ecotourism and cultural tourism should be developed and aimed at longer stay visitors (Berry and Ladkin, 1992; Garrod and Feyall, 1998; Mowforth and Munt, 1998; Stabler, 1998; McCool, 2001). As

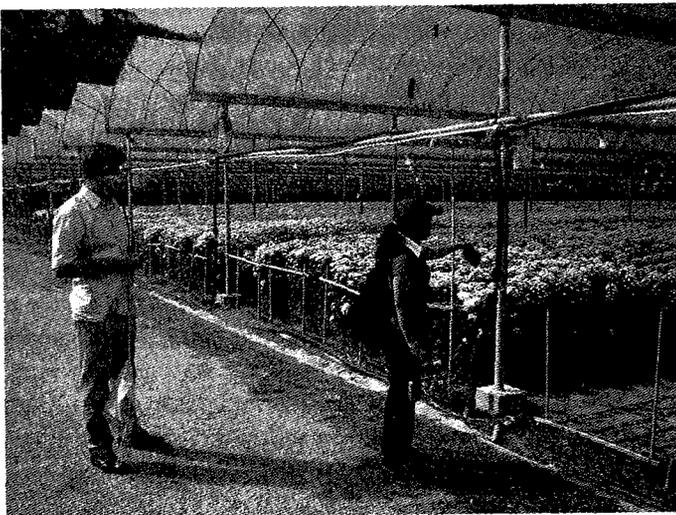
well as being a possible source of revenue for helping farming toward sustainability and subsidising conservation and environmental management, ecotourism can play an *integrative role* (like sustainable development or integrated development), bringing together different specialists, agencies and enterprises which would otherwise probably not co-operate (Ashton and Ashton, 2002).

Ecotourism should be a symbiotic relationship, whereby environmental features attract tourists, and the visitors pay a significant amount toward environmental management and livelihood development. Hopefully in the Cameron Highlands it can help initiate and support sustainable development (Lindberg and Hawkins, 1993; Fennell, 1999; Wearing and Neil, 1999; Page and Dowling, 2001; Pforr, 2001; Weaver, 2001). Some ecotourism supporters argue that it must not only fund environmental management and contribute to local livelihoods, but that it should also educate the tourists to develop ongoing environmental and cultural awareness and responsible behaviour (Boo, 1990; Cater, 1995; Orams, 1995; Duffy, 2002: 98-126.). Unfortunately, ecotourism initiatives are often ineffective or are even false fronts for damaging activities (Anathswamy, 2004). Ecotourism development in the Malaysian highlands must guard against such 'hijacking', and will have to effectively integrate with farming, conservation, environmental management, local livelihood improvement, and sustainable development efforts (Clifton, et al., 2004; Chan, et al., 2004). If obtained as a 'package' from consultants and then managed in isolation by a tourism department, or any other relatively narrow-focus agency, it is unlikely to offer its full potential. What is needed is a multidisciplinary body co-ordinating highland activities with a core mission to develop policies to promote sustainable development.

Ecotourism should put back more than it takes out of the environment and local culture; for example, tourists will often pay to do voluntary conservation, farm work, or other environmental management tasks, and can also be charged quite a lot for relatively basic accommodation. Ecotourism can often make use of facilities like redundant mansions and old plantation management buildings. A number of developing countries have invested in ecotourism, including the Galapagos Is. (Ecuador), Tanzania, Belize, Rwanda, Costa Rica, Cuba, Yucatan (Mexico), Zimbabwe, and others. Some of these depend upon it for much of their conservation funding and it is a major foreign exchange earner. World-wide there is a keen interest in trekking, and the Cameron Highlands offers some of the most spectacular and safest 'exotic' trekking trails in the tropics. Such tourism is very compatible with agriculture. Yet, it is presently poorly regulated and there has been little investment in developing it; many of those visitors we surveyed commented on the need for improvements and indicated that they were willing to pay more and stay longer if such changes were made. Guides should be better trained and supervised and there is a need for stronger marketing, especially overseas (Chan, 2000b; 2000c; Barrow, et al., 2003). Provided there is not economic depression or increased travel fears there should be a growing number of tourists from the west, SE Asia, and Malaysia interested in ecotourism, craftwork, archaeology, and so on (Nicolas, 2000; Lück, 2002). Crops like tea already provide a tourist attraction and contribute to the Cameron Highland resort 'image'. In the Cameron Highlands ecotourism should be developed to encourage and cushion change from environmentally damaging activities to more diverse, greener and sustainable, but sometimes less profitable, livelihoods. Currently much of the tourism in the Cameron Highlands is by short-stay, relatively low-spend visitors - so there is a need to reduce environmental impacts, encourage sustainability *and* increase residence time/profits. Improved profits might come from longer-stay, higher-spend ecotourists, and efforts should be made to expand this sector. As well as expanding agritourism there is potential to develop trekking, wildlife observation and other fields of ecotourism. Tourism subsidy to support a shift to sustainable agriculture may not be needed indefinitely, *if* there can also be development of organic production (i.e. growing without application of agrochemicals). Organic produce should command better prices than the present agrochemical-dependant (unsustainable) crops, but it takes some years for contaminated land to be declared free of contamination after chemical use has ceased. Part of a strategy to support sustainable agriculture and better environmental management in the Cameron Highlands should be to assess the potential for developing organic production. In most developed countries people increasingly seek organic crops and, for example, in the EU consumers will pay 30% or more for them (Dabbert, et al., 2004).

One strategy, which could be useful in the quest for sustainable development in the Cameron Highlands, is to zone areas spatially according to their environmental sensitivity, environmental value, resilience, and potential usage. There are a number of available frameworks for zoning, ranging from those developed by ecologists and biogeographers (e.g. Holdridge Life Zones system) to those adapted or developed by groups interested in promoting ecotourism and environmentally sensitive development (for an introduction see Fennel, 1999: 81-82; 124-126, particularly the Ecotourism Opportunity System; and Dowling, 1993). Another type of zoning is biodiversity conservation-focused and based on Biosphere Reserve principles developed by the Man and Biosphere Programme. If some form of zoning is adopted it should be done with an eye for 'dovetailing' mutually supportive activities and encouraging co-operation between, sectors, agencies, NGOs and local people. Wherever possible there should be little-disturbed buffer zones around sensitive core conservation areas. Less sensitive zones outside the buffer areas could be used for tourism activities that are less environmentally sound and for agriculture. Buffer areas might support some ecotourism and carefully controlled forest extraction, perhaps including enhancement of bamboo and rattan stands through some form of tolerant forest management to help counter forest products extraction. It would be wise to gazette as much unspoilt highland as possible to better enforce biodiversity conservation (plans for a Biodiversity Action Plan were announced in the *Eighth Malaysia Plan*). According to the UNEP/WCMC Protected Areas Programme ca. 65,000 ha is designated as Cameron Highlands Wildlife Sanctuary ([http://www.unep-wcmc.org/protected\\_areas/data/sample/1905v.htm](http://www.unep-wcmc.org/protected_areas/data/sample/1905v.htm) – accessed October, 2004). Nevertheless, there is a need for much tighter control of highland deforestation – mainly by limiting further expansion of agriculture by restricting the 15-year Temporary Ownership Licenses (Midmore, et al., 1996a). Conservation areas must remain viable over the long term, to help ensure this migration corridors need to be provided through agricultural areas to link reserves; and sufficient regard must be given to the possibility of climate change, increasing regional air pollution (especially acid deposition), and natural disasters. Too rigid zoning, with insufficient adaptability will not sustain flora and fauna. There will have to be trade-offs between agriculture, conservation, and other activities.

A wide range of conservation techniques are available at MARDI (Photograph 6.1) but Cameron Highland farmers still use large amounts of chicken waste, chemical fertilisers, pesticides and herbicides to enhance crop yields. There is virtually no use of compost, mulch, or green manure to reduce the aforementioned inputs and improve soil and water conservation (Photograph 6.2). Streams draining the farmed areas are polluted by chemical runoff, excess nutrients and soil washed from the fields. For some years research stations and individual researchers have been studying the problems associated with pesticide use by Cameron Highland farmers; the knowledge base should now enable the authorities to develop alternatives and enforce better controls on agrochemicals use. However, even if improved controls are enforced there may be significant background pollution for some time to come and this could delay accreditation of organic farming.



Photograph 6.1: Flower planting with plastic roofs and drip irrigation reduces soil erosion and pollution by fertilisers and pesticides.



Photograph 6.2: Farms in the Cameron Highlands cut into once forested hillside. Currently there is profitable production of non-tropical and sub-tropical crops like cabbage, salad vegetables, and cut flowers. Streams draining the area have heavy silt loads, even long after cutting the terraces and establishment of crops. Every 15 years or so new plots are cut from the forested hillsides.

### 6.3 Conclusions

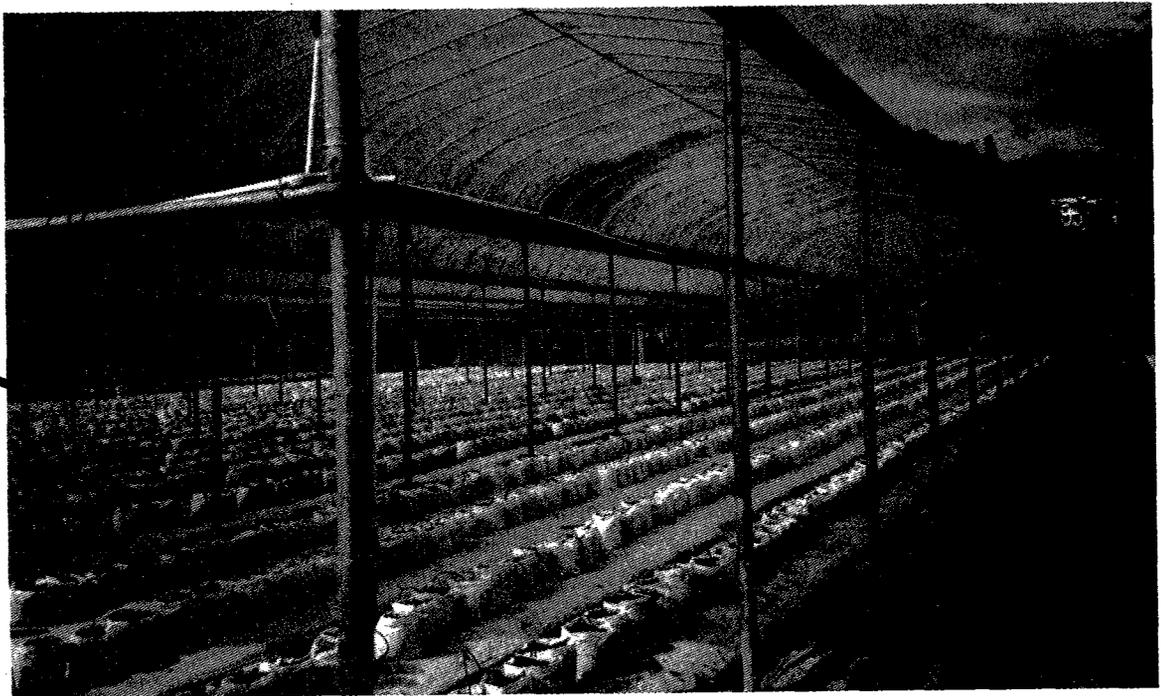
Sustainable development demands a proactive, adaptive, integrated and multidisciplinary approach. However, even the best techniques and skilled planning will fail to predict everything and monitoring may not give adequate advanced warning of problems; for example, altered demands for agricultural produce, sudden appearance of crop diseases, and tourist behaviour can be fickle. So, sustainable development efforts must be as diverse as possible and adaptable. Sustainable development and ecotourism can act as a unifying and integrative catalysts uniting disparate interests (Cater, 2000). They share a key feature: the need for reinvestment of enough of the profits of development in maintaining, and if possible improving, the environment and society. In the Cameron Highlands – a priority is to help farming become sustainable.

Advocacy is relatively easy; developing and implementing workable solutions is much more of a challenge. Some progress must be made soon, because it is clear that the Cameron Highlands are degrading quite rapidly. A first step should be to improve available data and monitoring. It would be useful to conduct a thorough ecoaudit of Cameron Highlands development (especially agriculture) - or even better, for the whole Main Range, to help stocktake, set goals, and establish priorities for action.

It is important to sustain and improve production on existing farms and strengthen the soil and water conservation practices used. Authorities should encourage and increasingly demand environmentally-friendly farming methods: it would be relatively easy to require each farm to install a system of drains and sumps to collect as much polluted runoff as possible before it can reach streams (Photograph 6.3). There should be control of plastic rain-shelters used by farmers to ensure there is no littering or burning of the materials when these are periodically replaced. More use might be made of green manure and mulching to cut erosion, and maintain fertility with less chemical fertiliser and chicken manure use. Composting organic waste from settlements and hotels might help sustain farmed plots and assist with highland refuse disposal (assuming the waste is not too contaminated with heavy

metals and other pollutants). If there is insufficient material to compost it may be possible to obtain organic waste in the lowlands and use the new highway to deliver it. On-farm drains and sumps can catch some of the silt and nutrients currently escaping to streams; however, such measures will not be wholly sufficient. Silt and nutrient reduction traps along the stream courses are a promising solution. There is already commercial cultivation of watercress in some of the cleaner streams of the Cameron Highlands (Rahman, 1980). Other aquatic or semi-aquatic plants which demand less clean water, like reeds, water hyacinth, or *Azolla* might be planted in silt-trap lagoons spaced along the streams to catch eroded soil and lock-up some of the dissolved nutrients from agricultural and sewage pollution. These weed-beds would need to be sited to avoid flood damage, but there is a long tradition of such installations around the world, so the challenges are not great. Periodic harvesting of these plants and silt could provide useful crops and compost for sustaining farms, as well as reducing downstream silt and eutrophication (excess dissolved nutrients) problems.

Sustainable agriculture is unlikely to be achieved if pursued with only a farming sector focus. However, with good co-ordination and an integrated approach a range of development activities could be fitted together in mutually supportive, flexible and adaptive ways.



Photograph 6.3: Rain shelters drip-irrigation and plastic bags to hold plants. These cultivation techniques are increasingly used in the Cameron Highlands and help to reduce stream siltation. Here at a research station a catch-drain surrounds the shelter; with a suitable sump and waste disposal regime, this sort of easily affordable installation could prevent a good deal of the silt and agrochemical pollution of streams.

#### End Notes

<sup>1</sup> Guidelines on ecotourism, with source address details are listed in Lindberg and Hawkins (1993: 42-54).

<sup>2</sup> The Ecotourism Society – founded in the USA in 1991 - holds regular workshops and publishes guidelines – e-mail: [ecotsocy@igc.apc.org](mailto:ecotsocy@igc.apc.org)

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## Bibliography

- Anathaswamy, A. (2004) Beware the ecotourist. *New Scientist* 181(2437): 6-7.
- Ashton, P.S. and Ashton, R.E. (2002) *Ecotourism: sustainable nature and conservation based tourism*. Krieger Publishing, Melbourne (FL).
- Barrow, C.J. (In press) Sustainable development in the Cameron Highlands, Malaysia. *Journal of Environmental Management* (Universiti Kebangsaan Malaysia) -----
- Barrow, C.J. (1980) Development in Peninsular Malaysia: environmental problems and conservation measures. *Third World Planning Review* 2(1): 7-25.
- Barrow, C.J., Clifton, J., Chan, N.W. and Tan, Y.L. (2004) Sustainable development in the Cameron Highlands, Malaysia. In Jamaluddin Md. Jahi, Kadir Ariffin, Salmijah Surif and Shaharudin Idris (eds.) *Facing Changing Conditions. Proceedings of the 2nd Bangi World Conference on Environmental Management*. Bangi: Environmental Management Programme, Centre for Graduate Studies Universiti Kebangsaan Malaysia and Environmental (EMS) Malaysia, pp. 222-234.
- Barrow, C.J., Chan, N.W., Clifton, J. Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Effects of environmental degradation on Orang Asli livelihood: a case study in the Cameron Highlands. pp. 437-448 In W.R. Ismail, N. Samar, A.A. Majid, M.A. Abdulla and A.L. Abdullah (eds.) *Society, Space and Environment in a Globalised World* (Proceedings of a Conference organised by the Geography Section, School of Humanities, Universiti Sains Malaysia and Persatuan Kebangsaan Geografi Malaysia, Penang 29-30 April 2003). Universiti Sains Malaysia, Penang [ISBN 983-2514-34-7].
- Barnett, V., Payne, R. and Steiner, R. (eds.)(1995) *Agricultural Sustainability: economic, environmental and statistical considerations*. Wiley, Chichester.
- Berry, S. and Ladkin, A. (1997) Sustainable tourism: a regional perspective. *Tourism Management* 18(7), 433-440.
- Boo, E. (1990) *Ecotourism Potential and Pitfalls* (2 vols.). World Wildlife Fund, Washington (DC).
- Cater, E. (1995) environmental contradictions in sustainable tourism. *The Geographical Journal* 161, 21-28.
- Cater, E. (2000) Ecotourism. pp. 4165-4168 In N.J. Smelser and P.B. Bates (eds.) *International Encyclopedia of the Social and Behavioral Sciences*. Elsevier, New York (NY).
- Chan, N.W. (2000) Degradation of highland areas in Malaysia. Effects on water resources. pp. 66-86 In Consumer Association of Penang (ed.) *Tanah Air Ku: Land Issues in Malaysia*. Consumer Association of Penang, Penang.
- Chan, N.W., Lee, B.H., Clifton, J. and Barrow, C.J. Barrow (2004) Ecotourism Management in Highlands: Experiences from Malaysia. Paper presented at the International Conference "Inaugural

International Conference - Southeast Asia Since 1945: Reflections and Visions", 20 - 23 July 2004, Penang, Malaysia. Organised by Asia Pacific Research Unit, School of Humanities, Universiti Sains Malaysia.

Chan, N.W., Clifton, J., Barrow, C.J., Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Development issues and prospects in Cameron Highlands. pp. 240-251 *In* W.R. Ismail, N. Samat, A.A. Majid, M.A. Abdullah and A.L. Abdullah (eds.) *Society, Space and Environment in a Globalised World* (Proceedings of a Conference organised by the Geography Section, School of Humanities, Universiti Sains Malaysia and Persatuan Kebangsaan Geografi Malaysia, Penang 29-30 April 2003). Universiti Sains Malaysia, Penang [ISBN 983-2514-34-7].

Clarkson, J.D. (1968) *The Cultural Ecology of a Chinese Village: Cameron Highlands, Malaysia*. Department of Geography Research Paper No. 114, University of Chicago, Chicago (IL).

Clifton J, Barrow CJ, Chan NW and Tan Y.L. (2004) Planning for ecotourism in fragile environments: case studies from Malaysia and Indonesia. *In* Proceedings (CD-ROM) of the International Conference "Inaugural International Conference - Southeast Asia Since 1945: Reflections and Visions", 20 - 23 July 2004, Penang, Malaysia. Penang: Asia Pacific Research Unit, School of Humanities, Universiti Sains Malaysia.

Clifton, J., Barrow, C.J., Chan, N.W., Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Ecotourism in Cameron Highlands (Malaysia) and Wakatoli Marine National Park (Indonesia): issues and challenges. pp. 383-392 *In* W.R. Ismail, N. Samar, A.A. Majid, M.A. Abdullah and A.L. Abdullah (eds.) *Society, Space and Environment in a Globalised World* (Proceedings of a Conference organised by the Geography Section, School of Humanities, Universiti Sains Malaysia and Persatuan Kebangsaan Geografi Malaysia, Penang 29-30 April 2003). Universiti Sains Malaysia, Penang [ISBN 983-2514-34-7].

Dabbert, S., Häring, A.M. and Zanoli, R. (2004) *Organic Farming: policies and prospects*. Earthscan, London.

Dowling, R.K. (1993) An environmentally based planning model for regional tourism development. *Journal of Sustainable Tourism* 1(1): 17-37.

Duffy, R. (2002) *A Trip too Far: ecotourism, politics & exploitation*. Earthscan, London.

Fennell, D.A. (1999) *Ecotourism: an introduction*. Routledge, London.

Fennell, D.A., Dowling, R.K. and Kingston Bodde, A. (2003) *Ecotourism Policy*. CABI Publications, Wallingford.

Foucat, V.S.A. (2002) Community-based ecotourism management: moving towards sustainability, in Ventenilla, Oaxaca, Mexico. *Ocean & Coastal Management* 45(8), 511-529.

Freeman, D. (1999) Hill station or horticulture? Conflicting imperial visions of the Cameron Highlands, Malaysia. *Journal of Historical Geography* 25(1), 17-35.

Garrod, B. and Feyall, A. (1998) Beyond the rhetoric of sustainable tourism. *Tourism Management*, 19(3), 199-212.

Gösling, S., Borgström Hansson, C., Hörstmeier, O. and Sagel, S. (2002) Ecological footprint analysis as a tool to assess tourism sustainability. *Ecological Economics* 43(3), 199-211.

- Government of Malaysia (1996) *Sixth Malaysia Plan 1996-2000*. Government of Malaysia, Kuala Lumpur.
- Government of Malaysia (2001) *Eighth Malaysia Plan 2001-2003*. Government of Malaysia, Kuala Lumpur.
- Hashim, G.M. (2003) *Soil Erosion & Nutrient Depletion*. MARDI, Kuala Lumpur.
- Heang, K.B. (1990) Cameron Highlands-Fraser's Hill-Genting Highlands road. *Malayan Naturalist* 43(1), 36-37.
- Lindberg, K. and Hawkins, D. (eds.) (1993) *Ecotourism: a guide for planners and managers*. The Ecotourism Society, Bennington (VT).
- Lück, M. (2002) Looking into the future of ecotourism and sustainable tourism. *Current Issues in Tourism* 5(3-4), 371-374.
- Macken, K.P. and Ong, T.S (1979) Survey of cultural practices and conservation measures performed by market gardeners in Cameron Highlands. Soil Conservation and Reclamation Section, Department of Agriculture, Peninsular Malaysia, Kuala Lumpur, 39 pp.
- McCool, S.F. (2001) *Tourism, Recreation and Sustainability: linking culture and the environment*. CABI Publications, Wallingford.
- Midmore, D.J., Jansen, H.G.P. and Dumsday, R.G. (1996a) Soil erosion and environmental impact of vegetable production in the Cameron Highlands, Malaysia. *Agriculture, Ecosystems & Environment* 60(1), 29-46.
- Midmore, D.J., Jansen, H.G.P., Dumsday, R.G., Azmi, A.A., Poudel, D.D., Valasayya, S., Huang, T., Radzali, M.M., Fuad, N., Samah, A.B., Syed, A.R. and Nazlin, A. (1996b) Technical and economic aspects of sustainable production practices among vegetable growers in the Cameron Highlands, Malaysia. *AVRDC Technical Bulletin* No. 23. Asian Vegetable Research and Development Center, Taiwan, 64 pp.
- Mowforth, M. and Munt, I. (1998) *Tourism and Sustainability: new tourism in the Third World*. Routledge, London.
- Nicholas, C. (2000) *The Orang Asli and the Contest for Resources: indigenous politics, development and identity in Peninsular Malaysia*. International Work Group for Indigenous Affairs, Copenhagen (iwgia@iwgia.org).
- Nooi, C. (1991) Environmental degradation in the Cameron Highlands. *Malayan Naturalist* 45(1-2), 14-16.
- Oh, C. (2000) Policy and legislation for the protection and conservation of highland areas and hill lands in Malaysia. pp. 87-99 In Consumer Association of Penang (ed.) *Tanah Air Ku: Land Issues in Malaysia*. Consumer Association of Penang, Penang.
- Orams, M.B. (1995) Towards a more desirable form of ecotourism. *Tourism Management* 16(1), 3-8.
- Page, S. and Dowling, R.K. (2001) *Ecotourism*. Addison Wesley Longman, Harlow.
- Pasoff, M. (1991) Ecotourism re-examined. *Earth Island Journal* 6(2), 28-29.

- Pfarr, C. (2001) Concepts of sustainable development, sustainable tourism, and ecotourism: definitions, principles and linkages. *Scandinavian Journal of Hospitality and Tourism* 1(1), 68-71.
- Rahman, S.A. (1980) the cultivation of watercress in Cameron Highlands. Research Paper No. 67 MARDI, Serdang 13 pp.
- Raine, A. (1995) *Hill Resorts and Nature Parks in Malaysia*. S. Abdul Majeed, Kuala Lumpur [ISBN 983-89941-2-x].
- Selman, P. (1996) *Local Sustainability: managing and planning ecologically sound places*. Paul Chapman, London.
- Shepherd, A. (1998) *Sustainable Rural Development*. Macmillan, London.
- Shirasaka, S. (1988) The agricultural development of hill stations in tropical Asia: a case study of the Cameron Highlands, Malaysia. *Geographical Review of Japan* 61 Series B2, 191-211.
- Stabler, M.J. (ed.) (1998) *Tourism and Sustainability*. CABI Publishing, Wallingford.
- Taylor, D.C., Mohamed, Z.A., Shamsudin, M.N., Mohayidin, M. G. And Chiew, E.F.C. (1993) Sustainability of English cabbage production practices in Cameron Highlands. Jabatan Ekonomi Pertanian, Universiti Pertanian Malaysia, Serdang (mimeo.).
- Voon, P.K. and Khoo, S.H. (1980) Upland development and settlement in Malaysia. *Malaysian Journal of Tropical Geography* 1(1), 47-58.
- Wazir-Jahan B.A.K. (1990) Environmental economics and forest resource industries among the Orang Asli of Peninsular Malaysia. Monograph, School of Humanities, Universiti Sains Malaysia, Penang.
- Wearing, S. and Neil, J. (1999) *Ecotourism: impacts, potentials and possibilities*. Butterworth-Heinemann, London.
- Weaver, D.B. (1998) *Ecotourism in the Less Developed World*. CABI Publishing, Wallingford.
- Weaver, D.B. (ed.) (2001) *The Encyclopaedia of Ecotourism*. CABI, New York (NY).
- World Bank (2003) *World Development Report 2003. Sustainable Development in a Dynamic World: transforming institutions, growth, and quality of life*. Oxford University Press, Oxford.

## CHAPTER 7

# SOIL EROSION AND WATER POLLUTION IN CAMERON HIGHLANDS: CONSERVATION STRATEGIES

Ghulam M. Hashim<sup>1</sup> & Aini Hayati Abdul Rahaman<sup>2</sup>

Malaysian Agricultural Research and Development Institute (MARDI)

<sup>1</sup> Peti Surat 12301, 50774 Kuala Lumpur

<sup>2</sup> Stesen Penyelidikan MARDI, Tanah Rata, 39000 Cameron Highlands

Email: [ghulam@mardi.my](mailto:ghulam@mardi.my)

### 7.1 Introduction

The district of Cameron Highlands, located within the largest mountain range in Peninsular Malaysia, the Main Range, has a strongly-dissected and mountainous terrain. Its elevation is from 1070 to 1830 m above mean sea level. The range of slope gradients is from 0° to 35°, with 66% of the land having gradients of more than 20°.

With an average annual rainfall of 2660 mm, there is a steady supply of water to the many streams that drain the district. The availability of water and the cool highland temperatures of between 14°C to 24°C, provide attractive conditions for the cultivation of a range of temperate vegetables and flowers. Besides agriculture, the cool conditions also create opportunities for development related to the agrotourism industry.

The rainfall regime is characterised by a large number of intensive rainstorms, especially during the peak periods of April-May and October-November. This, coupled with the steep and long slopes, makes the soils very vulnerable to runoff and soil erosion. Unfortunately; the approaches taken towards the development of land for agriculture or other purposes do not always give due recognition to the high potential for runoff and erosion.

In most cases, the land intended for development is cleared of all vegetation and exposed to rainfall for considerably long periods. At this stage, runoff and erosion occur unchecked, the extent varying according to prevailing soil, terrain and rainfall characteristics. Often, cleared land is levelled to create large, flat spaces, entailing massive earthworks that break up soil and move loose earth from one site to another. During the entire period of development and long after that, large amounts of sediment are generated and transported to streams and rivers.

The objective of this chapter is to discuss some of the results of research on soil erosion and water pollution conducted by MARDI, and put forward some views on the policies and measures that need to be undertaken to reduce the prevailing high rates of runoff and soil erosion.

### 7.2 Soil erosion in Cameron Highlands

The rates of soil erosion and runoff can be gauged by looking at some data on sediment loads in rivers published by various parties as well as data obtained through the monitoring of runoff and soil erosion by MARDI.

One of the earliest sets of soil erosion data was published by Shallow (1956). He measured the bed load in rivers draining several catchments (Table 7.1). Even in those early days it was clearly shown that vegetable cultivation produced the most amount of sediment compared to tea and forest. Later, other workers, including Baharuddin *et al* (1996), produced similar types of data that reflect a more recent situation. A comparison of Baharuddin's data with those of Shallow provided a clear picture of the tremendous increase in erosion rate over a period of 40 years (Table 7.2).

Table 7.1: The relationship between vegetation cover type and soil erosion, from studies of river sediment conducted by Shallow (1956)

Vegetation	Soil erosion (as measured in the form of sediment in rivers) (t/ha/y)
Forest	0.49
Tea and tree crops	9.76
Vegetables	14.65

Table 7.2: A comparison of sediment yields in 1956 and 1996 (cited by Wan Abdullah et al, 2001)

Location	Sediment yield (t/ha/y)	
	Shallow (1956)	Baharuddin <i>et al</i> (1996)
Sungai Bertam	2.5	13-27
Sungai Telom	OS	3-10

In Cameron Highlands, most farmers prefer to plant short-term vegetable crops over more soil-conserving plants such as perennial crops. These crops are normally harvested 2 or 3 months after planting. During the short cropping period, vegetative contact cover is present only for brief periods and, as a result, the farms are associated with high rates of soil loss, runoff and nutrient loss. Runoff-erosion plots with tipping-bucket measuring systems, were established at several vegetable farms, including a typical cabbage farm located on land where the original topography has been drastically altered. The slope gradient at the cabbage farm was less than 3°. Cabbage was grown over three seasons with short fallow periods between seasons. The results, shown in detail in Table 7.3, gave a high total soil loss of 83 t/ha and a high runoff of 1521 mm over a one-year period, despite the gentle slope gradient (Wan Abdullah *et al*, 2001).

Measurements made at other vegetable farms, with similarly low slope gradients, showed that the erosion rate can reach 150 t/ha/year. Sometimes the orientation of the farm furrows can make an important difference. When the furrows are aligned in a longitudinal (the rows running up and down the slope) direction, water flows directly downhill at a high velocity, thus with higher capacity to remove soil particles from the soil surface.

It is well known that soil loss, runoff and nutrient loss can be reduced if good quality vegetative cover is increased. This can be achieved through various means, including planting cover crops, intercropping with suitable species of plants, mulching etc. However, in vegetable farming, such erosion control measures are seldom practiced for various economic reasons. The only vegetative cover available is that provided by the crop itself, although for a very limited period only.

In cabbage farming, normally three crops are possible in one year because each crop requires an average of 105 days. Three crops will take up about 300 days. Between two crops there may be brief fallow periods, which, collectively can take away about 60-70 days. During fallows and early stages of each cropping period, the soil surface is bare or almost bare, exposing it to rainfall and flowing water. Thus, erosion and runoff are relatively high at these stages.

