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FOREST DIEBACK IN HORTON PLAINS NATIONAL PARK

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ABSTRACT

The pattern of forest dieback in Horton Plains National park was investigated during a one year research project conducted in 2006. During the project three hectares of the forest was sampled in three sites showing different degree of dieback (namely Anderson I, Anderson II and Thotupolakanda). Totupolakanda site is represented a severe dieback site while Anderson I site has undergone moderate dieback. Anderson II is a comparatively healthy site. During this study the nature and possible causes of forest dieback in the selected sites in the park area were investigated. A total number of 6191 trees belonging to 39 species in 26 genera and 17 families were recorded. Of the total number of trees recorded, 1343 were canopy dominant trees while 4643 were found in the sub-canopy. In addition 105 trees were recorded in the understory while 100 live fallen trees were also recorded. The most dominant families were Lauraceae, Myrtaceae and Symplocaceae. *Cinnamomum ovalifolium* was the most abundant species in Anderson I site and *Symplocues cordifoliya* were the most abundant species in Anderson site II. *Cinnamomum ovalifolium* and *Syzygium rotundifolium* were the dominant species in Totupolakanda site. Highest percentage of canopy and understory trees was recorded in Anderson I site and the highest percentage of sub canopy trees was recorded in Anderson II site. Percentage of unhealthy trees in Anderson II site is larger than the other two sites and it was about 39.78%. Further, the highest percentage of healthy tree was also recorded in Anderson II site. The study finds that the bark damage by sambar (*Cervus unicolor*) may entice stem defect of a tree which will eventually lead to a death of a tree. However, the causes of foliage discoloration, defoliation or crown dieback could not be evaluated.

KEY WORDS: Forest dieback, Montane grasslands, Montane forest, Sambar

INTRODUCTION

Horton Plains National Park is a protected area in the central highlands of Sri Lanka and is located in between 1550m to 2500m elevation range (above sea level) and covered by montane grasslands and cloud forests (Werner and Balasubramaniam, 1992). According to Werner (1982,1988), upper montane rain forests cover an area of approximately 400km^2 in the central mountains of Sri Lanka. The plain's vegetation is grasslands interspersed with montane forest, and includes many endemic woody plants. Large herds of Sri Lankan Sambar Deer (*Cervus unicolor*Family: Cervidae) feature as typical mammals, and the park is also an important bird area with many species not only endemic to Sri Lanka but limited to the Horton Plains.

The vegetation of the park is classified into two distinctive groups, wet "patana"grasslands (Muller-Dombois and Perera, 1971) and evergreen upper montane rain forests (Werner and Balasubramaniam, 1992). According to Balasubramaniam *et. al.* (1993), nearly 57 species of

woody plants belonging to 30 families have been recorded from the park. Among these, about 50% of woody species are endemic to Sri Lanka. Werner (1988) reported that trees in upper montane rain forests are umbrella shaped and 3 to 5 m tall. The forest canopy, mostly *Calophyllum walkeri* reaches the height of 20 meters (Balasubramaniam and Werner, 1992). The under story is characterized by *Strobilanthes* spp. which reaches 3m in height and dwarf bamboo species such as *Indocalamus* and *Ochlandra* are also found in the undergrowth layer (Werner, 1988). *Rhodomyrtus tomentosa* bushes specially grow in forest margin and near the mountain peaks (Balasubramaniam and Werner, 1992).

Forest dieback phenomenon was first reported in late 1970's on the slope of Thotupolakanda (Perera, 1978). He found that nearly 50% of *Calophyllum* and *Syzygium* trees were dead or dying. Further, the same phenomenon has been found around Kirigalpotta and in the Knuckles mountains (Werner 1982, 1988). Water deficiency has been attributed as the main cause of dieback as droughts are becoming more frequent (Werner, 1988). Moreover, canopy dieback has been observed on the western slopes, where heavy winds increase the effect of dry spells, by Werner and Balasubramaniam, (1992). A study on distribution of different soil nutrient levels by Ranasinghe *et. al.* (2007) found an association between soil concentration and forest die back in Horton Plains.

Main objectives of this study were to estimate the degree of dieback in some selected areas