To facilitate a discussion on vegetative cover and soil erosion, each crop cycle can be divided into 'early stage' and 'mature stage'. The early stage is from the start of field preparation till 30 days after planting, while the mature stage is from 60 days after planting till harvesting. During the mature stage, only a small proportion of the soil surface is exposed because the cabbage heads occupy a considerable proportion of the total farm area. In addition, at the mature stage, dense growth of weeds such as liverwort increases soil surface cover. However, the period when there is 'adequate' cover is only about 40 % of one cropping season. Therefore, as reported by Wan Abdullah *et al* (2001), erosion

during the early stage is, on average, 2.5 times higher than that during the mature stage

Table 7.3: Soil erosion for one year in a cabbage farm at Cameron Highlands (Wan Abdullah et al, 2001)

Season and period	Rainfall (mm)	Runoff (mm)	Soil loss (t/ha)
Season 1; 110 days	733	441	41.80
Off-season 1; 63 days	301	122	8.22
Season 2; 83 days	754	547	16.10
Off-season 2; 8 days	14	11	0.06
Season 3; 122 days	401	400	17.15
Total	2203	1521	82.74

The extent of soil erosion can also be appreciated by looking at sedimentation data. In the 1970's, it was estimated that 380,000 m of sediment were deposited at the TNB dam site in Habu per year. Assuming certain average values for soil bulk density and particle density and the total surface area exposed to soil erosion, the volume of sediment was converted to weight of soil lost through erosion. An average rate of soil loss of 125 t/ha/year was obtained by El-Swaify (1987). In this calculation, it was also assumed that the rate of sediment delivery from the eroding lands is 100% (El-Swaify, 1987). (In practice, sediment delivery is only a fraction of the soil lost through erosion).

### 7.3 Sedimentation and pollution in Cameron Highlands

Two of the most important off site effects of soil erosion are sedimentation and pollution. The extent of sedimentation reflects the rate of soil erosion in the contributing catchment areas, although only a small proportion of the soil that has been eroded reaches the stream or river. A portion of the eroded soil is stored in various parts of the catchment before being moved closer to streams during more intensive rainstorms. However, the trend in sedimentation rate over time provides an indication of whether the total area of land that is actively eroding has increased or decreased.

The results of surveys of sedimentation at the Habu dam reported by TNB and quoted by Wan Abdullah *et al* (2001) are shown in Table 7.4.

Table 7.4: Sedimentation at TNB's Habu reservoir (reported by TNB, cited by Wan Abdullah *et al*, 2001)

Year of survey	Measured deposits (000 m)	Excavated deposits (000 m)	Period (years)	Sedimentation rate (m <sup>3</sup> /km <sup>2</sup> /y)
1965	34	-	2	202
1967	108	-	2	52
1969	127	-	1	114
1970	148	-	5	292
1975	415	-	6	106
1981	532	173	3	595
1984	686	170	3	911
1986	850	67	2	1200
1987	1003	234	1	1726
1990	1717	88	3	1814

The rate of sedimentation has increased about 9 times over a period of 25 years. This means that either the area of land that is actively eroding has increased by nine times, or, if the increase in area is less than nine times, in recent years, erosion has been occurring at higher rates in some of the land that was exposed to soil erosion.

Most land users are aware of the high rates of erosion in the highlands. In agricultural land, soil fertility declines as erosion increases since the loss of soil from any site also involves a depletion of plant nutrients that are present in the soil. Farmers overcome this problem by increasing the rates of applications of manure and fertilisers. Over time, the amounts of manure and fertiliser used increases. Therefore, as the rate of soil erosion increases, larger concentrations of nutrients are mobilised from farmlands to the streams and rivers.

Monitoring of nutrient and soil losses by MARDI indicated that the loss of nutrient elements in runoff is closely related to the time of fertiliser application. Large amounts of nutrients that are dissolved in runoff are mobilised soon after fertiliser application.

The amounts of inorganic elements and their concentrations in runoff from a typical cabbage farm at different periods and for a whole year are shown in Table 7.5.

Table 7.5: Amounts and concentrations of nutrients lost in runoff from a cabbage farm in Cameron Highlands (Aminuddin et al, 2001)

	NH <sub>4</sub>	NO <sub>3</sub>	P	K	Na	Ca	Mg
Season 1							
Loss (g)	35	617	29	1637	715	2457	559
Conc (mg/kg)	1.4	25	1	20	10	26	9
Season 2							
Loss (g)	1	350	74	686	318	1698	312
Conc (mg/kg)	0.4	10	2	32	6	44	7
Annual loss (kg/ha/y)	4	115	12	278	123	497	104

Besides the soluble forms of nutrients, those that are attached to sediments also deplete the soil and contribute to pollution of streams and rivers. The enrichment ratio for nitrogen in sediment from a cabbage farm was found to be about 2.16 and the average of that from a tea field was 1. This means that, for the cabbage farm from which a soil loss of 83 t/ha/y was recorded, the loss of nitrogen was 2.16 times the nitrogen content of its topsoil, which was 0.26 %, times 83 t/ha/y. This works out to be about 0.5 t of nitrogen lost in sediment from a hectare in one year.

At the catchment and subcatchment scales, the concentrations of pollutants are still relatively low (Table 7.6). However, the level of pollution tends to be higher in catchments/sub-catchments where vegetable and flower farming are dominant. This situation is a result of higher rates of runoff and soil erosion associated with such activities and the higher amounts of manure and fertiliser used.

Table 7.6: Maximum values of inorganic pollutants in various Cameron Highlands catchments and sub-catchments (Aminuddin et al, 2001)

Catchment(C)/sub-catchment (SC)	Concentration (mg/kg)			
	NH <sub>4</sub>	N03	P	K
Vegetables (SC)	0.3	13	0.5	9.1
Flowers (SC)	0.1	0.7	0.1	7.6
Tea (SC)	0	0.8	Trace	4.9
Jungle (SC)	0	0	0	2.2
Bertam (C)	0.4	12	0.1	3.4
Telom (C)	0.7	2.0	1.0	3.9

#### 7.4 Soil erosion processes

In a discussion of soil erosion and its control it is also useful to consider the various physical processes that occur in the field during erosion events. Previous studies and observations show that several different erosion processes are active in Cameron Highlands (Ghulam and Wan Abdullah, 2001). These include mass movement such as landslides, slumping and river-bank erosion, as well as flow-driven processes such as raindrop detachment and entrainment. Acknowledging the processes and knowing how important each one is in different situations will assist in making decisions about the most appropriate control measures.

In large tea plantations, the tea bushes are often planted on steep slopes, some of which have gradients of more than 30 degrees. However, these slopes are often broken by wide contour terraces. A detailed study of field erosion features conducted after rainfall events in several plantations provided useful information on soil erosion processes. Various soil erosion features were recorded in the tea fields, especially along harvesting paths that run in a vertical direction. Some of these were flow pathways, miniature debris dams and terracets (naturally-formed miniature terraces), besides other small deposition sites. These were plentiful after rainstorms of moderate intensity. When rainstorms of very high intensity occurred, most of the debris dams and terracets were washed away while the flow pathways became visually more prominent. These are indications that, on these slopes, the soil erosion processes that were most active were entrainment and reentrainment. {A detailed explanation of flow-driven soil erosion processes is given by Rose (1993)}. When soil erosion occurs through these processes, the soil particles that are dislodged and transported are mainly from the surface layers of the soil.

Typically, after a major rainstorm in a tea field, all eroded soil that was deposited along flow pathways during earlier erosion events, are transported further down and deposited on the terraces in the form shown in Figure 7.1. How much of this material is eventually washed into streams and rivers is not yet known. A study conducted at a stream that drains a tea plantation showed that sedimentation and pollution levels were low (Aminuddin et al, 2001).

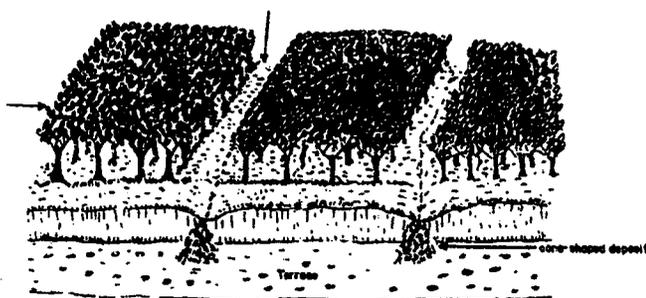


Figure 7.1: Cone-shaped deposits on a terrace at the bottom of a tea field

Typically, in farms with a bed-and-furrow system, relatively finer soil particles from beds are splashed by raindrops into the furrow network (Figure 7.2). The coarser particles tend to remain on the bed. During an erosion event, water constantly flows along the furrows, since furrow bottoms are hard and compact and does not facilitate water infiltration. The flow transports the fine soil particles that have been splashed into the furrows. As rainfall intensifies, so does the velocity of flow along the furrows. The finer ones, which are usually associated with nutrients, are transported furthest, most likely into streams. This process leads to the environmental problems of sedimentation and pollution.



Figure 7.2: Beds and furrows in a vegetable farm. Pedestals and raindrop marks on beds indicate raindrop detachment. Fine sediments are deposited in furrows.

In farms where crops are planted in specially prepared beds or bunds, the most obvious signs of soil erosion are the raindrop marks and the 'erosion pedestals' observed on bed surfaces. These indicate that raindrop detachment and re-detachment have been active. Some beds may also display rills running down along the walls. Most of the soil particles that have been eroded were deposited in the furrows. Even rainstorms of moderate intensity normally gave rise to a flow of water along the furrows because the furrow bottom is hard and compact. The flowing water transports the eroded soil. More intensive rainstorms generate flows of high velocity that are capable of carrying the sediment to the river system. This has quite serious implications for water pollution. Eroded soil or sediment from vegetable farms was found to have nutrient enrichment ratios of 2 or higher. This means that the concentration of nutrients in the sediment is more than twice that in the source or original soil.

Landslides, whether large-scale or miniature, result from a process known as mass movement. The nature of soils in Cameron Highlands is such that it facilitates infiltration of large amounts of water into the profile. Due to this nature of the soils and the steep slopes, most areas are prone to landslides. The large-scale ones are very common and well-known to most people. However, mass movement at the miniature scale often takes place too, but is not very readily noticeable.

In many farms, small-scale mass movement takes place from time to time, especially during very wet periods. Such occurrences create sites of sediment accumulation within farms. The sites are actually large piles of very loose soil that are easily picked up by flowing water, especially along furrows. The contribution of such mass movement processes to the total sediment load in Cameron Highlands is not yet known. Examples of such small-scale processes are cases of breakdown of bunds/beds, drain widening and gully-wall collapse. One common situation which can lead to disintegration of bunds is when moss or fungi coat the walls. Water that accumulates within the bund

during wet periods may create internal pressures that are high enough to cause collapse. However, often it is the very high intensity of rain that causes bunds to become saturated and, thus, unstable.

The high amounts of runoff generated during wet periods in Cameron Highlands usually lead to marked increases in flow velocity in streams and rivers. Such high-velocity flows give rise to erosion of stream and river banks where the soils are saturated. However, no quantitative data are available on the extent of bank erosion, nor on the amounts of sediment it contributes to the river system.

### 7.5 Modification to current development approaches

The major issues in Cameron Highlands, sedimentation and pollution resulting from soil erosion and runoff, are becoming more serious over time. Therefore, effective preventive action needs to be taken immediately, with a view to gradually reducing the environmental problems and eliminating the possibility of a disaster. This should only be done by involving all stakeholders, including land users, government agencies and important organisations such as TNB (Tenaga Nasional Berhad). Rather than wait to carry out rehabilitation work, as is often the case, it is better to install preventive measures based on knowledge of the fragility of the resources and the recurring climatic factors.

So far, development seems to be seen only in the context of economic achievements more than anything else. Conservation is, most of the time, relegated as a side issue. Since the environment of Cameron Highlands is fragile, conservation should be the major consideration in any form of development. Moreover, the district is often promoted as a tourist destination, with attractions that are all closely related to its natural resources and environment. The priority should therefore be towards the preservation of those resources and environment. One of the most urgent issues that should be addressed is the approaches to land development that are currently practiced.

In such a fragile environment, land development that does not adhere strictly to soil conservation principles will result in massive soil erosion and runoff. Present approaches tend to be too disruptive and expose land for long periods. Cameron Highlands cannot afford to carry on in this manner for too long. There is a need to find ways of avoiding total clearance of vegetation at development sites so that some trees are left behind to offer some protection to the soil. One of the more urgent tasks is to come up with an approach to development that emphasises working with small parcels of land. A piece of cleared land is too large if effective erosion control measures cannot be established within a satisfactory time frame. Excessive earthworks that are part and parcel of current development projects should be avoided. Ways must be found to substantially reduce the amount of earth being shifted around and the physical disturbance to the soil associated with the preparation of land for project development. Currently, a very popular practice is to clear land and create large flat surfaces. This provides a very convenient platform for farming activities or other development but is hardly suitable for a highland environment which is very prone to runoff and soil erosion. Even in less hilly landscapes, this practice will lead to substantial runoff and erosion. In Cameron Highlands, the earthworks are bound to disrupt soil structure, exposing large amounts of loose soil particles to be mobilised by overland flow. Although the flat top itself may not be subjected to largescale soil erosion, the sides continue to be exposed and subjected to recurring soil erosion processes. Furthermore, in the case of agricultural projects, extremely large amounts of manure and fertiliser are required to improve soil fertility that has been lost through the disruption of topsoil. In new vegetable farms, about 30 to 50 t/ha of chicken manure are applied to improve the fertility of the cultivated soil layer. Subsequently, 20 t/ha are applied for each cropping cycle. For chrysanthemum production, the amount of chicken manure applied is 2.5 t/ha/season (Wong et al, 2001). Such high amounts, mostly applied on the soil surface, increase the pollution potential associated with runoff and erosion.

Instead, any development project should be designed to incorporate the natural topographic features. Timing of operations should be planned in such a way that clearing is carried out only when materials, machines and men for the next stage of operation are ready. The period when the soil is exposed should be minimised as much as possible.

The operations that should be examined in detail and replaced are:

- The conversion of a hilly site into a flat piece of land
- The clearing a large piece of land in one operation
- The need for clear felling
- The long period of exposure of the soil surface after clearing
- The lack of erosion control measures during the early phases of land development

While 'development' cannot be avoided, it must be conducted in a manner that does not jeopardize the well-being of natural resources. The long-term consequences as well as the integrity of any particular ecosystem as a whole will have to be taken into consideration. For Cameron Highlands, the fragility of its land resources requires that development should be based on long-term conservation, rather than on immediate gains.

#### 7.6 Priority for perennial crops

Most vegetable crops are planted on bunds or beds. During harvesting, the entire plant is pulled out of the bed. This action disrupts the bed's surface and exposes it to rain. In this condition the bed is very vulnerable to erosion because the soil is easily detached and transported.

One of the ways of reducing the incidences of exposing disturbed soil to rainfall is to concentrate on crops which do not require frequent replanting. The crops that come to mind first are the sub-tropical fruits which are no longer popular among growers in Cameron Highlands. However, besides trees, there are vegetables that can be considered as perennials. These are vegetable crops that are harvested at frequent intervals without having to uproot the plants. One such crop is 'kaukee' or boxthorn. Harvesting, carried out every two to three months, only involves cutting the top portion of the stems, with the root system and the lower portion of the stems left intact. Another of its special features is that the stems are thorny and therefore not eaten. After taking the leaves, the cut stalks are used to mulch the furrows in the farm, thus providing an additional cover against erosion (Figure 7.3).



Figure 7.3: A kaukee field after harvest (right). The stubble and roots are not removed and the cut stalks are used as mulch.

Crops such as *kaukee* offer a more conservation-effective alternative to some of the present crops which promotes high rates of runoff, erosion and nutrient loss. A research programme to look into the effectiveness and viability of such conservation-effective crops in reducing runoff and erosion could be a useful step. The programme should be immediately followed by identifying certain very vulnerable localities where this type of crops can be offered as an alternative and encouraged to be adopted as intercrops in most vegetable farms.

As a long-term measure, a policy that encourages farming of this type of soil-conserving crops should be developed. Incentives such as longer leases, choice locations, financial assistance etc can be offered only to those who use *kaukee* or similar crops or who at least incorporate it in their farming systems as a soil conservation measure.

Several other plant species that are potentially useful for soil conservation purposes are vetiver, day lily and citronella. Preliminary studies in a rhizotron conducted by Wan Abdullah *et al* (2004) showed that, besides being perennial in nature, these plants exhibit favourable rooting characteristics.

### 7.7 Partnership between land users and government

At present, soil conservation knowledge and technology in various forms have been made available to land users. Most of them are aware of the environmental problems that have been caused by inappropriate land development approaches and farming methods that do not incorporate soil erosion control measures. However, land users prefer to carry on as they have been doing. This may be because, at the moment, there are no penalties for causing soil erosion, land degradation or water pollution. Poor land management in upstream areas leads to environmental degradation at sites further downstream, thus it is difficult to pinpoint culprits. Although legislation on land conservation and other environmental issues exist, they are difficult to enforce for various reasons. It is better not to rely on legislation in attempts to improve on the level of adoption of soil conservation technology.

Perhaps, it is time to introduce a more land user-friendly approach. Land users must be made to think that they, the government and everybody else have a stake in the wellbeing of the land and the larger ecosystem. It is pertinent to drive home the point that the land users are not merely 'users' but also 'stewards' or 'custodians' of the land, just as the government is. One way to achieve this is for the government (through the relevant agencies) to be partners to the land users. Land should be jointly developed with the government having a stake in the project. For example, in an agricultural project, the government should insist on incorporating trees or 'perennial' vegetable crops in the cropping system. Farmers are obliged to look after the government's stake in exchange for more favourable land lease conditions or some form of assistance from the government.

Despite many social, economic and political issues that need to be taken into account, partnership between land users and government should be actively pursued to replace the use of legislation and the dispensing of advice as the approach towards better land conservation. In addition to a more direct involvement of government (through its agencies), a system of incentives/disincentives on land conservation should be introduced. This, of course, implies that more funds and more manpower will be required for land conservation in highland areas such as Cameron Highlands. However, this is the price that has to be paid to ensure long-term land conservation.

The Department of Agriculture has successfully introduced the SALM (Skim Akreditasi Ladang Malaysia) scheme, which rewards farmers with certification for adhering to guidelines provided by the department (Mustafa Kamal Baharudin, personal communication). Discerning consumers would give priority to products of farms that possess SALM certification. Such products may eventually be given perks such as less stringent checks by health and other relevant authorities, the 'Malaysia Best' label, etc. Although soil erosion control is presently one of the conditions for SALM certification, a similar approach specific to land conservation could also be worked out. The MARDI office in Cameron Highlands can play a vital role in this area (Figure 7.4).



Figure 7.4: Left: The MARDI office in Cameron Highlands is a research and experimental station for highland agriculture. Right: Experimental chrysanthemum flower beds within the MARDI research station.

### Bibliography

- Aminuddin, B.Y., Wan Abdullah, W.Y., Cheah, U.B., Ghulam, M.H., Zulkefli, M. & Salama, R.S. (2001) Impact of intensive highland agriculture on the ecosystem. *J. Trop. Agr. & Food Sc.*, 29(1): 69-76. MARDI, Serdang, Selangor.
- Baharuddin, K., Rahim, A.N. & Zulkifli, Y. (1996) Sediment load in highland areas. In: *Proceedings in Highland Hydrology*: 68-71. International Hydrological Programme. (cited by Wan Abdullah et al, 2001)
- El-Swaify, S.A. (1987) Unpublished report on "International Conference on Steepland Agriculture in the Humid Tropics". MARDI-M'sian Soc. Soil Sci. Kuala Lumpur
- Ghulam M. Hashim and Wan Abdullah (2001) Soil erosion processes and nutrient loss in highland agricultural areas. In: *Agrochemical Pollution of Water Resources in the Cameron Highlands, ACLAR Proceedings no. 104*: 17-25. Australian Centre for International Agricultural Research, Canberra, Australia.
- Rose, C. W. (1993). Erosion and sedimentation. In: Bonnell, M, Hufschmidt, M.M. & Gladwell, J.S., eds., *Hydrology and Water Management in the Humid Tropics - Hydrological Research Issues and Strategies for Water Management*: 301-343. Cambridge University Press, Cambridge, U.K.
- Shallow, P.G.D. (1956) Riverflow in Cameron Highlands. *Hydroelectric Technical Memo. No. 3*. C.E.B., Federation of Malaya.
- Wan Abdullah Wan Yusoff, Salama, R. and Aminuddin, B.Y. (2001) Impacts of agricultural activities on soil erosion and water resources in the Cameron Highlands. In: *Agrochemical Pollution of Water Resources, ACLAR Proceedings no. 104*: 26-31. Australian Centre for Agricultural Research, Canberra, Australia.
- Wan Abdullah, W.Y., Ibrahim, O. and Aini, H.A.R. (2004) Potential crops for soil erosion control in Cameron Highlands. *Soils 2004 Conference Proceedings*: 159-162. M'sian Soc. Soil Science
- Wong, N.C., Lee, B.S., Yuen, P.M., Wan Abdullah, W.Y. and Mohd Ridzuan. (2002) effects of continuous monocropping of Chrysanthemum flowers under rain-shelter on soil quality. In: *"Sustainable Land Management"* (Shamshuddin, J., Harridan, J. & Samsuri, A.W., eds): 236-252. Malaysian Society of Soil Science

## CHAPTER 8

**"THE ORANG ASLI AND ECOTOURISM DEVELOPMENT  
IN CAMERON HIGHLANDS"**

Lim Hin Fui, Woon Weng Chuen and Mohd Parid Mamat  
 Forest Research Institute Malaysia  
 Kepong, 52109 Kuala Lumpur  
 Email: limhf@frim.gov.my

**Abstract**

*Ecotourism development has been taking place in Cameron Highlands for a long time. However, the involvement of local indigenous community has been marginal. A small number of Orang Asli is engaged in the tourism industry, working mainly as general workers in the hotels. The local community could contribute to the development of ecotourism development by playing a more active role. They have good knowledge of the tropical forests, their flora and fauna. They make use of the forest resources for generations and thus are able share their knowledge and experience with tourists from within and outside the country.*

*Ecotourism involving the Orang Asli community could be implemented at two levels in Cameron Highlands. In the urban area, an "Orang Asli Information Centre" could be established in Kg. Sungai Ruil, providing basic information on the Orang Asli community in Cameron Highlands. Tour groups could then be arranged to visit selected destinations of interests. At the village level, homestay programme and village housestay programme could be implemented. At these two levels, the Orang Asli could be trained to become tourist guides in showing the tourists the historical sites, types of houses in different villages, socio-economic activities, hill padi farming areas, trapping and fishing methods, animal trails and plant/tree identification. They can also lead the tourists in non-timber product harvesting trips. Tourists could also participate in the traditional bersewang dance.*

*The active involvement of Orang Asli's in ecotourism could only be achieved with government investment in putting up basic facilities and providing proper training to the Orang Asli. The private sector could assist by bringing the tourists to Orang Asli Information Centre and villages. The Orang Asli have to learn new languages and acquire communication skills besides having a sense of time management and commitment. Acquirement of additional knowledge on flora and fauna is essential. Involvement in ecotourism development is expected to uplift their living standards with better income compared to their current involvement in the vegetable and flower farming activities.*

**Keywords:**Orang Asli, ecotourism, Cameron Highlands

**8.1 Introduction**

Even though the Orang Asli has been living in Cameron Highlands for generations, this world-renowned hill ecotourism spot was named after its 'founder', William Cameron. The small plateau is well known for the establishment of the tea plantation, following the establishment of BOH Tea Plantation in 1929. In the 1930s, further external changes have resulted in the development of a road linking Tapah (Perak) in the lowland and Cameron Highlands (Pahang). The period marked the beginning of commercial agriculture in the highlands and also more frequent interaction between the Orang Asli and the wider society at large. With the opening of the Tapah-Cameron Highlands road in the 1930s, Tapai Semai (a sub-ethnic Orang Asli group) moved their settlements closer to the road to facilitate trading. This also witnessed the

intensification of commodity production among the Tapah Semai and the growth of market relations (Gomes, 1986). However, their involvement in modern agriculture is limited.

Over the years, the Cameron Highlands has also been developed into a popular tourism spot. Located 1,524 metres above sea level, it enjoys a cool climate with temperatures ranging between 10° and 20° C. It is a 1500 meter-high plateau surrounded by forest-clad peaks rising to 2,032 meters (Barrow *et al.* 2004). However, the involvement of the Orang Asli community in tourism development has been minimal and insignificant. There is much scope for them to be involved more in ecotourism (Barrow *et al.* 2004; see also Chapters 5 and 9) as the number of tourists visiting Cameron Highlands is expected to increase from 515,350 in 2000 to 3,467,170 in 2020 (Government of Malaysia, 1996), when Malaysia becomes a developed nation. This chapter examines the Orang Asli community in Cameron Highlands, their current involvement in ecotourism and their potential future involvement in the industry.

## 8.2 The Orang Asli Community

The district of Cameron Highlands experiences an increase in population over the years. In 1995, there were 27,509 peoples living in Cameron Highlands and the figure increased to 30,115 in 2000. This means an annual population growth rate of 1.8%. The population is projected to increase to 41,913 people in 2020 (Government of Malaysia 1996).

Among the population in Cameron Highlands, the Orang Asli is a substantial community. In 1990, there were about 2,570 Orang Asli in the district. By 2001, there were 4,275 Orang Asli or roughly 14% of the population in Cameron Highlands. These Orang Asli live in 27 villages, with an average population of 158 people per village. The largest village is Kg. Sungai Ruil, located near Tanah Rata town, with a population of 896 people while the smallest is Kg. Sungai Pinang with 26 people, located about 57 km away from the nearest town. About 96% of the Orang Asli in Cameron Highlands belong to the sub-ethnic group of Semai while the remaining 4% is Temiar (Table 8.1). The Semai is also the second largest Orang Asli sub-ethnic group (after Jakun) in the state of Pahang, comprising about 27% of Pahang's Orang Asli population.

In Cameron Highlands, the Orang Asli communities are living on state land, in villages located along the major rivers such as Sg. Bertam, Sg. Telom and Sg. Lemoi or their tributaries. Facilities such as houses, road, hall, water supply and electricity supply, vary from village to village, are provided to the villagers. By degree of development, there are 4 developed villages (15%) located near to the towns, 6 semi-developed villages (22%) located a distance from the town and 17 underdeveloped villages (63%) situated in the remote areas. In general, urban villages have more facilities. For example, there are telephone booth, civic hall and kindergarten class in the urban Kg. Sungai Ruil. These facilities have yet to be developed in the semi-developed and underdeveloped villages.

Before Malayan Independence in 1957, the Orang Asli were animists. Over the years, with government's Islamic missionary and other private religious missionary influence, some of the Orang Asli converted to other religions. In 2001, statistics gathered by the JHEOA office in Cameron Highlands showed that there were 884 Muslims (21%), 361 Christians (8%), and 231 Bahai (5%). The majority of the Orang Asli (i.e. 2,799 or 66%) remained animists.

Before 1995, Orang Asli travelled to the urban towns in Cameron Highlands by foot. With the opening of the logging road in 1994 along Sg. Bertam, Orang Asli are now able to take a ride from passing vehicles. In terms of accessibility, 10 villages (37%) are accessible by most vehicles, 14 villages (52%) by 4-wheel drives only while 3 villages (11%) are accessible by 4-wheel drives, to be followed by foot.

Table 8.1: Orang Asli Population in Cameron Highlands, 2004

No	Village	Sub-ethnic	Households	Population
1	Sg. Ruil	Semai	96	896
2	Sg. Ubi	Semai	45	228
3	Panggen	Semai	41	296
4	Sg. Kabuk	Semai	25	168
5	Sg. Chonhong	Semai	15	105
6	Sg. Triang	Semai	27	154
7	Kuala Boh	Semai	71	415
8	Sg. Relong	Semai	43	211
9	Leryar	Semai	26	141
10	Menson	Semai	13	106
11	Sg. Getam	Semai	39	154
12	Sg. Telimau	Semai	39	174
13	Terisu	Semai	40	209
14	Sg. Jarik	Semai	25	125
15	Lemoi	Semai	25	137
16	Telimau	Semai	11	53
17	Chenan Cherah	Semai	9	47
18	Renglas	Semai	14	91
19	Rening	Temiar	13	86
20	Cheros	Semai	11	73
21	Susu	Semai	14	51
22	Terakit	Temiar	11	36
23	Sg. Loon	Semai	10	95
24	Teji	Semai	13	79
25	Tiat	Semai	8	44
26	Abu	Semai	16	75
27	Sg. Pinang	Temiar	8	26
	Total		708	4,275

Source: JHEOA office, Cameron Highlands.

In general, the living standard of the Orang Asli community is regarded low compared to other ethnic groups in Malaysia. In the remote areas, they depend on subsistence farming, fishing, hunting and gathering of non-timber forest products (NTFP) to sustain daily livelihood. In the urban areas, villagers in Kg. Sungai Ruil, Kg. Ubi and Kg. Terisu show higher living standards as residents have more cash-income earning opportunities, particularly in the farming activities.

### 8.3 Current Involvement of Orang Asli in Tourism

The involvement of Orang Asli in tourism development in Cameron Highlands could be observed at two levels. In the first place, the Department of Aboriginal Affairs (JHEOA) initiated a craft centre at the district JHEOA at Kg. Sungai Ruil, Tanah Rata in 1994. The centre, known as Asli Kraft, operated from 1994 till the end of 1998 with the assistance of the Kuala Lumpur-based Koperasi Kijang Mas, an Orang Asli cooperative. The building was constructed by the district office, covering an area of 30 feet by 40 feet. Handicrafts were exhibited and sold at the centre. However, the centre stopped operation in 1998 when the cooperative failed to supply handicrafts. In 1996, a JHEOA rest house was completed with three rooms. In 2000, a chalet in the form of dormitory began operation. Currently, the chalet operator also makes use of the vacant Asli Kraft for activities.

Secondly, the Orang Asli community is involved in tourism industry at individual level. Most of Orang Asli is employed as general workers in the major hotels in Cameron Highlands. These Orang Asli are mainly from Kg. Sungai Ruil and their involvement in tourism is shown in Table 8.2. Other than those from Kg. Sungai Ruil, other Orang Asli from Tapah area has also worked in the hotel industry and they are employed in Equatorial Hotel.

In the hotel industry, the Orang Asli work as house attendants, cleaners, kitchen helpers, gardeners and general labourers. In general, the basic pay for a new worker with no experience is about RM240 a month. He/She is given a monthly food allowance of about RM60. A new worker also receives 1.5 points (tip and service charge, etc) a month and each point may value from RM200 to RM350. Thus, for a new worker, the gross monthly income averages RM550.00. Those serving the hotel for a longer period of time have higher points and consequently higher pay. On the average, a worker receives roughly RM800 a month in 2004.

Table 8.2. Involvement of Orang Asli of Kg. Sungai Ruil in tourism in Cameron Highlands, 2004

	No. of males	No. of females	Total
Selected major hotels			
(a) Merlin Inn	5	5	10
(b) Strawberry Park	4	0	4
(c) Heritage Hotel	6	12	18#
(d) Equatorial	14	11	25*
Sub-total 1	29	28	57
Caddy at golf course in Merlin Inn**			
(a) 15 years & above	45	0	45
(b) Below 15 years	25	0	25
Sub-total 2	70	0	70
Tour guide (Sub-total 3)	4	0	4
Total	103	28	131

# 4 workers are not locals.

\* More than half of these Orang Asli workers are from Tapah.

\*\* Mainly on part-time basis

There are four unlicensed Orang Asli tourist guides from Kg. Sungai Ruil working for three private tour operators in Cameron Highlands. Since the Orang Asli do not have formal training, they do not have licenses as tour guides. Consequently, these guides could only involve in bringing the tourists in jungle trekking. For example, one tour operator offers 6 types of adventures/tours to the tourists. These are Gunung Brinchang 4X4 WD Tour, Gunung Brinchang and Orang Asli Villages, Sunrise Tour, Sunset Tour, Countryside Tour and Jungle Trekking. The two Orang Asli's involvement is confined mainly to the 4-hour Jungle Trekking, starting from Trail No. 10 in Tanah Rata and ending in Kg. Sungai Ruil. For a two-person tour, the Orang Asli guide receives RM50. The income from this source is rather irregular, depending on tourist demand for jungle trekking.

#### 8.4 Potential Future Involvement of the Orang Asli in Tourism

Green tourism is getting more popularity when tourists emphasise sustainable development of natural resources. Malaysia is expected to invest more in green tourism and Cameron Highlands is certainly one of the appropriate spots for such development. A study conducted between 2003 and 2005 showed that

visitors to Cameron Highlands were attracted by environmental features and they disliked pollution and forest degradation (Clifton *et al.* 2003).

#### **8.4.1 Orang Asli Information Centre and Museum**

The overall involvement of the Orang Asli should commence with the establishment of an Orang Asli Information Centre. Currently, there is limited information on the Orang Asli in Cameron Highlands. Tourists and even some tour guides outside Cameron Highlands are not aware of the existence of an Orang Asli village (Kg. Sungai Ruil) within the urban area, Tanah Rata. At a later stage, an Orang Asli museum could be developed.

#### **8.4.2 Homestay Programme and Village Housestay Programme**

Basically, the Homestay Programme offers a distinctive style of living with emphasis on warm and friendly hospitality within private homes. Currently, the programme in Pahang are located in Temerloh, Kuala Lipis, Raub, Cameron Highlands, and Pekan. In Cameron Highlands, there are currently 12 participants, all Malays, in the Homestay Programme located in Taman Sedia, located between Tanah Rata and Brinchang, two major towns in Cameron Highlands. The programme involves living with foster parents. Activities of this programme for a three-day period cover jungle trekking, tea plantation tours, farm tours, cultural dances, and activities with local folks.

In view that local and foreign tourists have special interests in the lifestyle of aborigines in Malaysia, one possibility is to extend the Homestay Programme to the Orang Asli communities in Cameron Highlands. Four villages have potential for such development, namely the Kg. Sungai Ruil in the urban area, Kg. Kuala Boh, Kg. Menson and Kg. Tiat in the rural areas. Homestay could be easily initiated in Kg. Sungai Ruil as villagers have been exposed to tourists for a long time. With the completion of the Bertam Valley-Betau Highway by 2005, accessibility to the rural villages would make the Homestay Programme more feasible.

Future development may shift from the Homestay Programme to that of Village Housestay Programme. Some tourists have expressed the feeling that there is a lack of privacy and freedom when staying with their foster parents. Hence, for this category of tourists, setting up or renovating existing houses in the village could be initiated. The difference is that instead of living with foster family, the tourists could stay in well-furnished houses on their own. They could then participate in village activities as planned.

#### **8.4.3 Day Trip Activities**

This is to meet the need of tourists who wish to observe, participate and understand the normal daily livelihood of the Orang Asli communities. Table 8.3 below shows activities that could also be participated by those choosing the Homestay or Housestay programmes.

#### **8.4.4 The Historical Sites**

Two historical sites are found some distance from Orang Asli villages and these could be another attraction for the tourists. Both sites are related to the Emergency period (1948-1960) when the communists shot down two British planes flying in the region. The first site is the remains of a helicopter near Kg. Kuala Boh, accessible by foot in an hour walking towards the upstream of Sg. Mensun from Kg. Kuala Boh. The second site is located near Kg. Rening where the remains of an aeroplane is found and this take two hours to reach by foot. According to the Orang Asli, some outside tourists, with the help of the local villagers, visited these two sites from time to time. Currently, both sites are not highlighted in the tourist map of Cameron Highlands.

Table 8.3. Activities that could attract tourists

	Activity	Remark	Potential village
1	Hill padi cultivation	Understand the process of hill padi cultivation, its relation to the Orang Asli's socio-cultural way of life and impacts on the environment.	Rening, Telanok, Renglas, Cheros
2	Hunting	Understand how the Orang Asli make use of traditional forest products in hunting activities such as making traps. The use of blow pipe is another attraction. Identify animal tracks and zones are also attractive.	Rening and other accessible remote villages
3	Fishing	Participate in fishing trip and understand better the problem of fish depletion as well as methods of fishing such as <i>bubu</i> (trap), <i>jala</i> (net), root poisoning & hook and line.	Villages located along the Telom, Bertam and Lemoi Rivers
4	Forest vegetable and fruit gathering	(a) Female gather forest vegetables ( <i>pucuk</i> or young shoots) such as <i>pucuk ubi</i> , <i>pucuk pisang</i> , <i>pucuk 'lehau'</i> , <i>'menjelei'</i> , <i>'ke-deet'</i> and <i>'bekuicuh'</i> . (b) Harvesting of forest fruits such as <i>petai</i> ( <i>Parkia speciosa</i> ), <i>rambutan</i> ( <i>Nephelium lappaceum</i> ), <i>perah</i> ( <i>Elaterosperma tapos</i> ), <i>kasai</i> ( <i>Pometia pinnata</i> ).	Rural villages.
5	Rattan harvesting	Participate in rattan manao ( <i>Calamus manan</i> ) harvesting trip	Teji
6	Gaharu harvesting	Participate in gaharu harvesting trip.	Tiat
7	'Bersewang' cultural and religious activity	(a) To ensure "the deceased goes happily to heaven". (b) Hill padi harvesting period (January & February).	All villages.
8	The 'bersanding' wedding ceremony	The Orang Asli combines their traditional and Malay wedding cultural practice in the <i>bersanding</i> ceremony where the new couple sits on a stage as "king & queen" to be admired by others.	All villages.
9	Types of houses (Nasarudin 2003)	(a) <i>Rumah Yeau</i> temporary built in their farms using forest resources. (b) <i>Rumah Ran</i> temporary built on trees used during rattan harvesting trip, fruit harvesting, opening new land. (c) <i>Rumah pisang sesikat</i> built at river bank for fishing, in the farm and the forest. (d) Normal wooden/bamboo house. (e) Wooden house in Terisu Regroupment scheme. (f) Brick houses (latest).	Remote villages.
10	Tapioca eating	Observe and enjoy the tapioca food.	All rural villages
11	Blow pipe demonstration	Observe and learn how to use the blow pipe.	All villages.

## 8.5 The Role of Government and Local Community

The active involvement of Orang Asli's involvement in ecotourism could only be achieved with government investment in putting up basic facilities and providing proper training of Orang Asli. Bearing in mind that most Orang Asli are lowly educated and belong to the lower and middle income classes, it is difficult for them to develop ecotourism on their own. In this context, the government via various ministries, could provide fund in putting up facilities to further involve the Orang Asli in ecotourism development in Cameron Highlands. For example, the potential of developing an Orang Asli Information Centre in Kg. Sungai Ruil (Tanah Rata) should be further explored. There is currently an existing space available to materialise such a centre. Located near the urban Tanah Rata town, such a centre could provide information on the Orang Asli in Cameron Highlands. The centre could also acts as a link between the Orang Asli community and the tour guides/companies to facilitate the visits of tourists to Orang Asli areas and participate in their activities. Preferably, the centre should be initiated by the JHEOA and ultimately managed by the Orang Asli. This means the Orang Asli need some form of training on management and communication. Besides these, the government should also consider expanding the Homestay programme to the selected Orang Asli villages. Government funding is also needed to initiate village housestay programme. A museum could be planned and established in the future.

With these new ways of involving the Orang Asli in ecotourism development, the members have to learn new languages and acquire communication skills besides having a sense of time management and commitment. Acquirement of additional knowledge on flora and fauna is essential. Even though Orang Asli have some knowledge on forest resources, these knowledge has to be packaged to meet tourists' needs. Currently, local Orang Asli may not have such skills. For a start, educated Orang Asli outside Cameron Highlands could be employed in initiating various ecotourism projects. However, for the local community, the Orang Asli could be trained on at least the following areas in the long run.

- (a) Management of the Orang Asli Information Centre and museum (Photograph 8.1).
- (b) Professional tourist guides. Currently, there are four unlicensed Orang Asli tourist guides in Kg. Sungai Ruil alone. If given a chance, these guides are interested in going for proper training to become licensed tourist guides. Perhaps, the Pahang Tourism (Fraser's Hill Development Corporation) would like to identify potential Orang Asli and sponsor them for training to become professional guides. Currently, the training fee of RM300 for a two-week course is regarded a burden to the Orang Asli. According to Pahang Tourism, Orang Asli could apply for training where all costs (except transportation to and from training venue) are borne by the agency. JHEOA normally provides transportation to the successful candidates.
- (c) Coordination on ecotourism activities by the village committee. Selected village committee members need to be trained in coordinating activities for tourists coming to the villages.
- (d) Developing handicraft activities in selected villages.
- (e) Developing traditional medicinal plant products in selected villages.
- (f) Language courses, Orang Asli tourists and local leaders must be trained so that they too can communicate in other languages such as English and Chinese.

## 8.6 Conclusion

The involvement of Orang Asli in ecotourism development in Cameron Highlands could only achieve a high degree of success with assistance from both the government and the private sectors. While the government helps in providing facilities and training to the local communities, the private sector assists in bringing the tourists to the Orang Asli villages.

The planning for the involvement of Orang Asli in ecotourism development should not be a one way process based on a top-down approach. The local community needs to be given a say and be actively involved in the planning, implementation and reviewing stage as they know the local situation better. The

participation of local community in decision making is thus an essential part in the overall development. This would ensure long-term successful implementation of ecotourism involving the Orang Asli.

With more local and foreign tourists coming to the villages, the involvement in ecotourism development is expected to uplift Orang Asli's living standards with better income compared to their current involvement in vegetable and flower farming activities. An Orang Asli vegetable farmer earns between RM400 and RM800 a month. For daily farming worker, the daily wage is RM20 for male and RM15 for female. This is the case of the daily workers in Kg. Sungai Tiang where there are 30 male and female farm workers, earning an average monthly income of RM600 for male and RM550 for female. A professional tourist guide could earn at least RM1,000 a month. At the village level, tourists also provide more employment opportunities. Tourists are willing to pay for participating in various Orang Asli daily activities. Handicrafts made by the women folks could also be sold to the tourists. With better livelihood, this would result in lesser dependence on NTFP harvesting thus conserving the environment as well as the natural resources.



Photograph 8.1: The Sg Ruil Orang Asli village is an ideal place to develop an Orang Asli information centre, museum and cultural centre (for cultural performances) as it is located near to the main towns.

### Bibliography

- Barrow, C.J., Clifton, J., Chan, N.W. and Tan, Y.L. (2004) "Sustainable development in the Cameron Highlands, Malaysia". Pp. 222-234 in Jamaluddin, M.J., Kadir, A., Samijah, S. & Shaharudin, I. (Eds.), *Facing Changing Conditions. Proceedings of 2<sup>nd</sup> Bangi World Conference on Environmental Management*, Universiti Kebangsaan Malaysia.
- Clifton, J., Barrow, C.J., Chan, N.W., Chang, W.F. and Ting, P.L. (2003) Ecotourism in Cameron Highlands (Malaysia) and Wakatoli Marine National Park (Indonesia): Issues and challenges. Pp. 383-392 in Wan Ruslan, I., Samar, N., Majid, A.A., Abdullah, M.A. & Abdullah, A.L. (Eds.) *Proceedings of a Conference on Society, Space and Environment in a Globalised World*. Penang: Universiti Sains Malaysia.
- Gomes, A.G. (1986) *Looking for money: simple commodity production in the economy of the Tapah Semai of Malaysia*. Ph. D. thesis, Australian National University.
- Government of Malaysia (1996) *Rancangan Struktur Majlis Daerah Cameron Highlands dan Pihak Berkuasa Perancang Tempatan Cameron Highlands*.
- Nasarudin, S. (2003) *Laporan kerja-kerja Penyelidikan Rumah-rumah Tradisional Orang Asli dari Rumpun Bangsa Semai (Suku Kaum Senoi) di Kg. Panggen, Mukim Hulu Tenom, Daerah Cameron Highlands, Pahang*. Unit Peribumi, Bahagian Monumen & Pusat Konservasi Negara, Jabatan Muzium & Antikuiti, Kementerian Kebudayaan, Kesenian & Warisan.

## CHAPTER 9

BABER

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# THE ECONOMIC AND SOCIO-CULTURAL IMPACTS OF ECOTOURISM ON THE ORANG ASLI IN CAMERON HIGHLANDS, PAHANG, MALAYSIA

Suriati Ghazali, Chan Ngai Weng and Norizan Md Nor  
School of Humanities  
Universiti Sains Malaysia  
11800 Penang, Malaysia  
Email: suriati@usm.my

### Abstracts

*This chapter discusses the economic and socio-cultural impacts of ecotourism on the local communities, namely the Orang Asli in Cameron Highlands, Malaysia. Research employing a questionnaire survey, interview and field observation was conducted, focusing on how the Orang Asli people have benefited from ecotourism and their perceptions towards the tourists and tourism activities. Findings indicate that ecotourism development in Cameron Highlands has both positive and negative economic and socio-cultural impacts. Some of the positive impacts include income generation and employment opportunities, infrastructure development and the improvement of social services, telecommunication and access to electricity. However, the real economic impact is rather small and most of the Orang Asli are at the margin of ecotourism development. As a social group, they are delighted with the arrival of tourists but at the same time they perceived that they gain little from them. Another negative impact involves the degradation of forests and polluted rivers which has affected the well being of Orang Asli.*

### 9.1 Introduction

After a decade of sustained growth in volume and visibility, tourism is one of the leading global industries (11 per cent of global GDP) and constitutes one of the major migratory movements in modern society - about 700 million international travelers in 2001 (UNEP, 2002a) and 760 million in 2004 (New Straits Times, 23.6.2005). This has produced significant impacts on resource consumption, pollution and economic and social systems. This chapter will discuss the impact of ecotourism in Cameron Highlands, Malaysia, on the lives of the local communities, viz. the Orang Asli living in this area. The economic and socio-cultural impacts described here are the effects on host communities of direct and indirect relation with tourists, and of interaction with the tourism industry. The impact arises when tourism brings about changes in the livelihood of the local people, such as changes in economic activities, value systems, behaviour and collective traditional lifestyles. While tourism can generate positive impacts as it can create local jobs and generate income, it may also threaten indigenous identity (see for example UNEP, 2002b; Upchurch and Teivane 2000; Mbaiwa 2004).

### 9.2 Reviews on economic and socio-cultural impacts

Many researchers have discussed the impacts of tourism development on local communities. Ecotourism as a sector of the tourism industry is geared towards providing nature-based experience to tourists, as well as to generate positive economic and cultural benefits for host communities (Clifton, 2004; Clifton et al., 2003; see also Chapters 5 and 8). Nevertheless, previous studies have revealed both the positive and negative impacts of tourism to the economy and culture of the local people. In many discussions on tourism, this issue is much-debated even today.

It was noted that tourism has successfully brought about numerous economic benefits to the destination country. Archer and Cooper (1994:75) argue that international tourism is an invisible export in that it creates a flow of foreign currency into the economy of a destination country, which creates business turnover, household income, employment and government revenue. Some portion of the money received by the business establishments, individuals and government agencies is re-spent within the destination economy, thereby creating further rounds of economic activity.

Other researchers further argue that the local households in ecotourism area are able to reap the economic benefits of such tourism activity in many forms. For example, those who possess language skills or are well-equipped with knowledge on their culture and the environment are afforded the opportunity to become tourist guides or translators. Besides that, other services associated with the tourism industry such as accommodation, transport, catering, cleaning and the sale of food, drinks and handicrafts to visitors provide additional economic opportunities for host communities (see Clifton, 2004; English et al., 2000; Mbaiwa, 2004; Suriati, 2004).

On the other hand, the local economy would benefit indirectly through the establishment of ecotourism facilities such as roads, electricity or other services as well as infrastructure, often funded by external organisations and planned together with local governments. The availability of a number of income-generating activities in the local economy is able to reduce the dependence of the local people on only a single activity. This may encourage the creation of local entrepreneurs which will again serve to diversify and strengthen the local economy (Clifton, 2004; UNEP, 2002c; Suriati and Morshidi, 2004; Ku Mohd. Lafdzi Ku Ismail, 1991:94).

English et al. (2000) point out that rural communities living in ecotourism areas have shifted from an economy based on manufacturing to one driven by the retail and service sectors. They found that most of the expenses incurred by tourists fall into one of following four economic sectors: lodging, eating/drinking, retail and recreation services. Therefore a large portion of the economic activities in these sectors result from the existence of tourists and other visitors in ecotourism area.

Although proven to be able to provide job opportunities to local people, research show that many jobs occupied by the locals in tourism industry contributes lower pay. Mostly these are service-related jobs such as housemaids and hotel workers, waiters, gardeners and other unskilled labour. On the other hand, higher-paying and more prestigious managerial jobs go to foreigners or urbanised nationals (see UNEP, 2002d; Suriati and Morshidi 2004; Cooper 1998). Therefore, the reality of the economic impact of ecotourism on all local communities is still arguable. Clifton (2004) for example argues that many global tourism industries require a well-established network of contact at the international level. This necessitates a level of organisation comprising marketing in the country of origin, international and domestic flight arrangements and contacts with a range of individuals or locations. Furthermore, services demanded by ecotourists from the developed countries may be beyond the scope of host communities to provide. This result in a significant 'leakage' of economic benefits as money that could potentially reach local communities is lost to a more highly organised group of ecotourism operators.

Clifton (2004) also discusses the socio-cultural benefits of global ecotourism. The emphasis on genuine or authentic cultural experiences by ecotourists is able to encourage the staging of traditional dances and the exhibition of traditional attires and cuisine, which can lead to a re-affirmation of community pride in their history and culture (see also UNEP, 2002c; Lane and Waitt, 2001). Carter and Beeton (2004) on the other hand argue that tourism can be both a force for cultural enrichment or rejuvenation and the loss of cultural integrity. They argue that physical manifestation of culture are often a product of tourism, and host communities trade cultural expressions for benefits that tourism can provide.

Again, however, the reality of the socio-cultural impacts of tourism on local communities is frequently far from ideal. Many indigenous groups are seeking to modernise their culture through taking on and participating in aspects of the modern world. This process of cultural change is accelerated through unintended consequences of exposure to visitors' behaviour and morals (Clifton, 2004), which in turn lead to adverse impact on local communities, especially the younger generations who are frequently more liable to adopt the standards of attitudes and behavior witnessed amongst ecotourists (see also UNEP, 2002d; IDRC, 1996; Upchurch and Teivane, 2000).

Mowforth and Munt (1994:109) on the other hand argues that relationships within that society, the mores of interaction, the styles of life, the customs and tradition are all subject to change through the introduction of visitors with different habits, styles, customs and means of exchange. Even if the society survives, its culture may be irreversibly altered. Culture is a dynamic feature of human life, so the processes of cultural adaptation and change should not be assumed to be totally negative in its effect. However he suggests that to some extent the cultural elements should be sustained because the ability of the people to retain or adapt elements of their culture will distinguish them from other people.

Mercer (1994:128-130) on the other hand, comments on the possible effects of global tourism on the culture of the minorities or indigenous groups. He discusses that the environmental destruction resulting from the development will lead to the destruction of aboriginal sacred sites, such as in the Australian case. The Aborigines are also fearful that the projects will negatively effect their traditional way of life, their land, their capacity to perform their tribal ceremonies and pass on their cultural traditions to the next generation.

Suriati and Morshidi (2004) conclude that the growth of ecotourism has resulted in the encroachment of urban land uses and employment into rural settings, with some areas of agricultural land being used for a variety of purposes related to ecotourism. This has resulted in the reworking of the social, economic and physical landscape of the rural areas.

### **9.3 Tourism in Malaysia and the impact on local communities**

From an economic point of view, in Malaysia, tourism is the second most important sector following manufacturing. In 2004, tourism contributed RM29.7 billion to the national economy through foreign exchange and taxes (Bernama.com, 15.6.2005), and recorded a total number of 15.7 million foreign tourists compared to 10.6 million in 2003 (Ministry of Tourism Malaysia, 2005a). The increase in the total number of tourists arriving in Malaysia has contributed to an increase in income, for example from RM25.8 billion in 2001 to RM26.9 billion in 2002 (Suriati and Morshidi, 2004:16) and increase steadily to RM29.7 billion in 2004. This meets the vision of the Ministry of Tourism Malaysia, which is to direct Malaysia to be a dominant country in tourism, and that tourism will be the main sector in contributing to socio-economic development in the country (Ministry of Tourism Malaysia, 2005b).

Ecotourism industry which is based on both natural and cultural attraction is becoming important since the demand for exotic vacations has expanded to include visits to indigenous and minority ethnic groups in remote locations around the world (IDRC, 1996). In many places, indigenous peoples have maintained local traditions and developed sophisticated practices for the sustainable exploitation of their environment. However, these groups are particularly vulnerable to the negative impact of tourism. In the search for untouched and authentic tourists' destinations, many places once considered 'off the beaten track' have become overpopulated with visitors, accelerating the pace of social and environmental degradation (IRDC, 1996).

Malaysia has set up a National Ecotourism Plan in order to promote ecotourism which will boost the country's economy and at the same time will preserve natural heritage. With the objective to lead

Malaysia as a destination for international ecotourism, this plan draws attention on the need to establish and manage ecotourism areas (Chan, 2004). The identified initiatives, among others, includes enhancement of ecotourism coverage area, providing management and development plan for these areas and building up the financial know-how to support ecotourism (Ministry of Tourism Malaysia, 2005c). The plan identifies potential sites for ecotourism which include, among others, national parks, forest reserve, rivers, waterfalls, lakes and mountain sides, in which, most of these are the characteristics of the Cameron Highlands area.

#### **9.4 Research setting and methodology**

Cameron Highlands, situated in the midland of Peninsular Malaysia, is about 1,829 metres above sea level. First discovered in 1885 by a British surveyor William Cameron, the fame of Cameron Highlands grew during the colonial era when British Planters realised the potential of its fertile mountain slopes for growing tea. Since then Cameron Highlands, with its cool temperate surroundings has developed into a popular hilltop holiday spot for both locals and visitors alike ([www.cameron.com.my](http://www.cameron.com.my), 2003). As the popular tourists' destination for more than a decade, Cameron Highlands has many places of interest such as a number of tea estates, vegetable farms, strawberry farms, flower nurseries, Gunung Brinchang, jungle walks, waterfalls, and some old buildings left by the British. Most of these are situated in the vicinity of Ringlet, Tanah Rata and Brinchang, three main settlements (towns) in Cameron Highlands. These towns are populated by mainly the Chinese business operators, and the Malay and Indian government officials and service workers. The Orang Asli, on the other hand, are the inhabitants of the aborigines' villages situated a few kilometers away from these towns.

#### **9.5 The Orang Asli**

The Orang Asli is the minority indigenous groups in Peninsular Malaysia. They are divided into three main tribal groups namely the Negritos, Senois and Proto-Malays with a number of sub-groups. The tribal group that lives in the aboriginal settlements and villages around Cameron Highlands is mainly the Senois, of which the subgroups are Temiar and Semai. The survey, interview and field observation were done in the towns of Cameron Highlands and also in the aborigines villages nearby, such as Kampung Sungai Ruil, Kampung Sungai Kabuk and Kampung Sungai Tiang. 166 Orang Asli of the Senoi group were interviewed, of which 149 were the Semai sub-group and 17 were the Temiar sub-group. The discussion however will not be made with reference to villages, but to the overall socio-economic conditions and perceptions of the respondents studied.

#### **9.6 Socio-economic and demographic background**

The ages of the 166 Orang Asli interviewed ranged from 15 to 80, but the majority are from the 20 to 44 age group. Questions were asked regarding their socio-economic and demographic background, followed by their perceptions on how ecotourism have affected their livelihoods. 40.4 per cent of the respondents were males and 59.6 were females. 42.2 per cent have never attended school, 22.3 have primary education and 33.2 per cent have attended secondary school. 2.4 per cent or 4 respondents have attained higher education from a college (one respondent) and universities (3 respondents) (Table 9.1). There are no significant differences between the genders, in which, the majority of both genders have never attended school. However, most of them are the elder respondents of age 40 and above. On the contrary, younger generations of both genders have the same opportunity to seek education in schools. The high percentage of those without formal education and attained only primary education reveals that the Orang Asli living around Cameron Highlands form a lower educated group when compared with other major communities in Malaysia, such as the Malays, the Chinese and Indians. Because of this, previous researches on Orang Asli often conclude that Orang Asli are placed at the margin of development and are often excluded from

the mainstream of the socio-economic development (see for example Clammer, 1987; Nicholas, 1993 and 2000).

Table 9.1: Levels of education according to gender

Levels of education	Male		Female		Total	
	Count	%	Count	%	Count	%
Never attended school	26	38.8	44	44.4	70	42.2
Primary education	19	28.4	18	18.2	37	22.3
Lower secondary education	9	13.4	19	19.2	28	16.9
Upper secondary education	11	16.4	16	16.2	27	16.3
College, polytechnic and university	2	3.0	2	2.0	4	2.4
Total	67	100.0	99	100.0	166	100.0

The Orang Asli interviewed are engaged in various types of occupation. The majority of them are production workers and labourers, farmers and also as service workers (Table 9.2). There is no significant difference between the type of jobs employed by the males and the females, except that the females are prominent in high ranking jobs as professional and managerial workers when compared to men.

Table 9.2: Occupation of Orang Asli according to gender\*

Occupation category	Male		Female		Total	
	Count	%	Count	%	Count	%
Professional and technical workers	-	-	1	2.0	1	0.9
Administration and managerial workers	2	3.4	4	8.2	6	5.6
Clerical workers	6	10.4	-	-	6	5.6
Sales workers	2	3.4	5	10.3	7	6.5
Service workers	11	19.0	13	26.5	24	22.5
Agricultural, forestry workers, and hunters	16	27.6	11	22.4	27	25.3
Production workers and labourers	21	36.2	15	30.6	36	33.6
Total	58	100.0	49	100.0	107	100.0

\*This table excludes those claimed as not occupied in any economic activities, which were housewives, students and the elderly.

The majority of them (71 per cent) are salaried workers in the government offices, hotels and resorts, and also in shops and stalls. Most of them are occupied in low ranking jobs such as maintenance workers and cleaners in the offices, hotels and resorts. Others are caddy in the golf resorts, waiters in the restaurants, sales assistants in the shops and also a chef in a hotel. Some of the respondents are working with the government offices as clerk assistants and drivers. Only a few higher educated respondents have managed to work in the higher ranking jobs such as officers in the community development offices (3 respondents), and also as a female teacher and a male tourist guide.

Only 29 per cent of the Orang Asli interviewed are self-employed. They are farmers (26 respondents), hunters and gatherers (2 respondents) and business operators (3 respondents).

These findings reveals that ecotourism development in Cameron Highlands have an impact in both economic and socio-cultural aspects of the life of Orang Asli. Once known as the hunters and gatherers of

Malaysia and very much dependent on the land, rivers and forest as their sources of livelihood, they have now become incorporated into the global economy and have diversified economic activities in sectors other than agriculture. This is similar to other findings elsewhere which shows that tourism development has positive economic impacts on the local people because it generates income and employment opportunities from the infrastructure development such as tarred roads, hotels, lodges and resorts (see for example Suriati and Morshidi, 2004, UNEP, 2002c, Mbaiwa, 2003; Upchurch and Teivane, 2000). Where ecotourism offers a viable economic alternative, tourism opportunities have induced people like the Orang Asli to abandon cultivated land, allowing forests to regenerate. This has become one of the reasons that turned conservationists to ecotourism in order to provide local economic benefits while maintaining ecosystem integrity (see Stem et al, 2003).

The extent to which the Orang Asli are able to reap the economic benefits of the ecotourism industry in Cameron Highlands will be investigated further by looking at their income gained from their employment. Table 9.3 indicates the monthly income of 107 employed respondents.

Table 9.3: Distribution of income according to gender

Monthly income	Male		Female		Total	
	Count	%	Count	%	Count	%
RM300 and below	19	32.8	16	32.7	35	32.7
RM301- RM600	20	34.5	29	59.2	49	45.8
RM601-RM900	13	22.4	2	4.1	15	14.1
RM901-RM1200	6	10.3	1	2.0	7	6.5
RM1201 and above	-	-	1	2.0	1	0.9
Total	58	100.0	49	100.0	107	100.0

The majority of the working respondents studied can be categorised as low-income earners. More than 70 per cent of them earn RM600 per month and below (see also Chapter 8). Almost a third of them earn RM300 and below, and these are mainly self-employed farmers and low-paid labourers. Only a small minority, that is 6.5 per cent earn an income of RM901-RM1200. They are mainly clerks and officers in the government offices, drivers and sales operators. Only one respondent earns more than RM1200, that is the female school teacher who earns RM2500 per month. There is no significant difference between the men and women's income except in the category of RM301-RM600, in which there were significantly more women than men. In contrast, many men have an income in the upper category (RM601-RM900).

Most of those employed in jobs directly related to tourism (maintenance workers in the hotels, caddy in golf resorts, waiters and sales assistants), earn between RM301 to RM600 per month. Only a few, such as a cook, a tourist guide earn between RM601-RM900. Only one respondent, who gathers forest products and sells them to tourists claimed that he earns to more than RM1000 per month. This shows that ecotourism create jobs and generate income to the Orang Asli living in this area, and those working in non-agricultural sectors and directly related to tourism earn better than those working solely in the agricultural sector as self-employed farmers.

These findings support the similar study on the impact of tourism on local people such as by Suriati (2004) and Ashley and Roe (2002) and Clifton et al. (2003), in which, ecotourism offers a wide range of jobs to many lower educated, poor local people. Even though the income is still rather low, what little they obtain is important to the livelihood of the local people, especially at a time when ready money is becoming increasingly important to pay for necessities such as food, services and education. If we take this into account, it is easier to understand why the majority of Orang Asli view ecotourism positively within the areas studied (see discussion in Section 9.7).

### 9.7 Orang Asli's perceptions on economic and socio-cultural impact of ecotourism

The economic and socio-cultural impacts of ecotourism discussed here are from the view of the host communities, the Orang Asli. They gave their opinion on the effects of direct and indirect relations with tourists, and of the interactions with the tourism industry. Host communities are often the weaker party in interactions with their guests and service providers, leveraging any influence they might have (UNEP, 2002b). These influences are not always apparent, as they are difficult to measure, highly dependant on value judgments and are often indirect or hard to identify.

The respondents were asked on how they feel with the influx of tourist to Cameron Highlands and to their villages. Of the 166 respondents interviewed, 85.5 per cent (142 respondents) said that they are happy and excited with the inflow of tourists to Cameron Highlands whereas the rest (14.5 per cent or 24 respondents) felt irritated and disturbed. The percentage of women who gave negative gestures and are uncomfortable with the arrival of tourists is a little higher than that of the men. Table 9.4 summarises positive reasons and Table 9.5 demonstrates negative reasons behind their answers and gestures.

Table 9.4: The reasons for feeling happy and excited with the arrival of tourists

Reasons	Male		Female		Total	
	Count	%	Count	%	Count	%
The coming of tourists has increased the family income	10	16.9	8	9.6	18	12.7
We gain new experience, they gave us presents and we feel happy to know them	25	42.4	48	57.8	73	51.4
The village become more developed and cheerful	21	35.6	24	28.9	45	31.7
No comment	3	5.1	3	3.7	6	4.2
<b>Total</b>	<b>59</b>	<b>100.0</b>	<b>83</b>	<b>100.0</b>	<b>142</b>	<b>100.0</b>

Table 9.5: The reasons for feeling disturbed and uncomfortable with the arrival of tourists

Reasons	Male		Female		Total	
	Count	%	Count	%	Count	%
I don't like tourists, they are impolite; They are ignorant and rude; I feel disturbed and irritated for they just come to take a quick snapshot and are gone	5	62.5	13	81.2	18	75.0
I am shy and worried because our houses/ villages are poor/improper	1	12.5	3	18.8	4	16.7
No comment	2	25.0			2	8.3
<b>Total</b>	<b>8</b>	<b>100.0</b>	<b>16</b>	<b>100.0</b>	<b>24</b>	<b>100.0</b>

These grievances and irritation due to tourists' behaviour have been reported by other research on the perceptions of host communities (see Ransom, 2005; UNEP, 2002d; Suriati, 2004). The respondents were concerned that the tourists' photographs would not portray their village in the most favourable light. Similarly there were complaints that the inappropriate attire of the visitors shows a lack of respect for the elders. Such irritation can lead to social stress among the local communities.

### **9.8 Involvement in tourism industry**

Even though many respondents claimed that they are pleased with the inflow of tourists to Cameron Highlands, the number of those who perceived themselves as involved in tourism industry is small. Only 22 per cent (36 respondents, 18 men and 18 women) perceived that they have direct involvement with the tourism industry and with the tourists, particularly those who work as tourist guides, workers in the hotels and lodgings, assistant sales in shops and as caddy in golf resorts.

Attending courses related to tourism is another way of making the respondents feel that they have contributed to the tourism industry. Half of the respondents (54 per cent or 91 respondents) claimed that they have attended some short courses related to tourism activities sponsored by the local authorities such as the Department of Orang Asli Affairs and the Department of Tourism. What encourage them to attend the courses is very much social in reasons. Many respondents said that they are interested to know the tourists and to attain knowledge from them. Respondents who are the community leaders and those who work as officials in the government departments, for example, are often asked to attend such courses. It is related to their work, in which the community leaders are responsible in helping their people to enhance their knowledge and therefore enabling them to participate actively in tourism-related activities.

One of the purpose of such courses, among others, is to teach the Orang Asli ways to provide accommodation to tourists so that they will have the opportunity to increase their income. The tourists may choose to stay with the Orang Asli through a homestay programme (see Chapter 8). Those interested in joining the programme would have to register with the tourism department. The condition of their house would then be assessed by the department to evaluate their suitability as places of accommodation for visitors and tourists (Suriati and Morshidi, 2004:111). Therefore those who join the homestay programmes would also have to upgrade the condition of their houses.

Table 9.6 shows that 55 per cent of the respondents (92 persons) have entered the programme, which proves the positive attitude of the respondents towards the tourists. Surprisingly, their main reason for joining the programme is for social purposes, such as to make friends with the tourists, and to get experience from them (reasons cited by 93 per cent of the respondents involved in the programme). The economic purpose (to increase the income and to get aid from the government) has become the reasons for only a few of them (7 per cent). This reveals that the Orang Asli is very attracted to tourists socially but they realise that they will not gain much, economically, from them.

Of the other 29 per cent (48 respondents), who did not become a member of the homestay programme, 56 per cent said that they were reluctant to participate because they do not want to be disturbed by the tourists. For many of them, the tourists will just create problems for them. Some indicated that they have social constraints, including language and cultural barriers, which made them not interested in establishing relationship with tourists. 44 per cent thought that their house was in poor condition, have no rooms and lack facilities, and was thus not suitable for the homestay programme. Interestingly this finding supports the earlier discussion in that they do not like tourists because they feel that tourists are ignorant and their visit interrupts the Orang Asli's daily activities.

The rest of the respondents (16 per cent of the 166 respondents) did not comment on this matter because they do not know about the homestay programme and are not sure whether their houses are in the programme. These were mostly the younger and elderly respondents.

Table 9.6: The reasons for joining/not joining the homestay programme

Reasons	Male (Count)	Female (Count)	Total(Count)
Reasons for joining the homestay programme			
1. To get to know tourists/to attain knowledge from them	34	52	86
2. To increase an income/to get aid from the government	4	2	6
Total	38	54	92
Reasons for not joining the homestay programme			
1. I don't like tourists/ they disturb our daily activities/ they are impolite/ I cannot speak their language/ Our culture is different	11	16	27
2. My house is in poor condition/ there is no room/no facilities	5	16	21
Total	16	32	48

### 9.9 Perception on the benefits of the tourism industry

35 per cent of the respondents indicated that the influx of tourists and tourism-related activities in Cameron Highlands has benefited them because they have the opportunity to establish relationship with the tourists and to learn about the outside culture. They also enjoyed being photographed. Such responses are highest among women, revealing that women are more receptive to social and cultural change compared to men. Previous research acknowledge that tourism affects men and women differently, in that tourism increased access to and created impact on women more than men. More new jobs are created for women whereas their receptiveness usually lead to economic and social exploitation (Ritcher, 1994). Only 21 per cent, mostly male respondents regarded that tourists and tourism have benefited them in terms of income. Again, surprisingly, 45 per cent claimed that tourists and tourism do not benefit them or do not significantly affect their lives. They commented that their lives and well being have not changed, and the influx of tourists to Cameron Highlands does not mean much to them socially and economically.

These contradictory answers when compared to perceptions given before reveals that influences and impact of tourism are hard to identify and depend on value judgments of the respondents. However, the contradiction in perceptions indicates that the impacts are both positive and negative. It can be positive because it creates employment and income opportunities, but it can also be negative because the majority of the local people can only secure low ranking jobs. Meeting tourists of other cultures and learning something new from them can be regarded as positive, but it can also be seen as negative when it leads to the adoption of new, unacceptable behaviour and lifestyles by the majority of the local people.

Finally, this chapter investigates the perceptions of the Orang Asli on activities related to tourism in Cameron Highlands, that is the clearing of forests for the building of hotels and lodgings, and also for commercial agriculture (tea plantation).

56 per cent of the 166 respondents said that the clearing of forests for tourism activities do not give any positive economic or social benefit to them. Comments on physical degradation are often heard. The Orang Asli said that most of the rivers are polluted with high level of soil residue, which made it unsuitable for every day use (see reports on child deaths due to suspected water pollution in *The Star*, April 28, 2004; May 29, 2005). They are also worried and feel threatened with the recurring incidents of landslides due to the clearing of forests in Cameron Highlands (see *The Star Online*, 9.11.2004; 18.11.2004; 25.11.2004). In addition, many residents complaint that the temperature in Cameron Highlands is on increasing trend compared to previous years due to forest clearing.

Similarly, many respondents complaint about the negative effects of forest clearing on the livelihoods of Orang Asli. Due to rapid deforestation, they have now a very limited area to go hunting and gathering food. The Conservation Act which aim to conserve the forest has also given another impact on the economic and well being of the Orang Asli. While it secures valuable flora and fauna in the forests, it has affected the source of livelihood of Orang Asli. This led to resource use conflicts, that is competition between tourism and Orang Asli for the use of primary resources (see also Stem et al. 2003; Riemer, 2004). As hunting and gathering forest products are now controlled, many of the Orang Asli have given up their traditional occupation and seek other-salaried jobs around the towns of Cameron Highlands.

The remaining 44 per cent saw positive consequences of the clearance of forest for tourism development purposes. They believed that the development of hotels and shop lots will create more jobs for them. They also believed that the local economy will be enhanced by these activities.

Once known to be talented hunters and gatherers, many of the Orang Asli today (especially the younger generation) have lost their traditional skills. Even though 65 per cent of the respondents claimed that they are skilled in forest tracking, the fact is that the majority of them possess little skill in hunting, gathering forest products and finding food in the forest (more than 60 per cent). The majority of them have also admitted that they have no ability or talent to live in the forests compared to their grandparents or ancestors. Thus ecotourism development led to the irreversible socio-economic and cultural change in the livelihoods of the local communities such as the Orang Asli.

## **9.10 Conclusions**

This study offers insights into the economic and socio-cultural impacts of ecotourism on Orang Asli and their participation and attitudes towards ecotourism. Ecotourism has a dramatic impact at the local level, as some traditional cultures and economies are being modified to an extent that they are effectively destroyed. A number of perceived positive and negative impacts of the development are reported and these appeared to be related to levels of community attachment. Although respondents are generally supportive, there is also a sound opposition from the community. Therefore, it could be inappropriate to conclude that the respondents would be 'euphoric' about the development. On the other hand, views on tourism development are partly gender based. It appeared that women are generally more opposed to the development on the grounds of perceived negative impact. Paradoxically, women highlighted positive social impacts including the ability to attain knowledge from the tourists and the development in greater extent than the men. Further research into gender variations in relation to such development should have priority, particularly as any findings could assist in the tourism planning process.

National surveys of community attitudes everywhere have tended to indicate very supportive views on tourism (see Mason and Cheyne, 2000). However such surveys should be read with care and subjected to

the type of critical re-interpretation. This research has highlighted the complex nature of community attitudes towards tourism development. Reflecting and acting upon diverse community views will not be a simple task for those involved in planning for tourism. However, it is essential that this process occurs to ensure that negative impacts of tourism on communities are minimised and positive effects are maximised.

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### **Bibliography**

Archer, Brian and Cooper, Chris (1994). 'The positive and negative impacts of tourism'. In William F. Theobald (ed). *Global Tourism: The next decade*. Butterworth: Heinemann. 73-91.

Ashley, C. and Roe, D. (2002). 'Making tourism work for the poor: strategies and challenges in Southern Africa'. *Development Southern Africa*. 19(1):61-82.

Bernamea.com (15.6.2005). 'Sektor pelancongan catat pendapatan RM29.7 bilion'.

Chan, N. W. (Editor) (2004) *Ecotourism: Issues & Challenges*. Penang: School of Humanities, Universiti Sains Malaysia,.

Clammer, J. (1987). 'Incorporation and assimilation: The aboriginal peoples of Malaysia and the forces of modernisation'. *Journal of Social and Economic Studies*. 4:121-142.

Clifton, J. (2004). 'Ecotourism: Theory, reality and challenges'. In Chan Ngai Weng (ed) *Ecotourism: Issues and challenges*. Penang: School of Humanities, Universiti Sains Malaysia. 1-10.

Clifton, J., Barrow, C.J., Chan, N.W., Chang, W.F. and Ting, P.L. (2003) Ecotourism in Cameron Highlands (Malaysia) and Wakatobi Marine National Park (Indonesia): Issues and challenges. 383-392 in Wan Ruslan, I., Samar, N., Majid, A.A., Abdullah, M.A. & Abdullah, A.L. (Eds.) *Proceedings of a Conference on Society, Space and Environment in a Globalised World*. Penang: Universiti Sains Malaysia.

Cooper, C. (1998). 'The impact of tourism on residential experience in Central-eastern Europe: The development of a new legitimisation crisis in the Czech Republic'. *Urban Studies*, 35(12/December 1): 2253-2275.

English, Donald B. K., Marcouiller, David W., Cordell, H. Ken (2000). 'Tourism dependence in Rural America: Estimates and effects'. *Society & Natural Resources*, 13:3. (Database: Academic Search Elite).

<http://journalonline.tandf.co.uk/app/home/contribution.asp?wasp=799594e493854eb6> (Access date: 11/6/2005)

[http://www.motour.gov.my/laman\\_berita/index.php?/archives/44-sektor-pelancongan-catat-pendapatan-RM29.7-bilion.html](http://www.motour.gov.my/laman_berita/index.php?/archives/44-sektor-pelancongan-catat-pendapatan-RM29.7-bilion.html) (Access date: 19/6/2005)

<http://journalonline.tandf.co.uk/app/home/contribution.asp?wasp=799594e493854eb6> (Access date: 11/6/2005).

<http://journalonline.tandf.co.uk/app/home/contribution.asp?wasp=799594e493854eb6> (Access date: 11/6/2005)

<http://archive.idrc.ca/books/reports/1996/21-04e.html> (Access date: 11/6/2005)

- <http://www.channelviewpublications.net/jtc/002/jtc0020163.htm> (Access date: 11/6/2005).
- <http://www.cameron.com.my> (2003). 'About Cameron Highlands'.
- <http://www.cameron.com.my/english/gi.htm> Access date: 13.6.2005.
- <http://journalsonline.tandf.co.uk/app/home/contribution.asp?wasp=799594e493854eb6> Access date: 11/6/2005.
- <http://journalsonline.tandf.co.uk/app/home/contribution.asp?wasp=799594e493854eb6> Access date: 11/6/2005.
- IDRC (1996) 'Tourism, biodiversity and culture: Towards a sustainable ecotourism strategy'. International Development Research Centre (IRDC).
- Ku Mohd. Lafdzi Ku Ismail, (1991), *Penyertaan Bumiputera Dalam Pelancongan di Pulau Langkawi*. Unpublished M.A Thesis, Universiti Sains Malaysia.
- Lane, R. and Gordon, W. (2001). 'Authenticity in tourism and Native Title: Place, time and spatial politics in the East Kimberley'. *Social and Cultural Geography*. 2(4):381-405.
- Mason, P. and Cheyne, J. (2000). 'Residents' attitudes to proposed tourism development'. *Annals of Tourism Research*. 27(2):391-411.
- Mbaiwa, J.E. (2004). 'The socio-cultural impacts of tourism development in the Okavango Delta, Botswana'. *Journal of Tourism and Cultural Change*. 2(3):163-185.
- Mercer, D. (1994). 'Native peoples and tourism: conflict and compromise'. In William F. Theobald (ed). *Global Tourism: The next decade*. Butterworth: Heinemann. 124-145.
- Mowforth, M. and Munt, I. (1988). *Tourism and sustainability: New tourism in the Third World*. London: Routledge.
- Ministry of Tourism Malaysia (2005a). 'Tourist arrivals to Malaysia from selected market, 2003 and 2004' ([http://www.tourism.gov.my/statistic/tourist\\_arrivals.asp](http://www.tourism.gov.my/statistic/tourist_arrivals.asp) Access date: 13/6/2005).
- Ministry of Tourism Malaysia (2005b). 'Profil Kementerian'. ([http://www.motour.gov.my/laman\\_web/index.php?page=profil](http://www.motour.gov.my/laman_web/index.php?page=profil) Access date: 13.6.05).
- Ministry of Tourism Malaysia (2005c). 'Maklumat Pelancongan: Ekopelancongan'. [http://www.motour.gov.my/laman\\_web/index.php?page=ekopelancongan](http://www.motour.gov.my/laman_web/index.php?page=ekopelancongan) (Access date: 13/6/2005).
- New Straits Times (23.6.2005). 'Tourism on the up and up'. New Straits Times – Malaysia News Online. [http://www.nst.com.my/Current\\_News/NST/Thursday/Features/20050622181539/Art](http://www.nst.com.my/Current_News/NST/Thursday/Features/20050622181539/Art) (Access date: 23/6/2005).
- Nicholas, C. (1993). 'The Orang Asli of Peninsular Malaysia'. In B. Chaudhuri (ed). *Indigenous People: Struggle for survival*. Bangkok: Asian Cultural Forum on Development. 1-7.
- Nicholas, C. (2000). *The Orang Asli and the contest for resources: Indigenous politics, development and identity in Peninsular Malaysia*. Copenhagen: International Work Group on Indigenous Affairs.
- Upchurch, R.S. and Teivane, U. (2000). 'Resident perceptions of tourism development in Riga, Latvia'. *Tourism Management*. 21(2000):499-507.

Ransom, W.R. (2005). 'Local community perceptions of the socio-economic and cultural consequences of conservation and tourism'. Research Report, Project ELGON. (<http://www.env.leeds.ac.uk/elgon/percept.html> Access date: 11/6/2005).

Riemer, J. (2004). 'Chippewa spearfishing, lake property owner/angler, and tourism – a case study of environmental social conflict'. *Sociological Spectrum*. 24(1):43-70.

Richter, L.K. (1994). 'Exploring the political role of gender in tourism research'. In William F. Theobald (ed) *Global Tourism: The next decade*. Butterworth: Heinemann. 146-157.

Stem, C.J., Lassoie, J.P., Lee, D.R., Deshler, D.D. and Schelhas, J.W. (2003). 'Community participation in Ecotourism Benefits: The link to conservation practices and perspectives'. *Society and Natural Resources*. 16(5):387-413.

Suriati Ghazali (2004). 'Involving local communities and indigenous people in tourism: A case study in Kinabalu National Park, Sabah, Malaysia'. . In Chan Ngai Weng (ed) *Ecotourism: Issues and challenges*. Penang: School of Humanities, Universiti Sains Malaysia. 102-112.

Suriati Ghazali and Morshidi Sirat (2004). 'Making a living: The incorporation of Kadazandusun households into global economy'. Final report, USM short-term research grant. School of Humanities, Universiti Sains Malaysia.

*The Star and Sunday Star*, Various issues.

The Star Online (9.11.2004). 'Landslides seal off part of Tapah-Cameron Highlands road'. (<http://www.reach.org.my/index.php?option=content&task=view&id=113&Itemid=53> Access date: 22.6.2005).

The Star Online (18.11.2004). 'PWD district engineers and MHA put on full floods alert'. (<http://www.reach.org.my/index.php?option=content&task=view&id=125&Itemid=53> Access date: 22.6.2005).

The Star Online (25.11.2004). 'Fewer tourists visit Camerons'. (<http://www.reach.org.my/index.php?option=content&task=view&id=134&Itemid=53> Access date: 22.6.2005).

UNEP (2002a). 'UNEP Tourism Programme: Why is UNEP concerned with tourism?' UNEP Tourism, Production and Consumption branch. (<http://www.uneptie.org/pc/tourism/about-us/why-tourism.htm> Access date: 11/6/2005).

UNEP (2002b). 'Socio-cultural impacts of tourism'. UNEP Tourism, Production and Consumption branch. (<http://www.uneptie.org/pc/tourism/social.htm> Access date: 11/6/2005).

UNEP (2002c). 'How tourism can contribute to socio-cultural conservation'. UNEP Tourism, Production and Consumption branch. (<http://www.uneptie.org/pc/tourism/sust-tourism/soc-global.htm> Access date: 11/6/2005).

UNEP (2002d). 'Negative socio-cultural impacts from tourism'. UNEP Tourism, Production and Consumption branch. (<http://www.uneptie.org/pc/tourism/sust-tourism/soc-drawbacks.htm> Access date: 11/6/2005).

## CHAPTER 10

### TOURISM IN THE CAMERON HIGHLANDS: ISSUES, PROSPECTS AND CHALLENGES

Yee Shan Kon<sup>1</sup> and Chan Ngai Weng<sup>2</sup>

<sup>1</sup>President

Cameron Highlands Tourism Development Association (CHTDA)

C/O Hotel Rosa Pasadena

39100 Brinchang Cameron Highlands, Pahang, Malaysia.

Email: [rosapsch@tm.net.my](mailto:rosapsch@tm.net.my).

<sup>2</sup>Professor

School of Humanities

Universiti Sains Malaysia, 11800 USM Penang, Malaysia

Email: [nwchan@usm.my](mailto:nwchan@usm.my)

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#### 10.1 Introduction

Cameron Highlands has been a popular tourist destination in Malaysia ever since the British colonialists built a resort in the highlands way back in the early 1900s. However, despite the role of government in promoting the highland resort via the Tourism Development Board (TDC) and other government agencies, the role of the private sector has been limited to the offering of tourism products by hoteliers, souvenir vendors, trekking guides, vegetable farmers and others. For as long as one can remember, there has not been a tourist association formed by all stakeholders to promote the products in the area. The Cameron Highlands Tourism Development Association (CHTDA) is a first step towards greater coordination, cooperation and promotion of tourism in Cameron Highlands between all stakeholders.

On September 29, 2003, Pahang Tourism Exco, Dato' Maznah Mazlan while chairing a meeting and dialogue session regarding tourism industries in Cameron Highlands with local tourism service providers (e.g. hoteliers and theme park operators), local association (e.g. Flower and Vegetables Association, Environmentalist Association - REACH) and local Government Authorities (e.g. Town Council -MDCH, District Office and Police Department) came up with the idea of an association. While chairing the meeting, amongst other suggestions, Dato' Maznah strongly proposed that Cameron Highlands need to form a tourism association. Hence, on October 12, 2003; CHTDA held its first pro-temp meeting and Dato' Yee Shan Kon was elected as the pro-temp CHTDA Chairman while Mr. Mazhisham Mazlan was elected as the Secretary. The CHTDA administration office then started operations in the Cameron Highlands Tourist Information Centre in Tanah Rata. In April 20, 2004; CHTDA officially registered with the Registrar of Societies (ROS).

##### 10.1.1 CHTDA Mission and Vision

Amongst CHTDA's mission, vision and aims are the following:

- (i) To Promote Cameron Highlands Tourism Industry
- (ii) To Identify, Discuss and Take Action on issues related to the Local Tourism Industry
- (iii) To Create and Foster Good Relationships with Local Authorities, State and Federal Governments, Media Sector and the Public.
- (iv) To Promote Activities and Events from Time to Time for Social and Public Benefits.
- (v) To Apprehend Current Issues and Give Correct Information to Related Authorities, Media Sector and the Public.
- (vi) To Educate Members and the Public in regard to tourism related issues from Time to Time.

### 10.1.2 CHTDA's Activities in 2004

- (i) January 14, 2004 - Organized Meeting and Dialogue with Perak Immigration Department on matters related to Tourism Industry and Foreign Workers in Cameron Highlands.
- (ii) January 18, 2004 - Letter To Perak State Exco for Infrastructure and Public Facilities on the Importance of the new road from Simpang Pulai to Cameron Highlands and to request its official opening at the earliest possible date. Also to emphasise the need to expedite Road Maintenance and Clearance on the old road from Tapah to Cameron Highlands.
- (iii) April 20, 2004 - CHTDA Memorandum To District Officer, Town Council, Police Department And Water Department - Matter Related To Water Crisis, Public Facilities And Local Issues.
- (iv) June 23, 2004 - Meeting And Dialogue With District Officer, Town Council, Police Department And Water Department - Matter Related To Water Crisis, Public Facilities And Local Issues.
- (v) August 6 to 8, 2004 - Co Organize with Pahang Tourism Action Council – “Food and Fruit Fest 2004 in Cameron Highlands”; CHTDA Organized the Biggest Strawberry Pie (38 inches in diameter). Accredited by Malaysia World Guinness Book Of Record. CHTDA Members opens 28 Promotion And Sales Stall at the fest.
- (vi) August 31, 2004 - Organized Remote Airplane Show for Merdeka Day.

## 10.2 Issues Relating to the Tourism Industry in Cameron Highlands

### 10.2.1 Lack of Promotion

The hotel industry needs to spend more on the promotion of Cameron Highlands in the mass media. Currently, other than the Tourism Malaysia websites and other private websites, there is little promotion of Cameron Highlands as a major tourist destination. Out of the 25 promotional activities listed on the Tourism Malaysia website (<http://tourism.gov.my/> 3/12/04) none is remotely related to Cameron Highlands. Within these 25 promotional activities are water festivals, river festivals, sport fishing, dragon boat racing, food and fruits festivals, and even water painting competitions and underwater paintings exhibition, etc. They even promote several international marathons and sports tourism as big events. However, despite Cameron Highlands being such a well-known destination that is so unique in terms of climate and its natural heritage, there are no promotions. Tourism Malaysia could promote something like “Visit Cameron Highlands Year 2006” or “Visit The Highlands Year 2007”, after all we have besides Cameron Highlands, Genting Highlands, Penang Hill, Mount Kinabalu, Fraser’s Hill, Bukit Larut, etc.

### 10.2.2 Bad and inaccurate reporting

The mass media should not exaggerate the severity of landslides and other environmental problems in Cameron Highlands as this will be detrimental to the tourism industry and the hotels. For example, due to exaggerated press reports on landslides, a recent Star issue reported that there was a 20 % drop in the number of tourists visiting Cameron Highlands and a staggering 70% decline in business – that's the situation in the country's once leading hill resort despite it being the festive and school holiday season (The Star, Thursday November 25, 2004). Cameron Highlands Bumiputra Petty Traders and Entrepreneurs Association vice-chairman Ramiza Mohd Husain said food stall operators reported about 70% drop in business during the festive season compared to last year. This was because tourists are shunning the place following exaggerated reports of landslides and roads being closed on and off to motorists. CHTDA and the hoteliers and other service industries in Cameron Highlands feel that the media and tourists were over-reacting. Cameron Highlands need accurate and responsible reporting from the media and not sensational news that may overplay or exaggerate news of landslides. Small landslips and minor earth movements on hill slopes (which occur commonly everywhere) should not be taken as major landslides. Such minor landslips during heavy rain do not

endanger lives. The current repair works going on should not be seen as major landslides. News of landslides have a detrimental effect as they scare tourists away and all the service industries in the highlands which depend solely on tourists are adversely affected. If the reported landslides were true, Cameron Highlands residents would probably start to move out but this is not the case. Everyone as well as lorries were plying both the Tapah and Simpang Pulai roads every day and there have been no incidents. Tourists travelling to Camerons should also use their common sense and should travel in the morning and afternoon and not the late evenings because it usually rains on most evenings in Cameron Highlands and visibility is poor at night.

### **10.2.3 Lack of Tourism Product to entice tourists to stay for longer durations:**

Currently, the majority of tourists, whether foreign or locals, are basically “short-stay” visitors, i.e. they stay for only 1 or 2 nights. This is especially true for foreign tourists who stop by at Cameron Highlands on their way south (i.e. those coming into Malaysia from Thailand) and those passing by on their way north (i.e. those coming into Malaysia from Singapore or Indonesia). We cannot blame the tourists for not staying longer as Cameron Highlands do not have a wide range of tourism products to offer them like say Penang or Kuala Lumpur, both of which have heritage, food/cuisine, shopping, night attractions (in Cameron Highlands, the only night attraction that we can speak of is the Brinchang night market on weekends), sky-scrappers, theme parks (e.g. Sunway Lagoon), the 3 Ss (Sun, Sea and Sand/Beach), etc. Lack of tourism products is a serious issue that the authorities and planners have to look into. Without tourism products, visitors get bored easily and will not stay for longer periods. The irony is that Cameron Highlands have many yet undeveloped tourism products with great potentials – pristine highland forests, rich biodiversity, rivers, agriculture, food/cuisine, adventure tourism, animal watching, safari, heritage buildings, indigenous cultures, handicrafts etc. But all these must be developed, promoted and packaged in such a way that visitors need to spend at least 3 to 7 days in order to see/enjoy/experience all the attractions. In this way, not only will tourism products be increased but also visitor numbers as well as tourist revenue will correspondingly increase as staying longer means spending more. There is considerable potential to develop trekking, agrotourism, cultural tourism, wildlife photography and birdwatching (Clifton, et al, 2003; see also Chapters 5, 8 and 9 ). Attractive www sites in Europe, Japan, USA would help bring in more tourists.

### **10.2.4 Over-emphasis on Mass Tourism**

It is a well-known fact that most hotels and tourist operators in Cameron Highlands concentrate on increasing occupancy rates, sales, and earning the tourist dollar. Notwithstanding the money-making objective, hotels and tour operators should offer a wider range of tourism products, and especially venture into more exciting areas such as adventure and nature tourism, promotion of local cuisine, exhibition of local indigenous cultures, etc. Hotels and tour operators need to maximize the natural attractions of Cameron Highlands and start focussing on ecotourism. Hotels should promote ecotourism more. Currently, most hotels leave the ecotourism business to private small-time individual operators who neither have the skills nor investments to expand and develop this important sub-sector of the tourism industry (Chan, 2004).

### **10.2.5 Lack of training and qualification amongst tourist guides**

Currently, the majority of tourist guides are not licensed and have no paper qualifications. Many are not even aware of the simple basics of conservation. Often, when taking tourists into the forest, the tourist guide himself/herself would take the opportunity to collect rare plants (e.g. wild orchids or nepenthes) for sale. This is extremely embarrassing in the eyes of foreign tourists who are very environmentally conscious. More significantly, such activities destroy biodiversity and lead to species extinction. Ideally, all tourist guides should be trained and qualified. Hotels should employ only qualified tourist guides.

### **10.2.6 Lack of information for tourists**

In the past, when one enters Tanah Rata town, one will immediately spot the Tourist Information Booth just before the town. However, the booth has been deserted and left unattended for a long time. Currently, there is no information booth or Tourist Information Centre where tourists can get information on products, activities, hotels, attractions, maps, etc. This is one issue that needs to be sorted out as soon as possible. Lack of information can lead to shorter stay in the Cameron Highlands as tourists are not aware of the attractions.

### **10.2.7 Lack of information on the tourism industry in Cameron Highlands for planning purposes**

Currently, Tourism Malaysia and individual researchers (e.g. from the universities and other research institutions) conduct surveys on the tourism industry. However, the data collected is seldom made available for planning or other purposes. Our association can help in such surveys and collaborate with Tourism Malaysia or research institutions in data collection. As long as hotels or tour operators are our members, we can assist in getting information from them. Our association should be able to compile and collect information on tourism, e.g. room occupancy, products, tour rates, number of tourists, tourist feedbacks, prices, food outlets, attractions, etc. Such data is important as basic data is needed for planning purposes.

### **10.2.8 Lack of coordination and collaboration amongst organizations in the tourism industry**

Currently, there appears to be a big gap in terms of collaboration and coordination between the HQ of Tourism Malaysia in Kuala Lumpur, the Pahang State Tourism Malaysia Office, CHTDA, Hotelier Associations, tour operators associations, tourist guides, and other related government departments. Each of these seem to be operating independently. Ideally, all those involved in the tourism business in Cameron Highlands must come together and collaborate, cooperate and support one another. For example, government departments can work with NGOs and other bodies to promote and manage tourism sustainably. More importantly, these organizations should not be in disagreement or in dispute with one another. Problems will arise from time to time, and it is to everyone's advantage that these problems be solved together. There should be minimal, if not any finger pointing when problems arise. Various sectors, especially farming, tourism and conservation, have the potential to support each other to reduce environmental impacts, improve livelihoods and move toward sustainable development (see Chapter 6). Failure to do this will probably mean environmental degradation damaging the various sectors. The way forward is likely to be through careful coordination and an integrated approach. It might be a good idea for the Federal Government to establish an integrated regional sustainable development authority for Malaysian Highlands with sufficient resources and powers to adequately promote integrated highland development, better environmental management and sustainable development. Such an authority could have its headquarters in Cameron Highlands.

### **10.2.9 Environmental Degradation**

It cannot be denied that Cameron Highlands has undergone tremendous change over the last half-century or so. Pristine forests have been changed to farms, towns, highways and roads, housing areas, etc. There is no doubt that there is some degree of environmental degradation and such degradation of the environment will eventually affect the tourism business (Chan et al, 2003). For example, some people claim that Cameron Highlands is not as cold as before. If this is true, then people will stay away. However, people must realise that global warming is across the board – lowlands have also warmed, so it is not just Cameron Highlands. Opening of land for farming and other developments have also lead to soil erosion and landslides. This is a major problem that needs to be controlled, as discussed above; landslides frighten tourists who will stay away. We need to control environmental degradation. There must be greater efforts from all stakeholders in environmental conservation and this is where our association can also play a role. The Cameron Highlands offers opportunities as a

test-bed for the perfection of sustainable development approaches and strategies that could also be valuable in other highlands of Malaysia and elsewhere in the tropics. Manageable size and good infrastructure, including research stations – perhaps worth setting up an applied research institute?

In the Cameron Highlands there is already a mosaic of disturbance and settlement so conservation will have to rely on co-operation with land users and non-governmental organisations such as CHTDA, REACH, WWF Malaysia, MNS, etc (as in UK/European areas like the New Forest or Exmoor). Disturbance has led to streams flowing to lowlands suffering erratic discharge, higher peak flows, and reduced volume in dry periods (see Chapter 2). They are also contaminated with silt, sewage from highland settlement, agrochemicals, and nutrients leached from farms (see Chapters 6 and 7). The impacts of highland agriculture affects the health and livelihood of large numbers of highlanders as well as lowlanders. In this respect, would they be willing to pay a tax to combat the problem?

#### 10.2.10 Imposing A Visitation Fee for Cameron Highlands

In many countries, a visitation fee is charged for tourists visiting an area or an attraction (Clifton, 2004). For example, visitors visiting a mountain peak can be charged a fee, as they need to pass through a toll gate (via the only access road). In the case of Cameron Highlands, this is a possibility. Whether one is coming to Cameron Highlands via the old Tapah Road (from Tapah) or from the new Simpang Pulai Highway (from Ipoh), or in the future from the new roads to Gua Musang (from Kelantan) and Kuala Lipis (from Pahang), each car (based on the number of visitor) can be charged a fee. The fees collected can then be invested in improving infrastructure, tourist attractions, conservation, environmental management, maintenance of indigenous cultures, and local livelihood generation. Charges could be varied according to the origin and affluence of the visitors and the activities they pursue. Foreign tourists should be charged double, since this is the usual practice in many countries. For example, in Cambodia, one authority charged US\$20 to US\$60 a day to overseas tourists to visit archaeology sites, whereas locals are charged a much smaller amount.

#### 10.2.11 Greater role for the Orang Asli in the tourism industry

The *Orang Asli* in the Cameron Highlands could be more involved in tourism developments, especially in the services sector. Currently, many are employed as caddies in the Golf Course. However, it is likely that they can contribute effectively in other areas. Presently, they have limited involvement with commercial agriculture, which seems unlikely to change much; however, there is scope for them to be more active in the tourism sector, especially as trekking/ecotourism guides since they know the forest very well (Lim et al., 2004; see also Chapters 5, 8 and 9).

### 10.3 Conclusions

There is no doubt that Cameron Highlands remains one of the major tourist destinations in the country. However, we must not rest on our laurels because if we do, the tourism industry may not develop or find its full potentials. The challenge is to develop co-operation and proactive *integrated* development to prompt organisations and businesses in different sectors to work for sustainable tourism development. In the short-term individual hotels could benefit from training trekking and nature tourism guides, but co-ordinating all guides and serving all hotels would enable integration, economies of scale, provision of effective first aid – leading to longer term benefits. Hotels in highland resorts generally rely on their town commune or regional authorities to manage such things. The various sectors and sustainable development efforts should seek to be diversified and adaptable.

Elsewhere in the country, states such as Sarawak, Sabah and Pahang have invested heavily in ecotourism and reaping huge benefits from it. Other countries marketing ecotourism successfully are Ecuador (The Galapagos Islands), Tanzania, Belize, Rwanda, Costa Rica, Cuba, and the Yucatan (Mexico), and these and others appear to be profiting. Some of these depend upon it for much of their conservation funding and as a major foreign exchange earner. There are, however, some problems: for

example, the Galapagos Islands are currently having an ongoing battle between the fishing and ecotourism sectors. This has severely affected visitor numbers and conservation efforts.

Cameron Highlands has extremely rich biodiversity and natural treasures not found in the lowlands (see Chapter 1). Hence, it is natural that we should focus on the development of ecotourism given the fact that most foreign tourists are environmentally conscious and have never seen a rainforest before (Chan, 2003). Ecotourism can be 'passive' with people essentially just looking (and paying to manage the environment), or it can be 'active', with visitors paying and participating in agriculture, environmental management, conservation work, archaeology, and so on. Ecotourism should be a symbiotic relationship, whereby an environment or culture attracts tourists, and they pay a significant amount for maintaining it. Worldwide there is a growing interest in trekking and nature tourism (i.e. viewing wildlife and scenery), and the Cameron Highlands offers some of the most spectacular, accessible and safest 'exotic' trails in the world. Currently, Cameron Highlands trekking is relatively poorly regulated and there has been little investment in developing or marketing it in Southeast Asia or further afield. Many tourists surveyed by researchers commented on the need for improvements. There is scope to involve the Orang Asli who have a wealth of traditional knowledge and to train all guides in natural history, etc (Barrow et al, 2003).

It may be possible to interest visitors in the sponsorship of wildlife – paying for environmental management activities (this might even be partly by website, without the need to visit). For example, for a fee a tropical forest tree or seedling could be dedicated to a loved one, perhaps as a memorial or to celebrate an event like the birth of a child or an anniversary, or as a sign an individual or a company supports nature. Initially some famous people could be induced to establish a fashion for this.

Currently much of the tourism in the Cameron Highlands is by short-stay (Photograph 10.1), relatively low-spend visitors - there is a need to reduce environmental impacts, encourage sustainability and increase profits. The way forward could be longer-stay, higher-spend ecotourists. Can this be encouraged? In the Cameron Highlands crops like tea already provide a tourist attraction and contribute to the Cameron Highland resort 'image'. In Sri Lanka old estate buildings have been converted to high-spend tourism hotels with nature trails and guides – providing attractions to extended stays. Furthermore, cycle and mountain bike tracks could be established in less-sensitive areas with controls placed on these activities elsewhere. Off-road use of motorcycles and 4-wheel-drive vehicles should be strictly controlled. The televised "Tour de Langkawi" cycle race has a stage from Tapah to Cameron Highlands (the so-called "Mountain Climbing Stage") and this has already given the highlands much international publicity. All these means more activities and longer stay. Presently many attractions are roadside facilities – while these satisfy passing car and coach tourists for an hour or so, the problem is to hold visitors in the highlands for a week or more. To do that there would need to be a number of different trekking trails and other attractions, which a central authority could monitor to ensure people do not damage any by over-use. The authority could also help hoteliers and tourism agencies compile an itinerary to hold visitors a week or more and to adapt to unfavourable weather.

However, tourism development must have limits to growth. There is a risk a building boom will start again; some recent developments have been located in forested areas and on high ground where it is visually intrusive. Ideally building should be restricted to already deforested areas and lower slopes, finishes should be neutral colours to minimise aesthetic impact, and sewerage installations ought to be reliable to reduce the chance of overflows to streams. There is also the need to consider water demands as excessive demands during peak seasons, amongst other reasons, have resulted in water cuts. With improved road access there will be more vehicles running at quite high altitude, so it would be wise to monitor traffic emissions to assess whether there is any threat to the flora, fauna and people of the Cameron Highlands.



Photo 10.1: From Left: Activities such as visits to tea estates, bee farms and strawberry farms are currently the main attractions in Cameron Highlands but other activities such as wildlife watching, night safari, organised camping and trekking, agrotourism, health tourism etc can hold tourists for longer stays.

### Bibliografi

Barrow, C.J., Chan, N.W., Clifton, J., Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Effects of Environmental Degradation on Orang Asli Livelihoods: a Case Study in the Cameron Highlands. In Wan Ruslan Ismail, Narimah Samat, Aziz Abdul Majid, Moha Asri Abdullah and Anisah Abdullah (Editors) *Society, Space & Environment in a Globalised World: Challenges and Prospects*. Penang: Geography Section Universiti Sains Malaysia and National Geographical Association of Malaysia, 437-448.

Chan, N.W. (2000) Ecotourism best option for Camerons. *New Straits Times*, 19 January 2000.

Chan, N.W. (2003) Ecotourism in Cameron Highlands: The Best Option for Development? Paper presented at the International Conference "Asia Pacific Ecotourism Conference", 22-25 October 2003, Langkawi. Organised jointly by MATTA Kedah Chapter and Langkawi Development Authority (LADA).

Chan, N.W. (Editor) (2004) *Ecotourism: Issues and Challenges*. Penang: School of Humanities, Universiti Sains Malaysia.

Chan, N.W., Clifton, J., Barrow, C., Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Developmet Issues and Prospects in Cameron Highlands. In Wan Ruslan Ismail, Narimah Samat, Aziz Abdul Majid, Moha Asri Abdullah and Anisah Abdullah (Editors) *Society, Space & Environment in a Globalised World: Challenges and Prospects*. Penang: Geography Section Universiti Sains Malaysia and National Geographical Association of Malaysia, 240-251.

Clifton, J. (2004) Ecotourism: Theory, Reality and Challenges. In Chan, N.W. (Editor) *Ecotourism: Issues and Challenges*. Penang: School of Humanities, Universiti Sains Malaysia, 1-10..

Clifton, J., Barrow, C., Chan, N.W., Chang, W.F., Wong, C.F. and Ting, P.L. (2003) Ecotourism in the Cameron Highlands: Issues and Challenges. In Wan Ruslan Ismail, Narimah Samat, Aziz Abdul majid, Moha Asri Abdullah and Anisah Abdullah (Editors) *Society, Space & Environment in a Globalised World: Challenges and Prospects*. Penang: Geography Section Universiti Sains Malaysia and National Geographical Association of Malaysia, 383-392.

<http://tourism.gov.my/> 3/12/04

Lim, H.F., Woon, W.C. and Mohd Parid Mamat (2004) The Orang Asli and Ecotourism Development in Cameron Highlands. Paper presented at the national seminar "*Sustainable Development of Cameron Highlands: Issues & Challenges*", 11-12 December 2004, Brinchang, Cameron Highlands.

*The Star*, Various Issues.

## CHAPTER 11

### THE ROLE OF REACH IN ENVIRONMENTAL CONSERVATION - AWARENESS, EDUCATION & MONITORING

Rev Dr Vijendra Daniel  
Regional Environmental Awareness Cameron Highlands (REACH)  
No 1, Jalan Besar Brinchang, 39100 Cameron Highlands, Pahang, Malaysia.  
Email: reach@reach.org.my

#### 11.1 Introduction

Regional Environmental Awareness Cameron Highlands (REACH) is a community-based organisation established in 2001 for the preservation, restoration and maintenance of Cameron Highlands as an environmentally sustainable agriculture and hill resort within a permanent nature reserve, which is based in the longest mountain range in Peninsular Malaysia.

On the evening of 30<sup>th</sup> October 2000, a group of Cameron Highlands residents gathered at a local hotel to voice their concerns regarding:

- The quality and regularity of their piped water
- Destruction of the hills and forest leading to soil erosion, landslide, river pollution, loss of life from landslides and economic losses.
- Indiscriminate dumping of waste along roads, rivers and ravines.
- The state of the dumpsite, which has reached its capacity and was a breeding ground for pests.

#### 11.2 Chronology of Environmental Degradation in Cameron Highlands

Historically, there have been numerous incidents of environmental degradation in the Cameron Highlands. This has also been highlighted periodically by the press. Statistics have shown that: -

- From 1947 to 1977, the forest cover over the upper water catchments of the 3 main rivers in the district, namely Sg. Plau, Sg. Telom, and Sg. Bertam has dwindled from 95% to 65%. This amounts to a loss of 10,599 hectares, the size of about 84,792 Olympic sized swimming pools. (*Data by TNB Research – the research arm of the National Power Company*)
- The sedimentation rate at the Ringlelet Dam has worsened from 154 million m<sup>3</sup> in 1984 to 434 million m<sup>3</sup> in 1999, which is a dramatic 3 fold increase.
- Average rainfall over the upper catchment area of the Telom River has dropped by 2.4mm annually from the 1960s to 1999. (*Data from TNB Research*)
- Out of the 121 rivers in Cameron Highlands, only 12 are classified as Class I and II – which can be used for human consumption. (*Data from DOE*)
- In 16 short years, the mean temperature has increased by 0.6 °C, annually since 1979. (*Data from Malaysian Meteorological Service*).

### 11.3 The Birth of REACH

Out of these bleak environmental landscape, REACH (logo shown in Figure 11.1) was born under the guidance of Malaysian Nature Society (MNS) and more so by World Wide-Fund for Nature (WWF-Malaysia)

**R** egional

**E** nvironmental

**A** wareness

**C** ameron

**H** ighlands



Figure 11.1: REACH's logo.

#### 11.3.1 REACH Aims and Objectives

The aim of REACH is:

The preservation, restoration and maintenance of the Cameron Highlands as an environmentally sustainable agriculture and hill resort within a permanent nature reserve.

The objectives of REACH are:

- To maintain a balance between environmental protection and development and to safeguard water catchment areas as a vital resource both for supply to the highlands and the lowlands as well as for hydroelectric power.
- To promote and support projects, including raising funds, in pursuit of the aims and objectives of the Society, with the prior approval of the authority concern.

REACH is registered as a Community Based Organization (CBO) – made up of an eclectic collection of residents, many of whom have little or no knowledge of environmental matters, but share these deep concerns, sheer enthusiasm and the spirit of volunteerism.

#### 11.3.2 REACH Activities

REACH as a community based organization (CBO) run by ordinary residents of the community many with little or no experience in environmental work but plenty of enthusiasm and volunteerism set-out to create awareness in environmental problems in the highlands amongst the local community.

To date REACH has in its 3 years of existence organized the following activities:-

##### (i) Environmental Monitoring and Surveillance

Using man-power from its members and assistance from other groups, all with the aim of conservation of the environment of Cameron Highlands, REACH has managed to carry out many activities towards this end. As a community based organization (CBO) run by ordinary residents, REACH members started the hard way by learning about their environment. It is largely due to their commitment, enthusiasm, volunteerism and perseverance that REACH has become the main surveillance group as well as the major environmental organization in Cameron Highlands.

- ❑ Illegal land clearing and hill-cutting
- ❑ Clearing of land with heavy machinery
- ❑ Landslides and its consequences
- ❑ Building of dams over rivers without expert advice
- ❑ Indiscriminate tapping of water
- ❑ Indiscriminate dumping of waste
- ❑ Illegal collection of plants and intrusion into forests reserves
- ❑ Introduction of non-indigenous species to the forests

### **(ii) Data Collection and Documentation**

In order to understand our environment better and to be able to convince the authorities as well as the public on the importance of environmental conservation, data is needed. Data also need to be documented in a systematic manner for scientific assessment and public consumption. REACH has conducted many expeditions into the forest in Cameron Highlands. Data collection and plant identification was done in conjunction with the environmental monitoring and nature walks. From the research and data collection activities, the following were documented:

- ❑ Orchids – 600 species and variants documented
- ❑ Ferns – about 150 species
- ❑ Birds – 250 species

### **(iii) Environmental Education Activities**

REACH's environmental education activities are targeted towards the public, including farmers, tourists, school children and the general public. Among our activities are the following:

- ❑ Educational Talks
- ❑ Nature Walk with explanation of ecology concepts
- ❑ Insect Talk with emphasis on the role of insects in the ecological system
- ❑ Fern Identification – talks and practical aspects of fern identification
- ❑ Workshop on Botanical Illustration

### **(iv) Exhibitions**

Exhibitions carried out by REACH are mostly based on topics like :

- ❑ Beauty of the Highlands
- ❑ Indiscriminate land-clearing and its consequences.
- ❑ Water problems in the highlands.

- Indiscriminate dumping of waste

### (v) Reforestation

In recent years there have been widespread deforestation due to farming, housing, highway construction and other human activities in Cameron Highlands. As such, in order to conserve the environment, one of the activities is to reforest the cleared areas. Reforestation is one of our core activities which involve active participation of the community. This project was initiated by R.E.A.C.H. in partnership with the Department of Forestry. The project site had been illegally cleared by a local farmer for agriculture activities and was highlighted to the authorities by R.E.A.C.H. in 2001. The farmer was compounded RM500 by the district Office and later charged in court. The Magistrate Court handed him a penalty of RM4,000, which was later increased to RM10,000 by the High Court. Despite these actions, to date, the farmer is still actively cultivating the land much to the dismay of R.E.A.C.H.

The site is located in the Main Range of Peninsular Malaysia with its main forest cover being montane forest. It not only houses diverse biodiversity of flora and fauna but also forms part of the water catchment area for the Sungai Burung drinking water treatment plant. The Sungai Burung water treatment plant supplies drinking water to the population of Brinchang and its surrounding area. Thus, such clearing has an adverse effect not only on the flora and fauna but also to the drinking water quality in Cameron Highlands. To prevent further irreversible damage to the area, a smart partnership was formed between the Forestry Department, R.E.A.C.H. and the community to reforest the cleared land.

The cleared area approximately 15 acres (6 ha) near Gunung Brinchang, which is part of the Ulu Bertam Forest Reserve and Stateland forest, was identified for this pilot reforestation project.

Two different methods are used for the replanting process.

#### Process 1 – Conventional Method (Indirect Planting)

- (a) Collection of soil    (b) Collection of seedlings    (c) Nurturing of seedlings at nursery
- (d) Replanting at site    (e) Monitoring

#### Process 2 – Direct Planting

The process is based on the natural healing which was observed at the deforested site. It was noted that the pioneer plants at the site was grass of the pandanus spp. When this grass withers, mosses, ferns and soft-wood shrubs were found to thrive on this organic base. The replanting process is as follow:

- (a) Holes were dug and lined with organic base.
- (b) Gathering of seedlings from the vicinity
- (c) Replanting.

Under REACH's reforestation program we depend on four areas, viz. manpower, expertise, cash and kinds (funding) and logistics. (Figure 11.2).

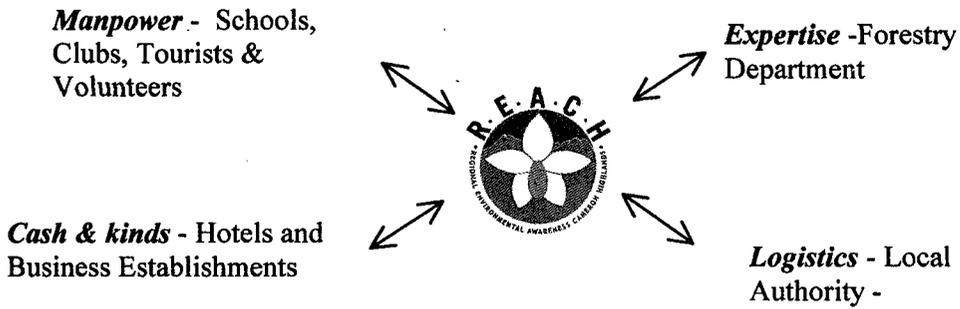


Figure 11.2: The four pillars of reforestation comprising manpower, expertise, cash and kinds (funding) and logistics.

**(vi) Recycling**

According to reports, Cameron Highlands generates about 30 tonnes of solid waste daily. REACH realizes that this is another area where community participation will generate better awareness of our solid waste problem.

The recycling efforts carried out by REACH involves various stages :

- (a) Awareness
- (b) Practical Demonstrations
- (c) Motivation- Incentives in terms of health and economic
- (d) Collection Centers and its maintenance
- (e) Logistics – Transporting the Recyclables
- (f) Compactor site

Under REACH's recycling programme, communities, vendors, tourists and local authorities are the target groups (Figure 11.3).



Figure 11.3: Communities, vendors, tourists and local authorities are the target groups for recycling.

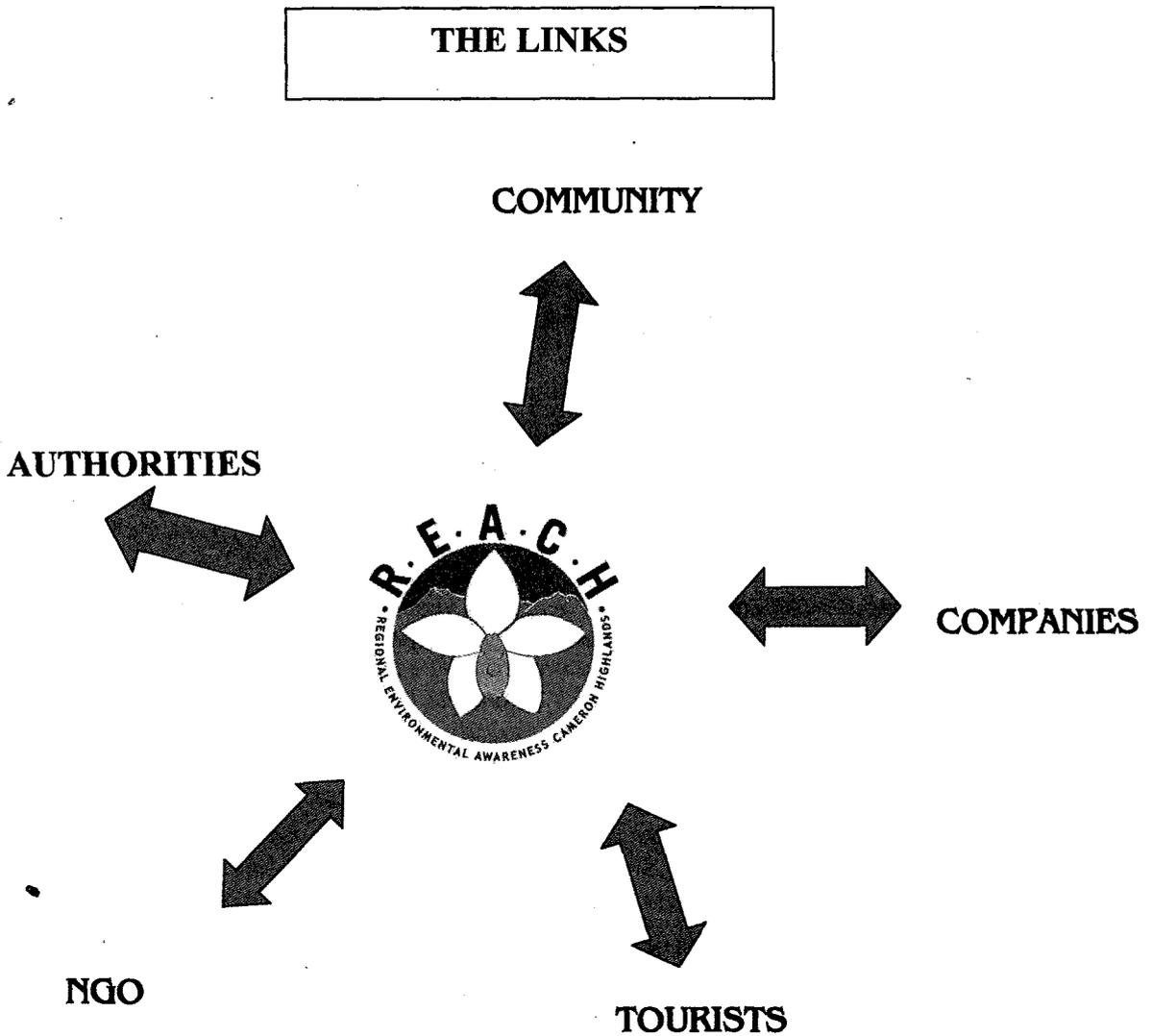


Figure 11.4: The links between community, authorities, companies, tourists and NGOs in Cameron Highlands are found in REACH.

## 11.4 Links with Target Groups

### 11.4.1 Community

Members of the community approach REACH on problems like illegal land clearing, indiscriminate dumping, water problems, fears on the pending incinerator site. People have even approach REACH to seek advice on whether certain plants like orchid and pitcher plants can be collected from the forests.

The schools, some hotels and apartment residents' associations are actively involved actively in recycling activities.

### 11.4.2 Authorities

District Office and the Local Council are in the process of identifying and handing over a suitable compactor site for REACH's recycling activities.

Local Council has handed over the Recycling Collection Centers in Brinchang from the Local Council with the help of the community.

Forestry Department and REACH have been working closely on the reforestation programme. REACH has highlighted a few cases of illegal entry and destruction of forest reserve to the Forestry Department.

Department of Environment (DOE) on the surveillance of illegal land clearing, river pollution and promotion of environmental awareness in the community.

Water Department. – on the quality of water and the tapping of water in catchment areas.

Department of Agriculture – on the recycling of pesticide bottles.

#### 11.4.3 NGO's

WWF-Malaysia – undertaken many projects together, technical advice and co-operation

MNS, TREES, WI – technical advice and exchange of information

#### 11.4.4 Private Sector/Companies

Hotels – Providing support in activities conducted – recycling, reforestation

TNB – to work on the rehabilitation of the Ringlet Dam

Recycling Vendors – to provide logistics to send the collection to the lowland

### 11.5 Conclusions

Regional Environmental Awareness Cameron Highlands (REACH). is a prime example of how people, the public and local communities can make a difference in environmental conservation. Despite being a small organization, REACH has “reached” out to a wide spectrum of stakeholders. Most importantly, government, private sector, farmers and the public have taken notice of the importance of conservation in Cameron Highlands. REACH has bridged the gap between government, private sector and NGOs. REACH will continue to work with all stakeholders towards the preservation, restoration and maintenance of Cameron Highlands as an environmentally sustainable agriculture and hill resort within a permanent nature reserve, which is based in the longest mountain range in Peninsular Malaysia.

### Bibliography

Daniel, V. (2004) The Role of REACH in Environmental Conservation, Awareness, Education and Monitoring. Paper presented at the national seminar “Sustainable Development of Cameron Highlands: Issues & Challenges”, 11-12 December 2004, Brinchang, Cameron Highlands.

<http://www.reach.org.my/>

## CHAPTER 12

# BIOENGINEERING EROSION CONTROL TECHNIQUES FOR SUSTAINABLE CONSTRUCTION IN CAMERON HIGHLANDS

Leong Kwok Wing<sup>1</sup> and Chan Ngai Weng<sup>2</sup>

<sup>1</sup>CHT-Natural Solutions Sdn Bhd

45 Jalan TPJ#7, Taman Perindustrian Jaya

47200 Petaling Jaya, Selangor, Malaysia

<sup>2</sup>School of Humanities

Universiti Sains Malaysia, 11800 USM Penang, Malaysia

Email: [k\\_wingleong@yahoo.com](mailto:k_wingleong@yahoo.com)

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### Abstract

*Cameron Highlands, a tropical place of natural beauty, climate and eco-diversity has been attracting healthy investment in the ecotourism industry, agriculture and increasing property development and with these increases, sizeable traffic flow.*

*To cater for these increases in traffic flow, the federal government has undertaken to build new roadways and widen existing roads for increased traffic handling capacity and public safety.*

*Roadway construction, property and over aggressive agro-commercial developments has collectively contributed over the years to massive soil depletion of the highlands and organic migration resulting in silting-up of lakes, clogging-up of drainage channels and basins, health and safety concerns in e-coli outbreaks, downstream floods causing utility loss of roadways, and loss of life and property.*

*Soil erosion is difficult to control in the tropics due to the complexity in climatic and geologic conditions. The problem is further exacerbated with high rainfall and hilly terrain in Cameron Highlands. The soil is composed of highly erodible residual soil and weathered rock. Typical construction practices calls for steep "cuts and fill" embankments, striping of localize vegetation-shrubs and heavy earth movements with total disregards to the rainy season.*

*This chapter presents technologies developed in northern America and Europe with the application of bioengineering to heal scarped slopes for sustainable development in tropical environment. Slope rehabilitation and re-vegetation cases will be presented with "before and after" photos of various locations in Cameron Highlands exemplifying sustainable construction and re-vegetation with indigenous species.*

*A brief description on bioengineering techniques with the use of erosion control and permanent turf reinforcement mattresses with soil nailing and "when to apply what" to effectively control erosion at source to reduce downstream sedimentation.*

**Key words:** Soil migration, erosion and sediment control, sustainable slope rehabilitation and vegetation, bioengineering, erosion control and permanent turf reinforcement mattress.

## 12.1 Introduction on the authors

Leong Kwok Wing is a California registered professional civil engineer (1981) with special focus on Best Management Practices (BMP) in design, analysis and development of civil and geotechnical projects. Obtained BSC in Civil Engineering(1979) from California State University Sacramento, worked for over 15 years in State of California Department of Transportation and Department of Parks and Recreation with experience in design, development and construction supervision, of highway, geotechnical foundation, water and sewerage systems, park systems and trails, storm water management, river channel and shoreline protection.

Since 1992, responsible for the marketing, design and construction in Asia of Alcoa-Presto's Geoweb Cellular Confinement System for slope protection, geotechnical soft soil heavy load design, "green" retaining walls, river embankments and shoreline protection systems.

Since 2000, manufactured erosion control mattress with American-European technology with re-use of palm oil fibre and coconut coir in Malaysia.

Member of IECA (USA) since 1993 and vice president of IECA(Malaysia) 2003-5. Lectured and taught BMPs for erosion and sediment control methods and storm management to Department of Environment senior officers at EiMAS (July 2004), Department of Drainage and Irrigation senior officers and engineers for IECAM-JPS (Pahang) at Bukit Tinggi (August 2004) and IECAM-JPS(Federal) at Port Dickson (October 2004).

Certified Professional Erosion and Sediment Control (CPESC 2001) and a Certified Professional Storm Water Quality (CPSWQ 2003) specialist USA.

Chan Ngai Weng is professor of physical geography at the School of Humanities, Universiti Sains Malaysia in Penang, Malaysia. Chan obtained his B.A.(Hons) in Geography and M.A.in Climatology and Meteorology from the University of Malaya in 1977 and 1981 respectively. In 1995, he obtained his PhD in Environmental Hazards Management from Middlesex University in the United Kingdom. He has served in Universiti Sains Malaysia since 1985. Chan is very much involved in academic research on environmental hazards as well as within the NGO community.

## 12.2 Introduction on Development and Environmental Hazards

In a rapidly modernizing world, especially in the developing countries, development is inevitable if not desirable. In fact, in much of the developing world, countries are trying hard to keep up with the developed world. Hence, in such a scenario, development is absolutely necessary for the progress of nations as well as for human society. Hence, throughout the world we have experienced industrial development, commercial development, agricultural development, infrastructural development and other developments. Many developing countries are chasing development feverishly but at what price? Without proper planning and the use of suitable environmentally friendly technology in all these sectors of development, many developing countries, including Malaysia, face enormous environmental problems. In the area of infrastructure development, notably construction of highways and roads into the interior, environmentally sensitive areas such as protected forests, water catchments and wildlife sanctuaries are negatively impacted upon (Chan, 2002; Chan, 2004).

In many highway construction projects in Malaysia, a combination of steep-cut slopes, poor soil characteristics, high intensity rainfall, poor or lack of drainage and poor protection techniques for slope protection have led to disasters such as massive soil erosion, landslides and downstream sedimentation and flooding (Chan and Wan Ruslan Ismail, 1997). Massive land use change, whether it is forest clearance

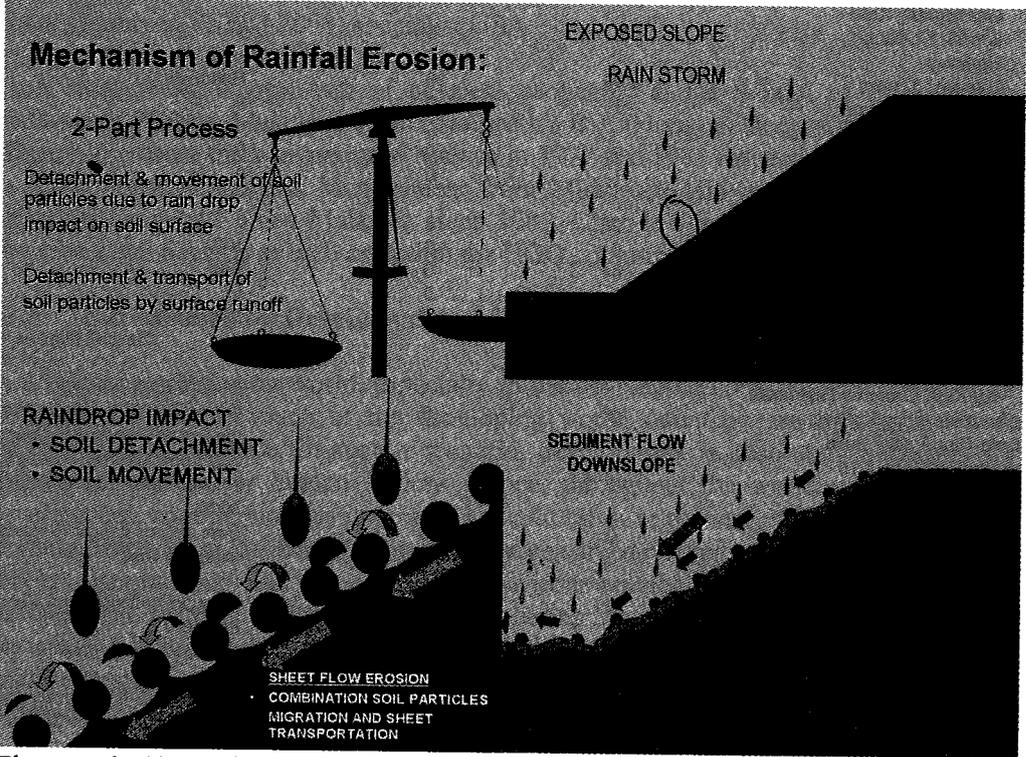
for highway construction, dam building, logging, farming, housing or other environmentally unsustainable development can significantly disturb natural systems. Amongst the negative effects, research has revealed that significant water yield increases occur after deforestation (Abdul Rahim, 1988; Abdul Rahim, 1990; Abdul Rahim and Harding, 1992), and that commercial logging resulted in significant increases in storm flow volume and initial discharge (Drainage and Irrigation Department, Malaysia, 1983). Such increases result in corresponding increases in soil erosion and the potential of landslide occurrence (Chan, 1998). Another serious environmental hazard arising out of uncontrolled forest clearance is the occurrence of accelerated soil erosion and landslides. Landslide hazards and disasters occur not only because humans choose to live in highlands and dangerous slopes (that offer good scenery and cool climate) but also because humans fail to provide appropriate protection to the areas they occupy. Hence very often, mismanagement of development and inadequate protection of slopes which are deforested give rise to imbalances in natural systems, of which the capacity of the natural system cannot cope with or adapt to. Increased in landslide characteristics (such as frequency, magnitude and extent) in many parts of Malaysia in recent years (Table 12.1) are directly related to the inability of disturbed natural systems to cope with sudden changes inadvertently induced or deliberately carried out by humans. For example, clearing dense natural tropical forests without replacing them, or replacing them with sparse agricultural crops increases the erosivity of rain splash erosion and runoff erosion. Chapter 7 documents the high rates of soil erosion in Cameron Highlands.

Table 12.1: Major Landslides in Malaysia

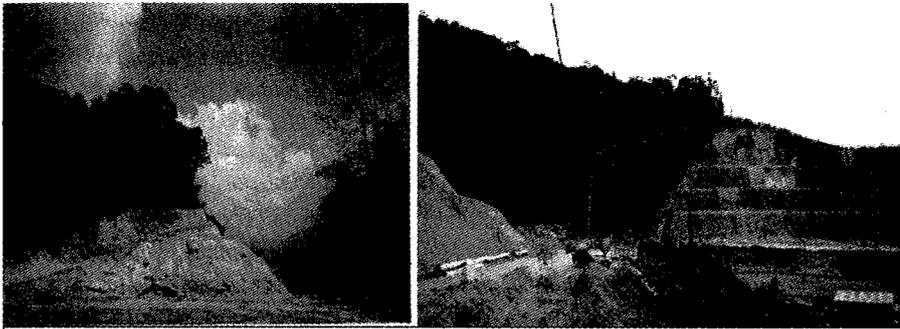
Date	Location	Number of Casualties	Number Injured	Number Evacuated and Damage
24.10.93	Km 58, Kuala Lipis-Gua Musang Road	1	15	0
28.11.93	Km 63, KL-Karak Highway	2	0	0
11.12.93	Highland Towers	48	0	Hundreds
24.10.95	Tringkap, Cameron Highlands	1	0	0
December 95	Cameron Highlands	7	0	0
06.01.96	North-South Highway near Gua Tempurung	1	0	0
09.10.96	Kuala Terla	3	2	0
October 96	Hye Keat Estate	0	0	100
29.08.96	Pos Dipang	44	0	tens
18.10.96	Gelang Patah, Johor	1	0	6
11.05.97	Pantai Dalam, KL	1	4	19 families
6.1.2000	2 Major mudslides: in Tringkap and farms Kg Raja, Cameron Highlands	6	1	Several families > 10 damage RM12 million.
10.1.2000	1 Major landslide along Kg Raja - Kuala Terla-Blue Valley Road at the 81.6 km point (about 10 metres of road collapsed)	0	0	Cut off 15,000 residents from the rest of Cameron Highlands. 500 farms affected, reducing vegetable and flower output by 30 %.
27.3.2000	1 Rockfall, Lorong Bukit Kukus, Grandview Height Block 16, Paya Terubong, Penang	0	0	Pose serious danger to residents using the road.
1.4.2000	1 landslip, Taman Salak Selatan, Kuala Lumpur	0	0	2 houses collapsed and 3 houses damaged.
26.4.2000	1 landslip at Kuala Langat Mining Company, Kuala Langat	2	0	Collapsed mine - NA.
7.5.2000	1 landslide at Bukit Berapit, Kuala Kangsar	1	0	Butterworth-KL train service cancelled (afternoon service); 1 van destroyed.

(Source: Major newspapers)

Landslides are complicated. There are many causes of landslides, depending on the climate, soils, location, land use, protection techniques, etc. In general, cleared areas that are not immediately replaced by concrete or other surfaces but left for considerable long periods before projects are finished are the most vulnerable. For example, Chan (1998) has shown that the average duration of a housing project may take between a year to a few years. Thus, this leaves the cleared surface exposed to the elements of nature. In Malaysia, the natural elements, particularly the weather elements are highly erosive. Geomorphological processes such as rain splash erosion and surface runoff erosion have been shown to be extremely high in wet equatorial areas. Given the high intensity of our rainfall within short durations, the erosivity of rain and runoff are main causes for loosening the soil (Photograph 12.1), weakening slopes and ultimately leading to mass movements of solid and semi-solid materials such as soil creep, landslips and landslides (Photograph 12.2). There are many ways in which such mass movements can occur, depending on the material of the slope (Brunsden and Prior, 1984). Landslides occur on bedding or cleavage planes, rock strata or fault fractures with slopes dipping downwards. The lack of support at the base of slopes, as for example on the sides of undercut slopes and cliffs, especially when heavy materials lie on top of weak and easily lubricated materials is a common condition leading to landslides. Usually, the steeper the slope angle the easier a landslide can occur. Slumping is also a form of mass movement of materials downslope. It occurs on curved shear planes of uniform materials, often leaving arcuate scars on the defaced slope or hillside (Photograph 12.3). Slumping often leads to earthflows (or mudflows in the event of slopes being made up of clayey material). In slumping, the clayey materials are over-saturated with water and so become dilated. Any subsequent "trigger" mechanisms such as a torrential downpour, rock blasting by quarrying operators or earth tremor can lead to movement. The water absorbed cannot be liberated or escape quickly because of the clayey material and its low permeability. Consequently, the sodden material is pulled by gravity downslope. Many landslips and landslides in Malaysia are of this type of movement.

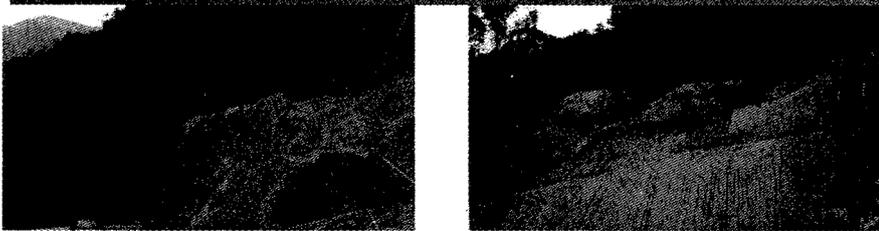


Photograph 12.1: The mechanism of rainfall erosion leading to soil detachment and sediment flow downstream.



**SOIL EROSION:**

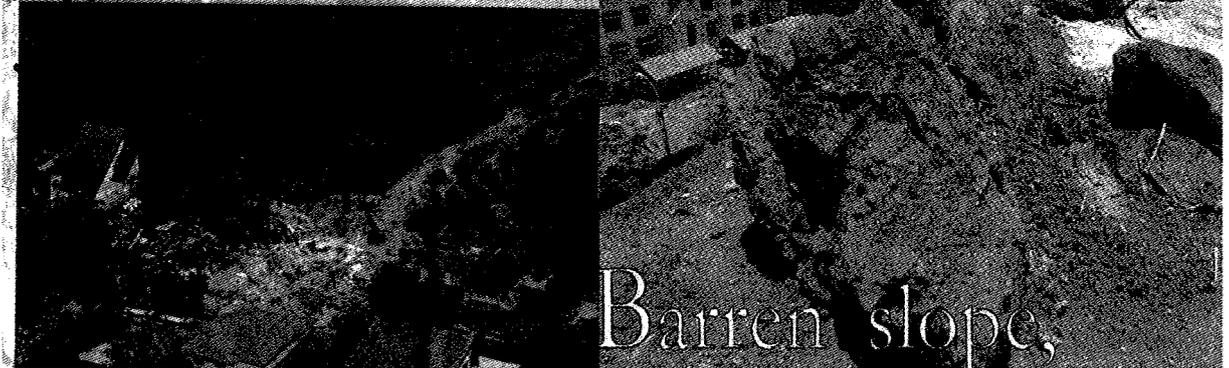
The process in which soil particles are **DISPLACED & TRANSPORTED** away by action of **WIND, RAIN, WATER, NATURAL DISASTER & MAN**



Photograph 12.2: Examples of exposed slopes/surfaces to soil erosion.

■ **House destroyed:** Bank chief survives, six family members killed

**Eight die in landslide**



Photograph 12.3: Examples of recent landslides in Malaysia.

In Malaysia, a country experiencing a wet equatorial climatic regime, many studies have shown that the rate of soil loss is alarmingly high in steep and hilly areas (Daniel and Kulasingam, 1974; Chan and Wan Ruslan Ismail, 1997; Main Rindam, 1997). This is because of the high erosivity of the high intensity rainfall as well as the steep slopes (Jackson, 1977). Based on the Universal Soil Loss Equation (USLE), the present study found that exposed hill slopes (in the Penang Hill area) with an average slope of 30 degrees can give rise to a 50-fold increase in surface runoff and a soil loss of between 700 to more than 10,000 tonnes/ha/year. The Department of Environment Malaysia classifies soil erosion rates as follows: (1) low erosion - < 80 tonnes/ha/year; (2) severe erosion - 80 to 150 tonnes/ha/year; and (3) very severe erosion - > 150 tonnes/ha/year. Based on the above classification, it can be seen that the potential soil loss in hill slopes in Malaysia can be extremely high. Even though the above soil loss calculations is based on a worse case scenario (i.e. assuming all vegetation are cleared), it cannot be denied that many hill slopes in urban areas

under land pressure (e.g. Penang, Kuala Lumpur and other major cities), have less than 50 % of the original vegetation left. As such, the soil loss of at least 350 tonnes/ha/year is still at least twice above the very severe category. For example, in the Paya Terubong area in Penang, it is estimated that about 30 % of the slopes have been cleared of vegetation. This would give an erosion rate of between 100 to 330 tonnes/ha/year.

In highland farming areas such as Cameron Highlands, though not as bad as completely exposing soil surfaces as in construction and deforestation, nevertheless involve clearing dense forests and replacing them with sparsely spaced crops. Soil erosion can increase many folds because of farming on hill slopes, often leading to landslides. For example, Daniel and Kulasingam (1974) found that erosion rates in forested and planted (vegetable) areas are  $25 \text{ m}^3 \text{ km}^{-2} \text{ yr}^{-1}$  and  $732 \text{ m}^3 \text{ km}^{-2} \text{ yr}^{-1}$  respectively. This is an increase of more than 29 times. In the current study, soil loss data collected between June 1995 and June 1996 on Penang island and computed based on the Universal Soil Loss Equation (Hudson, 1985) produced a soil loss of about 19,000 tonnes/hectare/year in freshly deforested land with slopes between 20 to 30 degrees. Given the high intensity of equatorial rainfall in Malaysia, the steep terrain and the resulting high rate of soil loss, landslides are the inevitable results. In comparison, soil loss in a forested catchment in the Air Itam water catchment in the Penang hills is only about 0.01 to 1.3 tonnes/hectare/year. Vegetable farming on hill slopes which recorded a soil loss of between 30 to 90 tonnes/hectare/year is already regarded by the authorities with concern (Penang State Government, 1993).

Highway construction through the dense equatorial forests has also been a major cause of soil erosion and landslides (Ahmad Chik, 1992). There have been numerous incidents of minor landslides along highways until the major landslide which occurred along the North-South Highway near Gua Tempurong in Bidor in 1996. In this landslide, an entire section of a hill slope collapsed and buried a section of the highway, killing one person. Since this incident, the Highway Authority PLUS has been told by the government to check all its slopes along major highways, and if necessary reinforce them. Quarrying is another major cause of landslides. Quarrying not only cuts away the rock and soil but also weakens the slope. Blasting by using dynamites and explosives also create localized earth tremors which weakens rock planes and joints. Such tremors can become trigger mechanisms for landslides and rockfalls to occur. Inadequate protection measures, amongst all the mentioned causes remain one of the main causes of slope failures (Photograph 12.4). Failure of developers to build retaining walls after cutting hill slopes is a common cause for landslides in uncompleted housing areas. A notorious example is the exposure of extensive areas of steep hill slopes in the Paya Terubong housing project. There have been many incidents of landslides, endangering residents living in nearby flats. In May 1996, two mudflows occurred burying an entire car park and part of the road connecting Paya Terubong to Air Itam. This is only one example. Contractors, in their efforts to cut cost and maximise profits, often get away by merely covering exposed surfaces with plastic sheets. This is fine as a temporary measure but not if the surface is exposed for long periods between months to many years.

### 12.3 Benefits of Erosion Control Mattress (ECM)

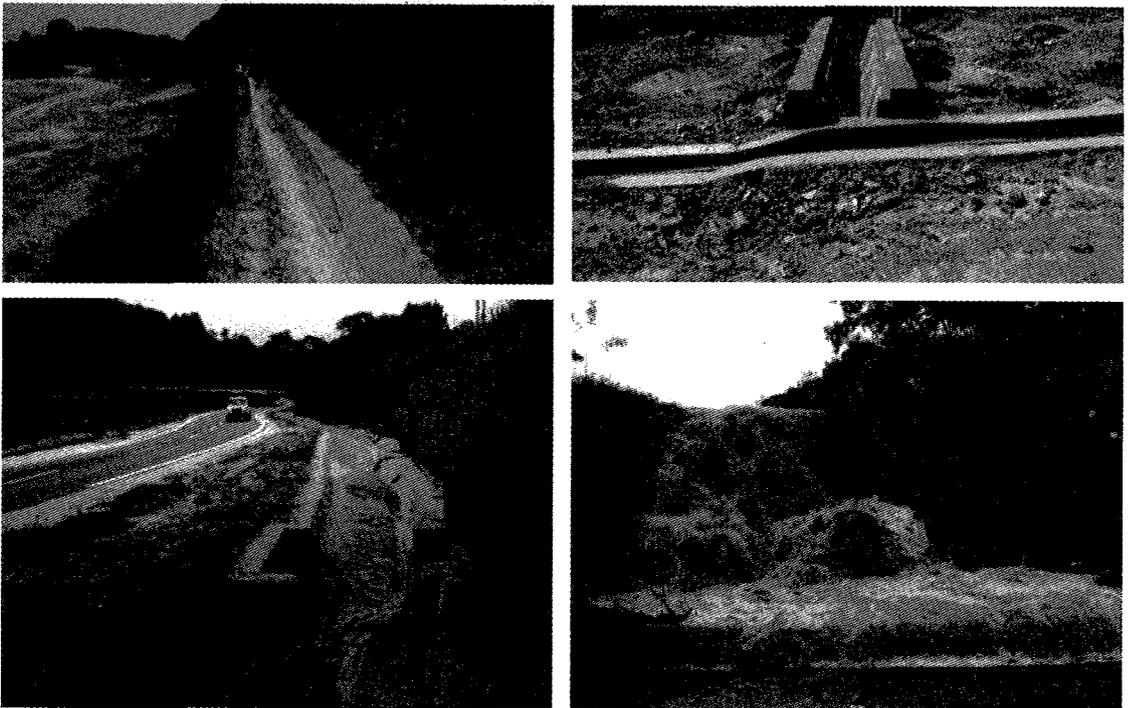
CHT-Natural Solutions Sdn Bhd have shown to be effective in controlling soil erosion and slope failure. This is because ECM will do the following: Cushion rain impact energy

- Slow down water flow velocity
- Retain moisture for good grass growing
- Fibre matrix retains soil and seeds on slope
- High flexibility provides better soil coverage
- Fibre also becomes plant food
- Double netting is UV-stabilised for durable root reinforcement
- ECMs are light weight and very user-friendly

ECMs make use of fibres that are readily available locally. In Malaysia, the biggest oil palm producer in the world, there is an abundance of oil palm fibres. After the oil is processed from the oil palm fruit, there is a lot of by-products including fibres that can be used in the making of ECMs (Photograph 12.5).

Increasingly, engineering solutions combine engineering techniques with natural/biological processes called Biotechnical slope erosion control. An example of biotechnical slope erosion control (an example of ECM) is shown in Photograph 12.6. This method allows nature to take over after engineering technique has been applied. There are many cases of effective ECM. Some examples of effective use of ECMs in actual projects are shown in Photograph 12.7, 12.8 and 12.9.

**Silt Flow & Poor Drainage = Sediment Deposits  
= Flooding**



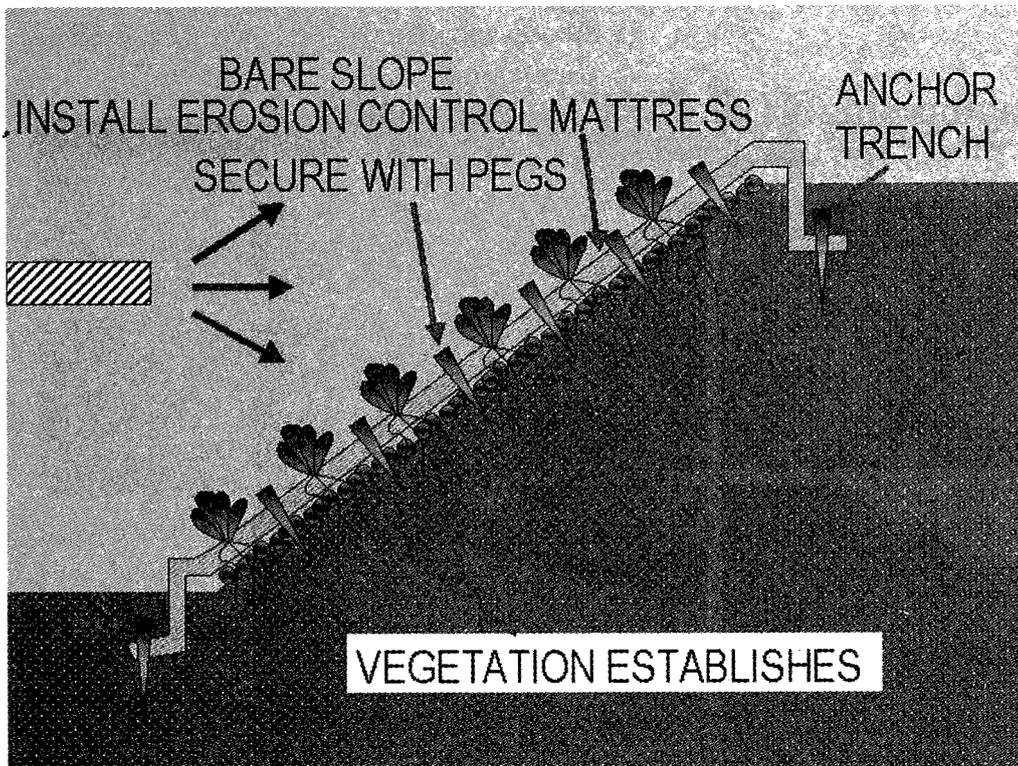
Photograph 12.4: Inadequate protection measures, amongst all the mentioned causes remain one of the main causes of slope failures.

**Palm oil fibre processing plant :**  
**Convert EFB to POF fibre**



CHT- NATURAL SOLUTION'S VIGORMAT<sup>®</sup> EROSION CONTROL MATTRESS :  
BIO-ENGINEERED FROM MALAYSIAN PALM OIL FIBRE FOR SLOPE EROSION CONTROL

Photograph 12.5: Top - Palm oil by-products are processed and converted into POF fibres to produce ECMs. Bottom - Erosion Control Mattresses bio-engineered from palm oil fibres.



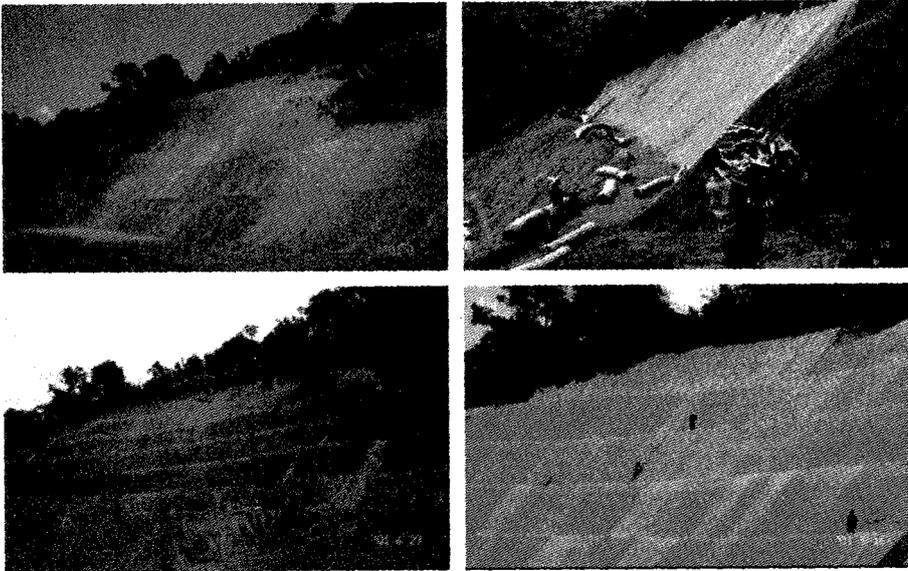
**BIOTECHNICAL SLOPE EROSION CONTROL :**

"...SYSTEM THAT USES VEGETATION TOGETHER WITH STRUCTURES TO MUTUALLY REINFORCE SURFACES AGAINST EROSION..." (Dr. Gray & Dr. Leiser 1992)



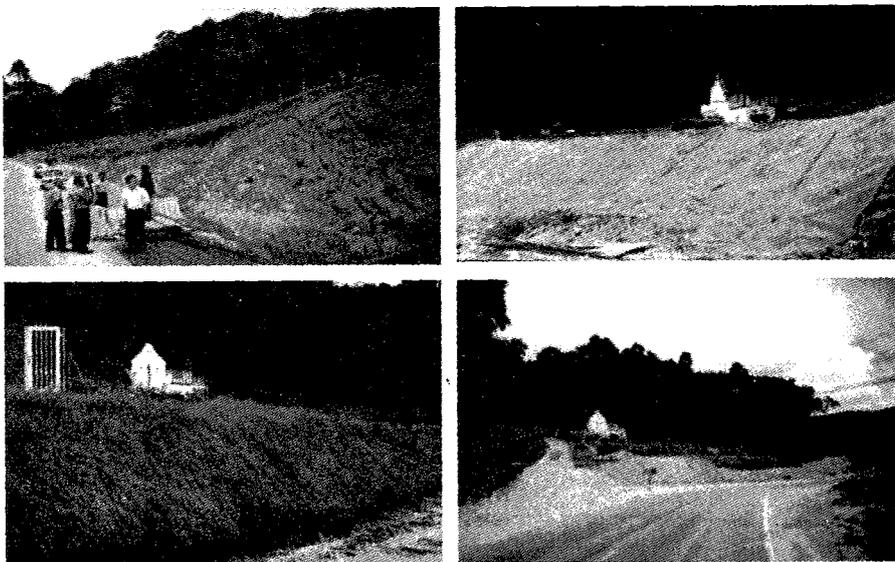
Photograph 12.6: Top – Layout of ECM on a slope. Bottom - An example of biotechnical slope erosion control in Cameron Highlands.

## Bioengineering: Hydroseeding w/Erosion Control Mattress



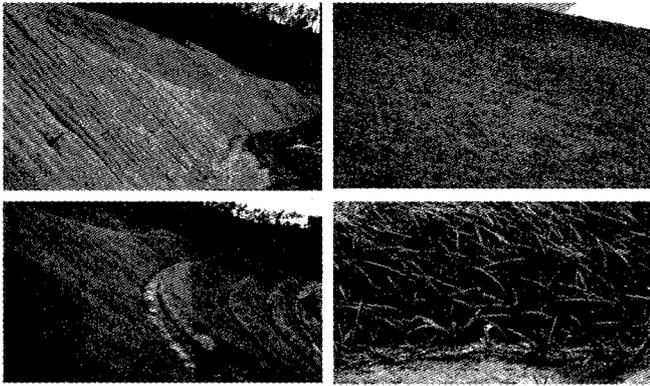
Photograph 12.7: Examples of bio-engineered ECM application on slopes in Cameron Highlands..

## JKR Highway Widening: Slope Healing @ Brinchang, Cameron Highlands



Photograph 12.8: Highway slope widening by using bio-engineered ECM application on slopes in Brinchang, Cameron Highlands..

### Bioengineering: ECM provides good Soil Protection & Grass Germination



Photograph 12.9: Bio-engineering ECM application on slopes yielding good soil protection and grass germination in Cameron Highlands..

#### 12.4 Conclusions

Development is necessary for progress. In the context of Malaysia, especially the highland areas, development in the form of farming, tourism, housing, highway/communications and dam construction are necessary and often unavoidable. Cameron Highlands will not be a top tourist destination today if not for all the infrastructures and facilities being put in place. Neither would its agricultural importance be what it is today without development. Communications such as roads and highways facilitate export of products as well as bring in tourists. Cameron Highlands, like other areas in the country, has a right to develop, albeit in a controlled manner because of its classification as an environmentally sensitive area. Development must not be stopped simply because it is an environmentally sensitive area. Given the right form of sustainable development, and given the adequate and appropriate protection technology, development can proceed. Development is necessary for progress, particularly in view of Malaysia's ambition to become a fully developed country by the year 2020. In the case of highlands, extra care must be taken if development is approved. The authors are of the opinion that development is a necessary process towards achieving Malaysia's Vision 2020 objective. What becomes questionable, however, is the manner in which development is being carried out, often manifested in projects which has scant regard for environmental protection. In a rapidly developing country like Malaysia, neither development nor the environment can be ignored or sacrificed for the other. To meet the challenges of the 21st century, rapid economic development must be balanced by prudent environmental protection and conservation. Towards this end, the use of protection techniques such as ECMs needs to be enforced in all areas involving slope cutting and exposed surfaces. The Malaysian Government needs to have a carefully envisaged development policy which emphasises environmental protection, whether it be via engineering structures or bio-engineering solutions. In this respect, it must develop a comprehensive soil erosion and landslide control strategy. At the highest level, policies need to be drafted. Developers who flout the law, without using the approved soil and slope protection techniques should be punished by the law. Landslide hazards will always be present in a country where physical conditions (heavy rain storms, monsoon rains, steep exposed slopes) and human use (deforestation, illegal farming, squatting, housing) continuously foster them. We can, therefore, never eradicate landslides from Malaysia, but if we are to successfully manage them with a balanced strategy of development and environmental protection using a combination of structural and non-structural measures, and also move towards sustainable development, then we would be moving on the right track towards their reduction.

## Bibliography

Abdul Rahim N (1988) "Water yield changes after forest conversion to agriculture land use in Peninsular Malaysia", *Jour. Trop. Forest Science*, Vol. 1 No. 1, 67-84.

Abdul Rahim, N. (1990) *The effects of selective logging methods on hydrological parameters in Peninsular Malaysia*, PhD, University of Wales.

Abdul Rahim, N. and Harding, D. (1992) "Effects of selective logging methods on water yield and streamflow parameters in Peninsular Malaysia", *Journal of Tropical Forest Science*, Vol. 5 No. 2, 130-54.

Ahmad Chik (1992) "Environmental Impacts of Road Construction up Gunung Raya, Pulau Langkawi", in Lim, R. P. and Lee, S. W. (Eds) *Hill Development*, Proceedings of the Seminar, Malaysian Nature Society, Kuala Lumpur, 16-19.

Brunsdon, D. and Prior, D. B. (Eds) (1984) *Slope Instability*. John Wiley and Sons, Singapore, 1984

Chan, N.W. (1998) Responding to Landslide Hazards in Rapidly Developing Malaysia: A Case of Economics Versus Environmental Protection. *Disaster Prevention and Management: An International Journal* 7 (1), 14 - 27.

Chan, N.W. (2002) *Pembangunan, Pemandaran dan Peningkatan Bahaya dan Bencana Air di Malaysia: Isu, Pengurusan dan Cabaran*. Penang: Penerbit Universiti Sains Malaysia.

Chan, N.W. (2004) Striking a Balance between Development and Environmental Protection in Cameron Highlands. Paper presented at the national seminar "*Sustainable Development of Cameron Highlands: Issues and Challenges*", 11-12 December 2004, Brinchang, Cameron Highlands.

Chan, N.W. and Wan Ruslan Ismail (1997) Impak Manusia Terhadap Unsur-Unsur Kitaran Hidrologi Di Malaysia. *Ilmu Alam* 23, May, 41 - 58.

Daniel, J. G. and Kulasingam, A. (1974) "Problems arising from large scale forest clearing for agricultural use - the Malaysian experience", *Malaysian Forester*, Vol. 37, 1974, 152-62.

Drainage and Irrigation Department, Malaysia (1983) "Sungai Tekam Experimental Basin, Transitional Report July 1980 to June 1983", *Water Resources Publication*, Vol. 16, Drainage and Irrigation Department Malaysia, Kuala Lumpur, 1983.

Hudson, N. (1985) *Soil Conservation*, Batsford Academic and Educational, London, 191-204.

Jackson, I. J. (1977) *Climate and Agriculture in the Tropics*, Longman, London, 1977.

Leong, K.W.. (2004) Bioengineering Erosion Control Techniques for Sustainable Construction in Cameron Highlands. Paper presented at the national seminar "*Sustainable Development of Cameron Highlands: Issues and Challenges*", 11-12 December 2004, Brinchang, Cameron Highlands.

Main Rindam (1997) "Tanah Runtuh: Punca dan Langkah Mengatasinya" (Landslides: Causes and Solutions), *Perantara*, June, 1997, 13-20.

Penang State Government (1993) *Technical Report for Environmental Management of the Penang Hill Study Area*, Final Draft for Penang hill Development Plan, December, Penang.

## CHAPTER 13

# A NEAR REAL TIME EARLY WARNING SYSTEM ON EROSION RISKS/HAZARDS FOR CAMERON HIGHLANDS CATCHMENT

Tew Kia Hui

Director

VT Soil Erosion Research and Consultancy

9 Jalan Akasia, Saujana Akasia 47000 Sg Buloh, Selangor

Tel: 6-03-61575881; Fax: 6-03-6157887

Email: valen@tm.net.my

Faisal Hj. Ali

Professor

Civil Engineering Department, Faculty of Engineering

Universiti Malaya, 50603 Kuala Lumpur

Tel: 6-03-79674648

### Abstract

*Soil erosion has become a very serious problem in Malaysia recently, and with the accelerated rate of land development both in the public and commercial sectors, this problem will certainly persist and worsen unless proper planning and management of land utilization is adopted at the early stage of any proposed land development. The fact that soil erosion and sedimentation continue to be an environmental problem of significant proportions in the country suggests that more definitive guidelines and stringent monitoring and enforcement of land development are required. Therefore, this chapter will focus on research works carried out on developing a near real-time early warning system on erosion risks and hazards to enable the various concerned authorities in monitoring as well as providing early warnings to the public should erosion risks and hazards reach a dangerous level. With the application of this new locally developed system, trademarked under EWARNS® (Early Warning And Risk Navigation Systems) as well as an in-depth understanding of the Best Management Practices on erosion and sediment control, it would be beneficial to the knowledge-based community in moving a step closer towards a better understanding of soil erosion issues to ensure a more sound and sustainable development in future.*

**Keywords:** erodibility, erosivity, soil erosion, real-time warning system

### 13.1 Introduction

Malaysia, in its rapid progress of developing in line with Vision 2020, is undergoing tremendous land development, especially in the development of infrastructures. Although these activities form an integral part of the socio-economic advancement in this country, their success is indeed limited, if insufficient attention is paid to the adverse effects of land development, particularly on soil erosion issues (Rubber Research Institute of Malaysia, 1980).

In engineering perspective, soil erosion is defined as a general destruction of soil structure by the action of water and wind (Beasley, 1972). It is essentially the smoothing process with soil particles being carried away, rolled and washed down by the force of gravity (Morgan, 1993). Rainfall is the prime agent of soil erosion, whereby the rain's runoff will scour away, loosen and break soil particles and then carry them away, thus leaving behind an altered bare earth surface (Wischmeier and Smith, 1978). In the case of a slope, an altered bare surface of the slope with the formation of sheet, rill, and gully erosion features will cause instability of the slope. This situation will gradually cause slope failure or landslide as commonly known. The soil erosion phenomenon is basically the function of the

erosivity of the rainfall and the erodibility of the soil (Hudson, 1979). In other words, when the rainfall acts upon the earth surface, the amount of the soil erosion loss will basically depend upon the combination of the strength and the magnitude of the rainfall to cause the erosion process and the ability of the soil to withstand the rain itself (Roslan and Tew, 1995; Tew, 1996).

The soil erosion-related problems could be identified and minimized if the knowledge of the soil erosion-prone areas are identified and mapped. A near real-time early warning system on erosion risks and hazards would provide vital information on this issue.

### 13.2 Study area

The study area, Cameron Highlands Catchment is located within the Cameron Highlands district of 59,153 hectares (146,171 acres). It comprises an area of 16,916 hectares (41,801.94 acres), which could be subdivided into 5 smaller sub-catchments, namely:

- Lower Bertam Catchment
- Upper Bertam Catchment
- Kial - Kodol Catchment
- Lower Telom Catchment
- Upper Telom Catchment

The 5 sub-catchments are as shown in Figure 13.1 and the 3-Dimensional View is as shown in Figure 13.2.

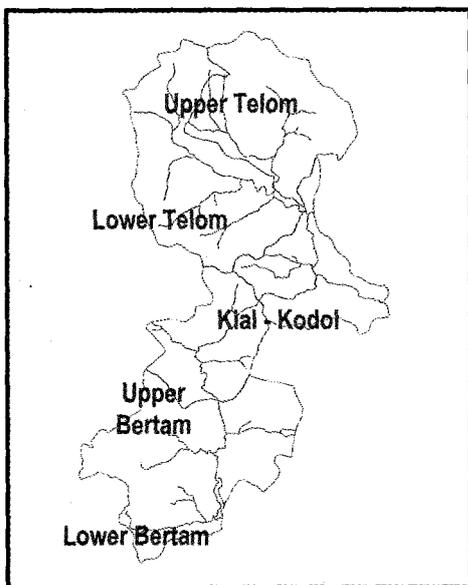


Figure 13.1: Cameron Highlands Catchment

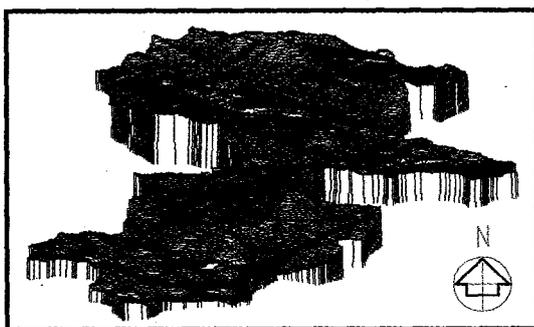


Figure 13.2: 3-D View of Cameron Highlands Catchment

### 13.3 Methodology

The methodology adopted for the study would be subdivided into:

- Collection of the baseline information on factors influencing soil erosion
- Development of near real-time soil erosion assessment (transmission and receiving units)
- Production of an early warning system that will trigger if the erosion risks and hazards reached a dangerous level

#### 13.3.1 Baseline information

The gathering of baseline information was carried out for factors influencing soil erosion, which is based on the Universal Soil Loss Equation, (USLE). These factors would include the Rainfall Erosivity, R, Soil Erodibility, K, Slope Length and Steepness, LS and Land Use Management, CP.

For Rainfall Erosivity, R, nine rainfall stations, which are located within the Cameron Highlands Catchment were taken into consideration as shown in Table 13.1. R factor values for the 9 stations were then interpolated to produce the R Factor Map.

Table 13.1 Rainfall Stations in Cameron Highlands

No.	Station Name	Site No.	Ave. Annual Rainfall (1990 – 2000) (mm)
1	Ladang The Blue Valley	001	332.3
2	Pejabat TNB Kg. Raja	002	426.6
3	Alur Masuk Telom	003	993.3
4	Ladang The Sg. Palas	004	464.7
5	Stesen Kaji Iklim Tanah Rata	007	609.1
6	Stesen Jana Elektrik Habu	009	467.1
7	Ladang Teh Boh	010	442.2
8	Gunong Emas Tea Plantation	012	697.6
9	Station Kajicuaca Cameron Highlands	111	857.6

Soil Erodibility, K, is calculated based on the results of the “Hand Auger Soil Sampling” being carried out for 30 locations (2 samples taken for each location) within the Cameron Highlands Catchment. Sieve analysis was carried out for the soil samples taken and subsequently the input parameters from the results of tests being carried out were inserted into the Malaysian Nomograph for Calculation of Soil Erodibility Factor, K to determine the K factor (Balamurugan, 1990). Interpolation of K values using IDRISI (Geographical Information System, GIS) programme would produce the K Factor Map needed for the purpose of database development of the study area.

The Slope Length and Steepness, LS, is acquired by digitizing the contours from the Cameron Highlands Topographical Map (Sheet 3662) with a scale of 1:50,000. The LS factor is then calculated by using the “slope analysis” programme in IDRISI, which is based on the USLE’s graph (standard conditions are 9% slope and length of 22.1 m). By entering the graph for other values of slope steepness and length, the LS ratio that is to be applied in the USLE can be obtained. Interpolation of the slope length and steepness using GIS would produce the LS Factor Map (Bols, 1978).

The Land Use Management, CP, for the study area would take into consideration the three land use scenarios as comparison, namely:

- (i) Worst Case Scenario
- (ii) Land Use according to Structure Plan
- (iii) Land Use based on SPOT 4 Satellite Imagery

The worst case scenario would be based on the assumption that the whole catchment area is cleared, whereas the land use for Structure Plan would be based on the MDCH's Structure Plan (1995 – 2020) (Majlis Daerah Cameron Highlands, 1996). The SPOT 4 Satellite Imagery (taken on the 7<sup>th</sup> July 2002), which was acquired from Malaysian Centre for Remote Sensing (MACRES), indicates the current land use situation. CP factors used for the study area were based on research work and observation carried out locally (Harper, 1987). Nevertheless, further modifications were made from original US conditions to suit our local climate, such as shown in Table 13.2.

Table 13.2: Land Use Management Factor, CP

Land Cover	CP Factor
Water Body	0.000 - 0.001
Swamps	0.001
Apartment / Mixed Residential	0.003
Government Institution / Quarters	0.003
Impervious	0.005
Forest	0.010
Grassland	0.015
Orang Asli Settlement	0.015
Recreational	0.100
Permanent Cropland	0.150
Cropland	0.200
Rangeland	0.229
Horticultural / Agricultural	0.250
Bare land*	0.800 - 1.000
Construction	1.000

\* incl. mining areas and newly cleared land

Source : (Roslan and Tew, 1996)

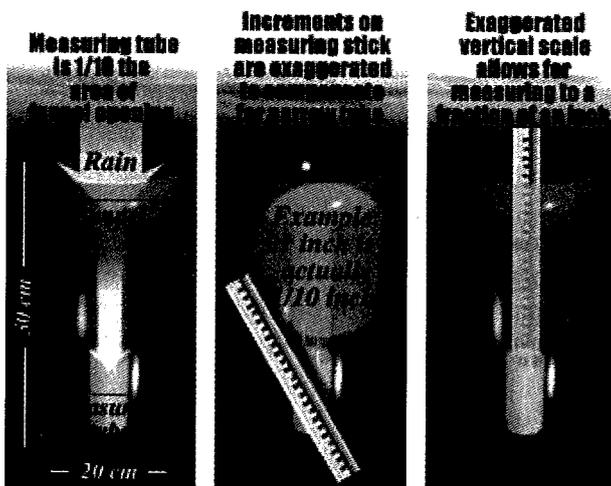
### 13.3.2 Near real-time soil erosion assessment

The near real-time soil erosion assessment would incorporate the use of transmission and receiving units. The transmission units would include the rain sensor, interface module and a SIM-card based transmitter powered by using a solar panel, which shall be named 'rainfall sensing and transmission unit' as shown in Photograph 13.1.



Photograph 13.1 Rainfall sensing and transmission unit

The rainfall sensor which has 8 levels of rain detection at every second, would send signals to the interface module to be processed and converted to rainfall depth at every minute interval based on calibrated values against measured rainfall depth as shown in Photograph 13.2.



Photograph 13.2: Rainfall depth measurement

Such information would then be sent out via e-mail (using a SIM-card GPRS based transmitter) to the receiving unit every minute once rainfall is detected.

Once it reaches the receiving unit (PC / NB running on MS Windows environment and connected to the internet lines), the e-mail containing rainfall data would be intercepted. The information sent via e-mail would then be directly recognized and identified from which transmission unit as every SIM-card would contain different IDs. For the study area, as there are already existing nine rainfall stations which record daily rainfall data, rain would be used as a 'variable' as these data change from time to time. Simulation of daily rain data (converted into rainfall erosivity) was carried out for year 2003 that could generate erosion risks and hazards. Figure 13.3 shows the average daily rainfall erosivity for year 2003. Using a programming language software to provide automated keyboard simulation, the information gathered from the varying Rainfall Erosivity,  $R$ , would be multiplied with the  $K$ ,  $LS$  and  $CP$  factors, to produce the Soil Erosion Loss,  $A$ , for the study area.

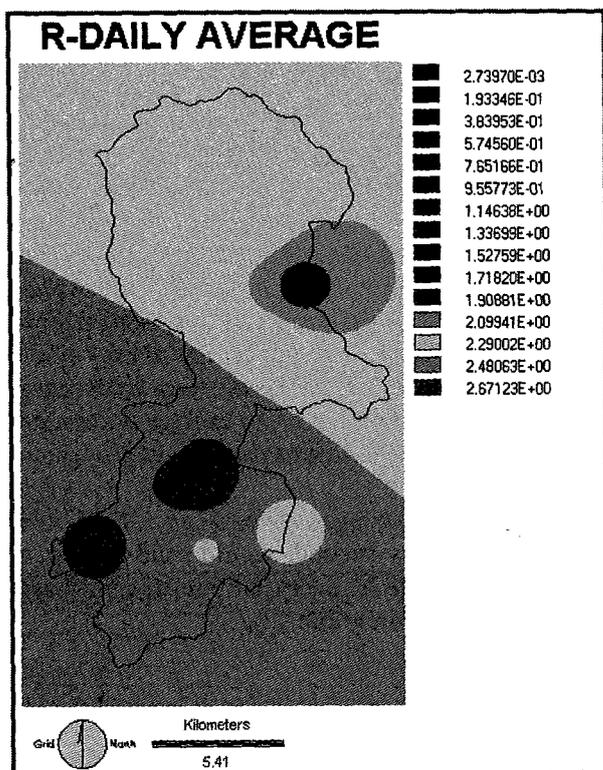


Figure 13.3: Daily Average Rainfall Erosivity for Cameron Highlands Catchment

Subsequently, near real-time simulation would be carried out using recorded data sent via e-mail from the nine rainfall stations for various incidences of rainfall event for the year 2003 to give an indicative sign of potential erosion risks and hazards. These input would then be processed using an automated keyboard simulation procedure to produce soil erosion risk maps based on interval of rainfall data specified.

### 13.3.3 Near real-time early warning system

An early warning system would be developed by taking into account the threshold value of 150 t/ha/yr or more, whereby soil erosion risk has reached a severe or dangerous level (Department of Environment, 1996). This would be based on the classification of soil erosion risk for "hill slope areas" as shown in Table 13.3. Preliminary warning would also be given once erosion risks and hazards reach to the 100 - 150 t/ha/yr mark. Warnings would be subdivided for various types of land usage such as the built-up areas, roads and agricultural areas. With this, the individual warning would be triggered to alert the authorities involved to stand-by and monitor the situation more closely if there is unusually heavy rain at any instance.

Table 13.3: Classification for Soil Erosion Risk for "Hill Slope Areas"

Soil Erosion Loss Range (t/ha/yr)	Classification (Risk)
< 50	Low
50 - 100	Moderate
100 - 150	High
> 150	Critical

Source : (Roslan and Tew, 1995)

### 13.4 Result analysis

#### 13.4.1 Factors influencing soil erosion

Analysis of the factors influencing soil erosion was carried out and mapped using IDRISI module. Following are the descriptions of the various factors as well as the ranges of their respective values:

- Rainfall Erosivity, R, ranges between 650 – 1,000 MJ.mm/ha.hr.yr and the erosivity is generally higher towards the western and southern sections of the catchment.
- Soil Erodibility, K, ranges between 0.05 – 0.45. Soils on the northern section record higher erodibility compared to the rest of the areas within the catchment.
- Slope Length and Steepness, LS, ranges between 0 – 6 with the middle and northern sections recording higher LS values compared to the other areas within the catchment.
- Land Use Management, CP, for the catchment is based on the values for various land uses as shown in Table 13.2 and taking into consideration of the 3 different scenarios. For the current situation as according to the SPOT 4 Satellite Imagery, forest covers 28,561.07 acres (68.32%), followed by agricultural/grass area of 8,627.97 acres (20.64%), bare area 1,170.05 acres (2.80%), impervious 839.91 acres (2.01%), structure 2,552.65 acres (6.11%) and water body / river 50.30 acres (0.12%).

#### 13.4.2 Soil erosion assessment

Generally, soil erosion assessment for the three different scenarios for the Cameron Highlands Catchment would be based on the classification of soil erosion risk for “hill slope areas” as shown in Table 13.3. The Soil Erosion Loss, A, for the Cameron Highlands Catchment is estimated for 3 different land use scenarios, namely, the Worst Case Scenario, Structure Plan and SPOT 4 Satellite Imagery as shown in Table 13.4. The Weighted Soil Erosion Loss, A, for each of the scenarios would be:

- 1) Worst Case Scenario 124.42 t/ha/yr
- 2) Structure Plan 18.88 t/ha/yr
- 3) SPOT 4 Satellite Imagery 16.64 t/ha/yr

Table 13.4: Soil Erosion Loss, A, based on 3 different scenarios for Cameron Highlands Catchment

Soil Erosion Loss, A, Range (t/ha/yr)	Area (acre)		
	SP	SPOT 4	WC
0 – 50	36,785.86	39,081.13	17,594.03
50 – 100	3,997.92	1,853.24	1,372.04
100 – 150	850.38	552.71	5,847.39
150 – 200	167.79	140.50	6,651.24
200 – 250	0.00	23.76	4,914.65
250 – 300	0.00	47.53	3,372.55
300 – 350	0.00	17.68	1,268.32
350 – 400	0.00	7.23	406.50
400 – 450	0.00	6.55	269.22
450 – 500	0.00	0.65	94.05
500 – 550	0.00	1.05	12.97

Note:

SP – Land Use according to Structure Plan

SPOT4 – Land Use based on SPOT 4 Satellite Imagery

WC – Land Use based on Worst Case Scenario

### 13.4.3 Near real-time soil erosion assessment and early warning system

The near real-time soil erosion assessment, which currently uses the recorded data simulation based on year 2003, would certainly prove to be useful if more of the 'rainfall sensing and transmission units' are installed along areas of high risks and concern. Updating of land use from time to time using the latest satellite imagery such as IKONOS would make the system more effective. Further to that, the warning system would be triggered once critical areas such as built-up areas, roads or even agricultural areas record soil erosion risk of more than 150 t/ha/yr based on certain rainfall events. Sample early warning system display for Day 1 (dated 1<sup>st</sup> January 2003) is as shown in **Annex 13.A**.

### 13.5 Major Findings And Discussions

From the baseline information analysis that was carried out, the agricultural area records the highest soil erosion risk (40.07 t/ha/yr) based on the present situation. However, for Worst Case Scenario, the commercial, agricultural, forest, road and water body / river areas would record Soil Erosion Loss, A, of more than 100 t/ha/yr if the area is completely cleared. Therefore, preventive and mitigation measures should be taken at these areas.

Surrounding areas that denote high soil erosion loss as shown by the SPOT 4 Satellite Imagery, most likely show cleared agricultural areas, such as follows:

- (i) Ladang Blue Valley
- (ii) Ladang Lembah Perlong
- (iii) Sg. Ikan
- (iv) Sg. Merah
- (v) Sg. Mensun
- (vi) Sg. Palas
- (vii) Sg. Pertang
- (viii) Sg. Ringlelet

### 13.6 Conclusion

In conclusion, this study has revealed among others, important findings, as follows:

- Locations of *high soil erosion loss* areas as well as sedimentation impacts from the various sub-catchments. These locations include areas surrounding Sg. Ringlelet and Sg. Merah in the Lower Bertam Catchment; areas surrounding Sg. Mensun in the Upper Bertam Catchment; areas surrounding Sg. Palas in the Kial-Kodol Catchment; areas surrounding Sg. Pertang and Ladang Lembah Perlong in the Lower Telom Catchment; and areas surrounding Ladang Blue Valley and Sg. Ikan in the Upper Telom Catchment.
- Forest areas record the highest soil erosion risk for the worst-case scenario (141.25 t/ha/yr), meanwhile for the present condition according to the SPOT 4 Satellite Imagery, agricultural area records the highest risk of 40.07 t/ha/yr. Therefore, indiscriminate clearing of forest would definitely contribute to massive soil erosion losses.
- The estimated soil erosion loss, A, for Kial - Kodol Catchment is found out to be the highest (34.27 t/ha/yr) based on the present situation and this is followed by the Upper Telom Catchment (17.31 t/ha/yr). This justifies the fact that intensive agricultural activities as well as clearing of land for agricultural activities have contributed a sizeable amount of soil erosion losses and sedimentation in rivers.
- Water body / river area in the Kial - Kodol Catchment faces the highest erosion risk compared to that in the other sub-catchments, which would have impact on the Sultan Abu Bakar Dam located downstream.

Based on the findings and with the development of a near real-time early warning system on erosion risks and hazards trademarked under EWARNS® (Early Warning And Risk Navigation Systems), it is hoped that better monitoring of the Cameron Highlands Catchment would be provided. It is also

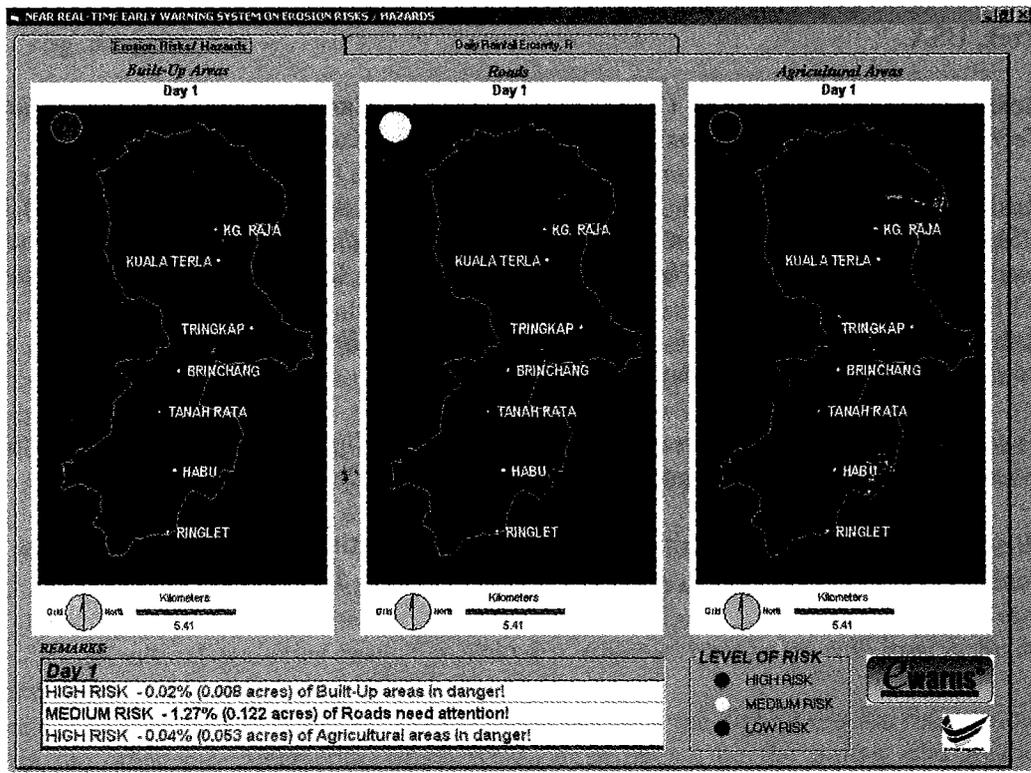
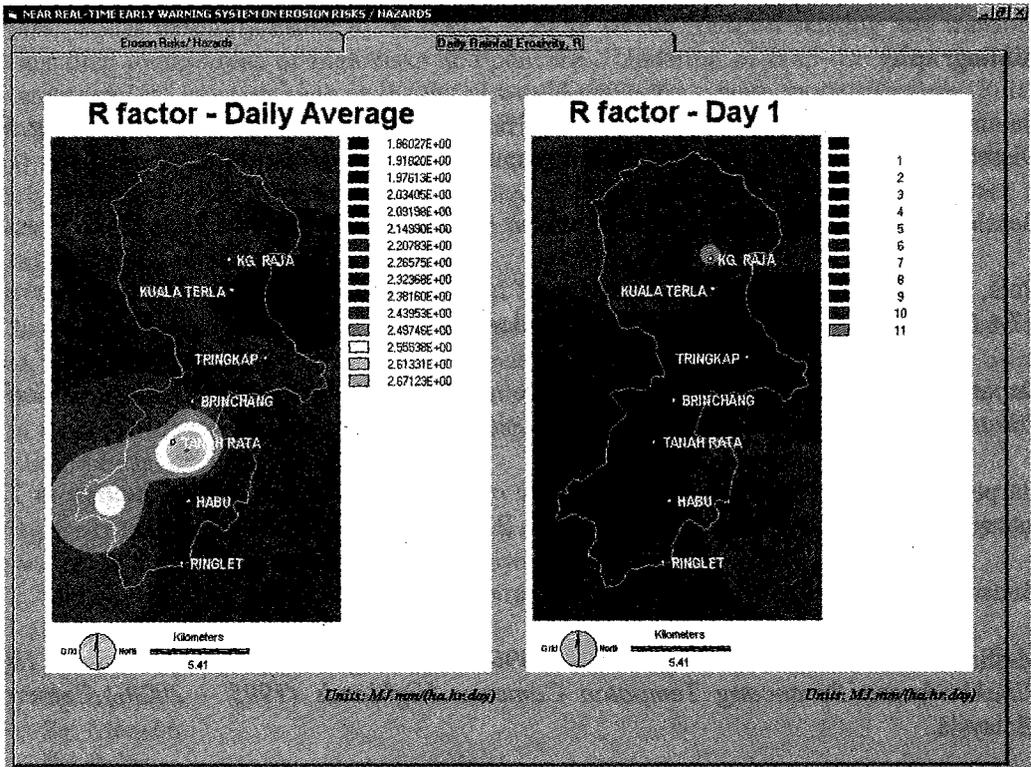
hoped that more attention should be paid to control indiscriminate or illegal clearing of areas with potentially high erosion risk. Where developments in these areas are unavoidable, preventive and mitigation measures should be initiated early and duly enforced.

### Bibliography

- Balamurugan, G. (1990). *Soil Erosion and Sediment Balance in the Sungai Kelang Basin*, M. Phil Dissertation, University Malaya, Kuala Lumpur, Malaysia.
- Beasley, R. P. (1972). *Erosion and Sediment Pollution Control*, Iowa State Univ. Press, USA.
- Bols, P. L. (1978). The Iso-Erodent Map of Java and Medura, *Belgian Technical Assistance Project ATA 105*, Soil Research Institute, Bogor, Indonesia.
- Department of Environment (1996). *Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia*, Kuala Lumpur, Malaysia.
- Harper, D. (1987). *Improving the accuracy of the Universal Soil Loss Equation in Thailand*, Fifth International Soil Conservation Conference, Bangkok, Thailand.
- Hudson, N. W. 1979. *Soil Conservation*, Cornell Univ. Press, USA.
- Majlis Daerah Cameron Highlands (1996). *Rancangan Struktur Cameron Highlands dan Pihakberkuasa Perancang Tempatan Cameron Highlands (1995 – 2020)*, Cameron Highlands, Malaysia.
- Morgan, R. P. C. (1993). *Soil Erosion and Conservation*, Longman Scientific and Technical, New York, USA.
- Roslan, Z. A. and Tew, K. H. (1995). Erosion Study in Cameron Highlands, *Malaysian Science and Technology Congress*, Perdanasiswa, Universiti Malaya, Kuala Lumpur, Malaysia.
- Roslan, Z. A. and Tew, K. H. (1996). Determination of the Land Use Management Factors of the USLE in reducing Soil Erosion Loss, *Tenth Congress of the Asia and Pacific Division (APD) of the International Association for Hydraulic Research (IAHR)*, Langkawi, Kedah Darul Aman, Malaysia.
- Rubber Research Institute of Malaysia (1980). *Soil Erosion and Conservation in Peninsular Malaysia*, Kuala Lumpur, Malaysia.
- Tew, K. H. (1996). *Production of Malaysian Soil Erodibility Nomograph in Relation to Soil Erosions Issues*, M. Eng. Thesis Dissertation, UTM Skudai, Johor Darul Takzim, Malaysia.
- Wischmeier, W. H. and Smith, D. D. (1978). Predicting rainfall erosion losses - a guide to conservation planning, USDA, *Agriculture Handbook No. 537*, USA.

**ANNEX 13.A**

*Sample Early Warning Panel for EWARNS® (observation dated 1<sup>st</sup> January 2003)*



## CHAPTER 14

# SOIL EROSION AND SEDIMENTATION ASSESSMENT, CONTROL AND MONITORING PLANS FOR AGRICULTURAL PROJECTS IN CAMERON HIGHLANDS

Tew Kia Hui

Director

VT Soil Erosion Research and Consultancy  
9 Jalan Akasia, Saujana Akasia 47000 Sg Buloh, Selangor  
Tel: 6-03-61575881; Fax: 6-03-6157887  
Email: valen@tm.net.my

Azman Abu Bakar

Director

Perunding Azman, Ooi & Rao Sdn Bhd  
(Tel: 03-41494227)

### Abstract

*In recent decades, soil erosion has become a significant problem in Cameron Highlands. The combined rapid rate of land development both for the agricultural and property development sectors has exacerbated the problem. This hazard will certainly persist and worsen unless proper planning and management of land utilization is adopted at the early stage of any proposed land development there. The fact that soil erosion and sedimentation continue to be a serious environmental problem in Cameron Highlands suggests that more definitive guidelines and stringent monitoring and enforcement of land development are required. Therefore, this chapter will focus on the soil erosion and sedimentation assessment, control and monitoring plans for agricultural projects in Cameron Highlands. A case study - Proposed High-Tech Hydroponic Farming on Lots 1587 & 1592, Part of Blue Valley Estate, Mukim Hulu Telom, Cameron Highlands, would be showcased to provide information on the methodology of assessment, proposed control measures and monitoring plans that could be adopted for future agricultural projects in Cameron Highlands as well in other highland areas within Malaysia. This is crucial in order that potential risk areas be identified first even before carrying out earthworks or land clearing so that an Erosion and Sediment Control Plan (ESCP) could be developed to plan out the staging of earthworks for the entire project area. With in-depth understanding of the Best Management Practices (BMPs) on erosion and sediment control within an agricultural project, the experience would be beneficial towards a better understanding of soil erosion issues and to ensure sustainable agricultural development in Cameron Highlands.*

**Keywords:** erodibility, erosivity, soil erosion, *Erosion and Sediment Control Plan (ESCP)*

### 14.1 Introduction

Cameron Highlands, an idyllic highland resort in Malaysia is mostly covered by thick tropical rainforest covering 59,153 hectares (86.22%). With the cool temperature averaging between 10°C to 23°C Cameron Highlands becomes an ideal retreat for holiday makers. The climate and soil are conducive to the cultivation of tea, vegetables, citrus fruits, coffee, strawberry and mushroom. However, the agricultural activities carried out in Cameron Highlands proceed at an alarming rate to meet the increasing demand of

vegetable and cash crops from all over Peninsular Malaysia. This has led to indiscriminate clearing of new lands and without proper covering provided after harvesting of the crops, thus exposing the soil to direct rainfall and making it vulnerable for landslides to occur. This has been supported by the fact that recent agricultural and property developments have taken their toll in the highland itself with many on-going and new proposed projects. Although these activities form an integral part of the socio-economic advancement in Cameron Highlands, their success is indeed limited, if insufficient attention is paid to the adverse effects of land development, particularly on soil erosion issues (Rubber Research Institute of Malaysia, 1980). As a result of human ignorance, a spate of landslides and flash floods had since occurred in Cameron Highlands lately in which significant property damage and loss of lives occurred.

In engineering perspective, soil erosion is defined as a general destruction of soil structure by the action of water and wind (Beasley, 1972). It is essentially the smoothing process with soil particles being carried away, rolled and washed down by the force of gravity (Morgan, 1993). Rainfall is the prime agent of soil erosion, whereby the rain's runoff will scour away, loosen and break soil particles and then carry them away, thus leaving behind an altered bare earth surface (Wischmeier and Smith, 1978). In the case of a slope, an altered bare surface of the slope with the formation of sheet, rill, and gully erosion features will cause instability of the slope. This situation will gradually cause slope failure or landslide as commonly known. The soil erosion phenomenon is basically the function of the erosivity of the rainfall and the erodibility of the soil (Hudson, 1979). In other words, when rain falls upon the earth surface, the amount of the soil erosion loss will basically depend upon the combination of the strength and the magnitude of the rainfall to cause the erosion process and the ability of the soil to withstand the rain itself (Tew, 1996). The soil erosion-related problems could be identified and minimized if the knowledge of the soil erosion-prone areas are identified and mapped.

#### 14.2 Case Study area

The case study was carried out on a 60-acre proposed "high-tech hydroponic farming" agricultural project situated on Lot 1587 and 1592, Part of Blue Valley Estate, Mukim Hulu Telom, District of Cameron Highlands, Pahang, as shown in Figure 14.1. The project site is generally hilly with steep-sided cut slopes, numerous steep-sided gullies, which may be deep or shallow, wide or narrow depending on location as shown in Figure 14.2 (*3 Dimensional View of the project area*). Degree of slopes generally varies from  $10^{\circ}$  to  $70^{\circ}$  and ground elevation varies from EL 1406.00 m at the entrance of the project area (southern section) to height EL 1476.00 m at the northeast boundary.

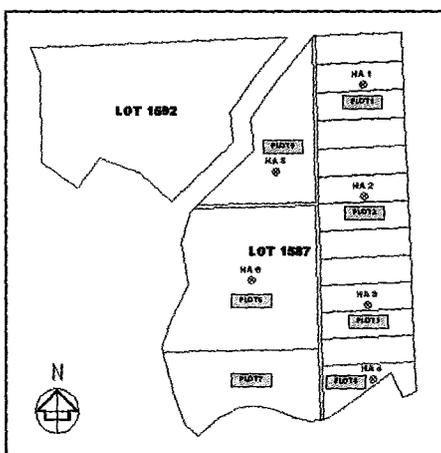


Figure 14. 1: Project Area Layout with soil sampling locations

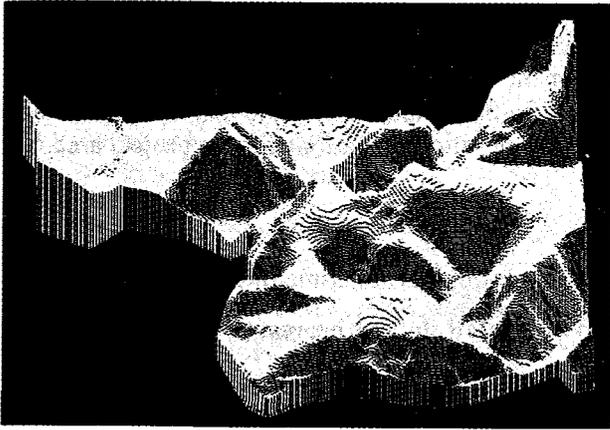


Figure 14.2: 3-D View of Project Area

Earlier earthworks had been carried out on the site but were stopped in February 2003. This had stripped most of the project area of vegetation, leaving it barren as shown in Photograph 14.1. However, at certain locations, vegetable farms, sheds and earth drains are observed, especially at the middle and southern sections of the project area.



Photograph 14.1: Project Area which is already Barren

### 14.3 Soil Erosion Assessment Report

#### 14.3.1 General Principles

The Soil Erosion Assessment Report (SEAR) is a specific document submitted to the Land Office / Local Authority in Cameron Highlands, which would include the assessment of factors influencing soil erosion, mapping of factors involved, environmental monitoring and also recommendations of mitigation measures to be taken to minimize the impacts of soil erosion and sedimentation on-site. It is aimed to provide a better understanding on the impacts of soil erosion and sedimentation before, during and after the

construction period in which amendments to the Earthworks Plan would be required based on the outcome and findings before it could be approved by the relevant authorities.

This report would also incorporate the Erosion and Sediment Control Plan (ESCP) and Environmental Monitoring Programme, which is important to address specific issues and denote the locations of erosion and sediment control measures on plan as well as the proposed monitoring stations for the project area.

### 14.3.2 Data Acquisition

The acquisition of data needed for the project area, so as to carry out this assessment report would include:

- *Rainfall data* – information on daily rainfall recorded by rainfall stations nearest to the project area for a period of at least five years
- *Soil data* – specific information on the soil composition would be required as this could be done using a hand auger to a depth of 1 meter. Alternatively, information could be acquired from the Soil Investigation Report
- *Slope Length and Steepness data* – this could be obtained from the Survey Plan that was carried out and the slope being analysed using the Geographical Information Systems (GIS)
- *Land Use data* – for modelling purposes, the land use for conditions before, during and after construction would be required. The existing land use could be obtained from the Survey Plan, but for a large area, such information would need to be obtained from satellite imagery or aerial photographs. During construction stage, the land use would be based on the Earthworks Plan with the indication of the earthworks area. After construction, the proposed Layout Plan would be used as a reference to estimate the land use during that time.

Therefore, the following data / plans are required:

- Daily Rainfall Data (at least 5 years)
- Soil Sampling / Soil Investigation Report
- Earthworks Plan
- Layout Plan
- Survey Plan
- Silt Trap / Sediment Basin Details Plan

### 14.3.3 Baseline Database Formation

The methodologies adopted for the Soil Erosion Assessment Report for a project area are as follows:

- i) analysing “Survey and Earthworks Layout Plan” to determine the elevation (before and after construction);
- ii) analysing rainfall data to determine the Rainfall Erosivity, R;
- iii) analysing summary of laboratory results acquired from “Soil Investigation” to determine the Soil Erodibility Factor, K;
- iv) using elevation information to produce the Slope Length and Steepness Factor, LS (before and after construction);
- v) using site observation information and “Survey, Earthworks and Layout Plan” to determine the Cover Management / Land Use Factor, CP (before, during and after construction); and

- vi) gathering of all the information from the respective maps to produce Soil Erosion Loss, A (before, during and after construction) to identify the risk areas involved.

#### 14.3.4 Database Analysis

The analysis on each of the factors influencing erosion needs to be carried out in the assessment report. This would include analysis on:

- i) *Rainfall Erosivity Factor, R*. The areas with higher rainfall erosivity denote implication of higher erosion risk based on this factor.
- ii) *Soil Erodibility Factor, K*. According to international standards, if the K factor value is above 0.10 then the area would be considered highly erodible and erosion risk is higher too.
- iii) *Slope Length and Steepness Factor, LS*. The steeper and longer slope areas will show higher LS factor. Therefore, this would increase the erosion rate in the area.
- iv) *Cover Management Factor, CP*. The CP factor would increase if the area is left barren and this would certainly increase the erosion rates. The estimated CP value for any area is as shown in Table 14.1.

Table 14.1: Cropping and Management Practices Factor, CP

Land Cover	CP Factor
Water Body	0.000
Bareland*	1.000
Horticultural	0.250
Permanent Cropland	0.150
Cropland	0.200
Rangeland	0.229
Grassland	0.015
Forest	0.010
Swamps	0.001
Residential	0.003
Impervious	0.005
Commercial	0.008
Construction	1.000

\* incl. mining areas and newly cleared land (Roslan & Tew, 1996)

- v) *Soil Erosion Loss, A*. The soil erosion loss would very much depend on all the factors that influence erosion. For areas having erosion losses of more than 150 t/ha/yr, they would be considered having critical erosion risk as shown in Table 14.2. Therefore, mitigation measures would need to be proposed for erosion and sediment control for these areas to ensure minimum impact to the surrounding environment.

Table 14.2: Classification for Soil Erosion Risk (Roslan and Tew, 1995)

Soil Erosion Loss Range (t/ha/yr)	Classification (Risk)
< 50	Low
50 – 100	Moderate
101 – 150	High
> 150	Critical

The project area's weighted soil erosion loss, A for different scenarios are as detailed as below:

(i)	Pre-construction	-	73.49	t/ha/yr
(ii)	Construction	-	46.92	t/ha/yr
(iii)	Post-construction	-	28.05	t/ha/yr

Generally, the soil erosion loss before the construction period is moderately high as most of the project area had already been stripped bare from its vegetation. This has accounted to 40.55% of the area having soil losses of more than 50 t/ha/yr.

During the construction period, the erosion risk would be reduced from the present situation as the platform level is formed, while the highest soil erosion loss value recorded is 327 t/ha/yr at the western section mainly due to construction of fill-slopes there. With the Erosion and Sediment Control Plan (ESCP) in place, measures such as a four-stage construction would be introduced as well as control measures, namely the temporary earth drains will divert the soil losses into the proposed temporary silt basins/wet sediment basins/on-site detentions.

However, the soil erosion losses after the construction period would be reduced drastically with most of the project area (94.49%) having soil erosion loss of not exceeding 50 t/ha/yr.

#### 14.4 Erosion and Sediment Control Plan

The Erosion and Sediment Control Plan (ESCP) is a plan, which details temporary measures that will be implemented during the construction phase. It may include permanent measures that will remain in place once construction is completed, to control the environmental impacts of erosion and sedimentation.

An effective ESCP aims to prevent controllable erosion and minimise the adverse effects of sediment transport from on-site to off-site areas. ESCPs may range from simple plan for small sites (say less than 5 hectares) to detailed comprehensive plan for a complex development on large sites (say greater than 50 hectares) for areas of high ecological value. In general, an ESCP for an agricultural development project serves to provide:

- a clear interpretation of the impact the proposed development will have on the environment, and consequently will help to improve the quality of evaluation and interpretation by the government authorities responsible for commenting on, approving, and monitoring a project;
- a clear interpretation of proposed erosion and sediment control measures to mitigate the erosion and sediment problem;
- a saving of time and costs as both the agriculturist and the approving authority have to abide with the implementation of the plan;
- an improvement in the efficiency and cost effectiveness of the proposed erosion and sediment control measures and techniques; and
- a plan that could be easily used to verify whether approved measures implemented during construction are in place or require adjustments.

##### 14.4.1 Four-Stage Construction ESCP for Project Area

The Erosion and Sediment Control Plan involved a four-stage construction, which would only cater for Lot 1587. The proposed future development on Lot 1592 will be carried out at a later stage of time in

order to create a better hydroponic farming's platform level for the respective owners, and a separate ESCP will need to be submitted.

The four-stage construction ESCP would include the following:

- construction of four numbers of temporary silt traps, which are to be backfilled at various stages of construction as the earthworks progresses;
- temporary earth drains and six numbers of temporary silt basins/wet sediment basins/on-site detentions for Plots 1 – 6 are to be constructed at various stages of earthworks;
- temporary earth drains are to be constructed along the access road and later to be converted to permanent cascade drain upon completion of earthworks;
- hydroseeding of slope surfaces as the slope construction progresses;
- cut and fill of earth for the completed four-stage construction is to be balanced; and
- all temporary earth drains and silt basins/wet sediment basins/on-site detentions would need to be in place (*except for access road*) until the “Greenhouse Shade Structures” is completely constructed, and eventually are to be replaced with a permanent drainage system via rain gutters along the roof and pipes to be channelled to the underground on-site detentions (OSD) tanks as shown in Figure 14.3.

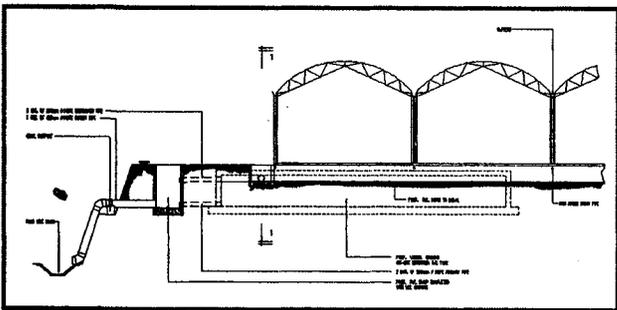


Figure 14.3: Underground On-Site Detention (OSD) Tanks

#### 14.4.2 Erosion Control Measure Principles

Erosion control is based firstly on protection of the soil surface from rain and runoff, and secondly on capturing eroded soil particles on site. The best way to control the generation of sediment is to prevent erosion. The following principles are effective in reducing the soil erosion loss and particle transport.

- **Keep disturbed areas small** – can be done through scheduling construction activities to minimize the extent and duration of exposure of bare soil. Account shall be taken of the season and in the case of quick sensitive operation, the weather forecast. The work shall be carried out in stages and the area of construction shall be limited. Should any disturbed areas be formed, it shall be stabilized immediately.
- **Protect disturbed areas against runoff from above site** – runoff from undisturbed areas above site shall be intercepted (e.g. with diversion channel) and diverted around the works.
- **Keep on-site runoff velocities low** – removal of vegetation cover increases both the volume and velocity of runoff. Contour drain, retention of natural vegetation, provision of buffer strip of

vegetation, short slopes and low gradients shall be applied (if necessary) to help keep runoff velocities low and therefore, reduce erosion.

- **Stabilized disturbed areas** – shall be done as soon as possible once land construction activities are finished. Both structural and vegetative methods can be used such as ground cover, turfing and hydro-seeding.
- **Inspect and maintain control measures** – it is vital that all control measures and management practices be inspected on a regular basis, particularly after heavy rainfall. Maintenance shall be carried out promptly.

#### 14.4.3 Sediment Control Measure Principles

Sediment control measures shall be implemented to maintain effluent water quality. The following control devices shall be adopted (where necessary):

- **Runoff Diversion Channels** – the purpose of runoff diversion channel is to protect work areas from upslope runoff and to divert sediment-laden water to appropriate sediment retention systems. Channels are among the most effective and least costly practices for control of erosion and sedimentation, in which they can be temporary or permanent. They are often designed to divert 'clean' water away from working areas and are capable of carrying the flow from the critical 5 years return period rainfall storm. It is important that a suitable erosion proof outfall is constructed as diversions concentrate water flow and increase erosion potential. The diversion shall be inspected after every rainfall and during prolonged periods of heavy rain and cleaned if need be, as sediment will often be deposited in the diversion channels due to their low grades and low velocities.
- **Contour Drains** – should be used to control runoff on construction areas and are generally of a temporary nature e.g. rebuild at the end of each day's operation or in the event of rain. They are commonly used on long, narrow sloping areas to control runoff. Grades shall not be greater than 2% and drains kept as short as practicable. Their positioning is often determined by the necessity for stable outfalls. As with diversions, these shall be checked after rainfall and during prolonged periods of heavy rainfall.
- **Earth Bunds** – used on site to control direct runoff. They shall be built near the perimeter of the site to keep sediment from leaving the area, constructed across slopes to reduce slope length, and used to divert sediment-laden water to sediment traps. They are particularly useful in controlling runoff after top-soiling and grassing before the grass is able to establish. Compacted topsoil bunds are usually used in this situation and care must be taken with their design, construction and maintenance as they would concentrate water flows and increase erosion potentials. They shall be inspected after every rainfall and any build up of sediment removed.
- **Silt fence** – Silt fences are very useful for retaining sediment from small bare areas or sites with low slope angles. They are not generally designed for concentrated runoff flows and are therefore usually unsuitable for large catchments, ditches and so on. Only in special circumstances should they be used in channel flows. In operation, the fence usually becomes clogged with fine particles, which reduce the flow rate. A pond then often develops behind the fence, which must be allowed for to avoid outflanking of the fence. Fences usually fail through undercutting or by being outflanked and require constant maintenance. If not sited correctly, they also fail through being flattened or overtopped.

## 14.5 Environmental Monitoring Programme

The soil erosion and sedimentation issues would need to be tackled at source especially during the construction phase, which involves earthworks activities. Activities within the project area such as construction of access roads, drains and vegetation clearing within Lot 1587 would cause serious erosion. If the soil erosion during this stage is not contained, sediments will be transported out of the site especially during rainy seasons. Therefore, daily routines in erosion monitoring are required.

### 14.5.1 Daily and Regular Routines in Erosion Monitoring

The Site Manager should assign on-site staff to maintain constant vigilance over the sedimentation status of drains, culverts and other control measures, such as earth drains and silt traps installed within the site. If these installations are not functioning properly, the Project Manager should be notified immediately. Gradual build-up of sediments should not be permitted behind retention structures, since these might then overflow in case of sudden flash floods. The Site Manager should ensure that sediment is removed from such structures when this is required to maintain their retention capacity.

Maintenance schedules and instructions for maintaining control measures need to be developed by the Site Manager. It is the responsibility of the contractor to ensure that the major provisions of the Erosion and Sediment Control Plan (ESCP) are being adhered to. A routine end-of-day maintenance check and keeping of on-site records are strongly recommended before, during and post rain periods (see **Annex 14.A**). All maintenance schedules should be specified on the plans. The plans should also remind the contractor of his responsibility to inform other construction workers about the erosion and sediment features on the site.

### 14.5.2 Soil Erosion and Sedimentation Monitoring

#### (i) Frequency

Soil erosion within the site should be monitored by the Site Manager and on-site workers assigned to the task. If erosion problems arise that are not contained by the installed mitigation measures, the Project Manager should be notified immediately. Sediment build-up on the silt traps should be monitored weekly and reported to the Project Manager. Evaluation of the contractor's compliance with recommended mitigation measures and adherence to applicable guidelines in relation to the earthworks practice should be performed every two months.

#### (ii) Methodology

*Sediment transport within the project site:* Permanent reference poles with vertical measurement scales and clearly visible reference numbers should be placed at the four silt traps and six silt basins proposed within the site. The Site Manager or staff assigned to the task should take photographs of the submerged sections of the reference poles each week using a digital camera, and submit the photographs via email to the Project Manager, thus allowing him/her direct and visual assessment of the sedimentation within the project area.

*Monitoring of implementation of mitigation measures and earthworks practices:* The Consultant is to perform monthly field surveys to oversee that all proposed mitigation measures for soil erosion and sedimentation are in fact installed, maintained, and operational.

### 14.5.3 Monitoring Stations

Ten numbers of monitoring stations for soil erosion and sedimentation are proposed with four located on silt traps and six located on silt basins within the project area. The Project Manager should be notified on a regular basis the performance of each of these stations and instruct the on-site staff to carry out maintenance works when necessary.

### 14.6 Conclusion

The soil erosion and sedimentation assessment, control and monitoring plans for an agricultural project provides vital information on the high soil erosion risk areas during the earthwork stage, erodibility of the soil as well as mitigation measures to be taken to minimize soil erosion loss at site. Risk months which have also been identified for better planning and scheduling of earthworks activities within the project area. The Erosion and Sediment Control Plan (ESCP), Stormwater Management as well as the Environmental Monitoring Programme would assist in minimizing the erosion and sedimentation on site and off site.

Last but not least, mutual responsibilities and commitment by both the approving authorities and the respective agricultural project proponents should also be emphasized in order to ensure that soil erosion and sedimentation arising from the agricultural activities in Cameron Highlands could be effectively controlled and minimized for the benefit and interest of all parties concerned and the general public at large.

### 14.7 General Recommendations

The general recommendations for agricultural projects as listed below:

- i. Monitoring of the earthworks during earthworks at the proposed site according to what is set out in the '*Environmental Monitoring Programme*' has to be carried out periodically in order to ensure the proposed temporary earth drains, silt traps and silt basins/wet sediment basins/on-site detentions are functioning properly.
- ii. Adherence to the '*Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia*' and '*Erosion and Sediment Control Plan*' should be complied with and the drainage should be designed according to '*Design Standard and Procedure for Peninsular Malaysia*' and '*Urban Stormwater Management Manual for Malaysia (MASMA)*'.
- iii. Proposed cut and fill slopes at the project area are to be covered with Erosion Control Mattress (ECM) / Permanent Turf Reinforcement Mattress (P-TRM) before hydroseeding to prevent erosion.
- iv. Vegetating and mulching of filled areas should be carried out. Also, temporary covers such as plastic sheets should be provided at the earthworks areas that are prone to soil erosion during rainy season.
- v. Maintenance schedules and instructions for maintaining control measures need to be developed. It is the responsibility of the contractor to ensure that the major provisions of the sediment control plan are being adhered to. A routine end-of-day maintenance check is strongly advised. All maintenance schedules should be specified on the plans. The plans should also remind the contractor of his responsibility to inform other construction workers about the erosion and sediment features on the site.

**Bibliography**

- Beasley, R. P. (1972). *Erosion and Sediment Pollution Control*, Iowa State Univ. Press, USA.
- Hudson, N. W. 1979. *Soil Conservation*, Cornell Univ. Press, USA.
- Morgan, R. P. C. (1993). *Soil Erosion and Conservation*, Longman Scientific & Technical, New York, USA.
- Roslan, Z. A. and Tew, K. H. (1995). Erosion Study in Cameron Highlands, *Malaysian Science and Technology Congress*, Perdanasiswa, Universiti Malaya, Kuala Lumpur, Malaysia.
- Roslan, Z. A. and Tew, K. H. (1996). Determination of the Land Use Management Factors of the USLE in reducing Soil Erosion Loss, *Tenth Congress of the Asia and Pacific Division (APD) of the International Association for Hydraulic Research (IAHR)*, Langkawi, Kedah Darul Aman, Malaysia.
- Rubber Research Institute of Malaysia (1980). *Soil Erosion and Conservation in Peninsular Malaysia*, Kuala Lumpur, Malaysia.
- Tew, K. H. (1996). *Production of Malaysian Soil Erodibility Nomograph in Relation to Soil Erosions Issues*, M. Eng. Thesis Dissertation, UTM Skudai, Johor Darul Takzim, Malaysia.
- Wischmeier, W. H. and Smith, D. D. (1978). Predicting rainfall erosion losses - a guide to conservation planning, USDA, *Agriculture Handbook No. 537*, USA.

**ANNEX 14.A**  
On-Site Records

INSPECTION TYPE:				
Routine Weekly	Pre-Rain	During Rain	Post Rain	
DATE: _____		FOR WEEK ENDING: _____		
WEATHER: _____		STORM START TIME: _____		
		STORM DURATION: _____		
TIME ELAPSED SINCE LAST STORM: _____				
INSPECTED BY: _____				
(print name)		(title)		
_____				
(signature)				
Check "Yes", "No" or "N/A" if not applicable.				
NO.	DESCRIPTION	YES	NO*	N/A
1.	Are all erosion control devices in-place and functioning in accordance with the erosion control plan?			
2.	Are all sediment traps, barriers, and basins clean and functioning properly?			
3.	Are sediment controls in place at site perimeter and storm drain inlets?			
4.	Are all discharge points free of any noticeable pollutant discharges?			
5.	Is sediment, debris, or mud being cleaned from public roads where they intersect with site access roads?			
6.	Are all exposed slopes protected from erosion through the implementation of acceptable soil stabilization practices?			
7.	Are all temporary stockpiles or construction materials located in approved areas and protected from erosion?			
8.	Are dust control measures being appropriately implemented?			
9.	Are all materials and equipment properly covered?			
10.	Are all material handling and storage areas clean and free of spills, leaks, or other deleterious materials?			
11.	Are all equipment storage and maintenance areas clean and free of spills, leaks, or any other deleterious materials?			
12.	Are all on-site traffic routes, parking, and storage of equipment and supplies restricted to designated areas?			
13.	Other? (explain below)			

## CHAPTER 15

# CONCLUSIONS AND RECOMMENDATIONS OF THE SEMINAR ON SUSTAINABLE DEVELOPMENT IN CAMERON HIGHLANDS

11-12 December 2004

Hotel Rosa Pasadena, Brinchang, Cameron Highlands

Organized By

UNIVERSITI SAINS MALAYSIA

With Support from

BRITISH COUNCIL

Chan Ngai Weng (Editor)

Professor

School of Humanities

Universiti Sains Malaysia, 11800 USM Penang, Malaysia

Email: [nwchan@usm.my](mailto:nwchan@usm.my)

### 15.1 Introduction

Cameron Highlands is a major tourist attraction and an important agricultural region in Malaysia. More importantly, it is also a major water catchment area housed within some of the world's oldest rainforests in the lower elevations and rich montane forests in its hills. The forests also act as rich biodiversity reservoirs, climate control, green lungs, water catchments, habitats for fauna and flora, livelihood for indigenous people, and natural flood defence. Hence, Cameron Highlands is an extremely environmentally and ecologically sensitive area with vital natural functions. However, rapid development in Cameron Highlands over recent decades has changed land use profoundly. A variety of development in urbanization, tourism, agriculture, housing, highways and other infrastructure has mushroomed. All these have brought about negative consequences on the pristine environment, viz. climate change resulting in hotter temperatures, lower rainfalls, soil erosion and landslides, water pollution and scarcity, loss of biodiversity, loss of hunting and gathering habitat for the orang asli, downstream flooding, etc. But development is necessary for society and country to progress. What is unnecessary is development that destroys the environment and our natural resources. Hence, a balance needs to be found between the need for development and the need for conservation. It is against this background that this seminar was organized bringing together Government, Industry, NGOs and all stakeholders to debate and find the best solutions forward. As far as the organisers are concerned, all attempts have been made to invite all relevant government departments, institutions, private companies, NGOs and the public to participate as it is imperative that all stakeholders work together to come up with the following recommendations to ensure the sustainable development of Cameron Highlands.

### 15.2 Recommendations

#### (1) Gazettement of a National Park in Cameron Highlands

Currently, despite being recognized as one of the most environmentally and ecologically sensitive areas in the country that also functions as vital water catchments and forest reserves, there is no national or state park in Cameron Highlands. Because of its fragility and important functions, it is recommended that the Pahang State Government, possibly in consultation with the Ministry of Natural Resources and

Environment, start working towards the gazettement of such a park (either a State or National park). The criteria for selection of area should be based on the following:

- its current status and land use should be a natural area – for example, forest reserve rich in flora and fauna is suitable
- its adaptability to change (whether environmental change or climate change) is low
- there should be strict minimum elevation and size
- the gazettement of stateland forests into forest reserve (water catchment, soil protection) to include the remaining clean rivers

## **(2) Expedite the Preparation of the Cameron Highlands Structure Plan**

The Majlis Daerah Cameron Highlands (MDCH) is in the process of preparing the Master Plan but it is not finished yet. The process needs to be speeded up and the plan put in place to guide development.

## **(3) Eco-audit for planning purposes in all sectors**

Currently, there is no eco-audit for the major sectors of development such as tourism, agriculture and housing. The Department of Environment should be the main body overlooking this, possibly with assistance from the State Government and Local Government (MDCH).

## **(4) Maintaining Water Quality of Rivers**

Due to many reasons, the quality of river water in Cameron Highlands has deteriorated alarmingly. Hence, it is recommended that the rivers, especially those used for abstracting water supply, be protected as well as restored. The DOE, JPS, JBA, Forestry, Health Department and MDCH should be the lead agencies involved in this. Some of the recommended measures include:

- River Restoration
- Gazettement of River Reserves and Buffer zones
- Monitoring of water pollutants
- Need of an integrated water supply to farms
- Advocate drip irrigation for farms
- Enforcing the Polluter pay principle
- Generate greater levels of environmental awareness and education

## **(5) Advocate good agricultural practices**

Agriculture has often been blamed for the degradation of land and environment in Cameron Highlands. This is predominantly due to the traditional practices of excavating hill slopes and farming on exposing farm. The Ministry of Agriculture should be the lead agency in charge of implementing this section. It is recommended that farmers adopt good agricultural practices to minimize the adverse effects on the land via the following:

- Strict control of usage of pesticide
- Use of composted chicken dung
- Promote Recycling of Organic Waste from farms into Compost
- Mandatory Erosion control and recommend ESCP for new and existing projects
- Use Recovery of investment (tax)
- Promote Organic Farming with Certification
- Promote Crop Cover instead of farming on exposed land
- Promote Terracing

- Promote Drip Irrigation
- Promote all other forms of environmentally friendly farming practices

#### **(6) Tourism**

Cameron Highlands is one of the top tourist destinations in the country, both for foreign as well as for local tourists. Hence, it is imperative that the tourism sector be sustainable. More importantly, what attracts the tourists must not be destroyed or degraded to such an extent that tourists are no longer attracted. Already, it has been shown that the climate is now warmer than it was several decades ago. The natural assets and attributes of Cameron Highlands need to be preserved in order that tourism be sustainable. The lead agency, obviously will be the Ministry of Tourism with collaboration from the Cameron Highlands Tourism Development Association (CHTDA) and other organizations. The following recommendations apply:

- Focus on Ecotourism as Cameron Highlands possess enchanting and attracting natural treasures such as forests, unique flora and fauna, rich biodiversity, highland geomorphology and geology, cool climate, etc.
- Mass-tourism should not be encouraged as Cameron Highlands is not a city like Kuala Lumpur or Penang. Mass tourism will eventually make tourism sector unsustainable via environmental degradation and overcrowding.
- Promote the involvement of local communities and Orang Asli in the tourism sector, notably as guides in ecotourism
- Provide Standards and certification for the practice of tour operators, tour guides and other workers in the tourism sector to make it professional

#### **(7) Awareness and education programme for all stakeholders**

Deterioration of the environment and its quality in Cameron Highlands cannot be blamed squarely on one sector or any group of persons. All stakeholders are responsible. Hence, awareness and education should be extended to all. The lead agencies should be the Department of Education, NGOs such as REACH, MNS and WWF-Malaysia, the Land Office and MDCH. The targets should be farmers, land developers, hoteliers, traders, tourists and the public. Some recommendations to increase awareness and education are:

- Involve local communities
- Representation of local communities in the local council
- Education on farming methods (do's and don'ts)
- Education and awareness for tourists (do's and don'ts)
- Education of land developers, especially those who are not locals
- Local authorities to be made aware of the need to balance development with conservation
- School children to be a main target group for environmental education

#### **(8) Intensify Interdepartmental coordination**

Lack of consultation, collaboration and cooperation due to sectoral based development and the safeguard of self-interest has always been a stumbling block towards greater integration of organizations in many states in Malaysia. In the case of Cameron Highlands, there is a need to foster greater cooperation and support between different government departments, private organizations and the public for more effective management of the highlands. In this respect the following are recommended:

- Special Units to be developed in MDCH to look into the viability of interdepartmental coordination and collaboration amongst government agencies

- Various other government departments such as JKR, DOE, JPS, Land Office, Forestry Department etc to also look into the viability of interdepartmental coordination and collaboration with other government agencies dealing with similar issues
- Intensify interdepartmental cooperation on environmental issues and monitoring (MARDI, MMS, DOE, Universities, Research Institutions)
- Greater collaboration and coordination also needed between government agencies and NGOs on environmental issues.

**(9) Research and Development on highland issues**

The highlands in Malaysia are unique ecosystems rich in biodiversity and natural resources but research in highland ecosystems is lacking. A great deal of flora and fauna have also not been documented. Interactions between the various ecosystems and physical systems are extremely complex and needs to be understood better. In this respect the following recommendations are proposed:

- Setting up of Field Research Centre and Research Institute (for research, student exchange, etc) in Cameron Highlands
- Development of more research initiatives in the mountains. For example National Geographic can be invited to study and film a documentary of Cameron Highlands.
- Intensify research on environmental issues by government agencies (MARDI, MMS, DOE, Universities, Research Institutions)
- Intensify research on environmental issues by NGOs (REACH, WWF Malaysia, MNS, etc)
- Collaborative research between government agencies and NGOs

**(10) Enforcement and Monitoring (DOE, MDCH, Land & District Office, JPS)**

More frequent monitoring and stricter enforcement by the authorities need to be carried out. Government should collaborate with NGOs and the public by giving incentives to NGOs and the public who report illegal activities (for example illegal clearing of forest or open burning). NGOs and the public who work on the ground are the government's best "eyes". Equally, guilty offenders must be severely punished with hefty fines, suspension/cancellation of licence or jail.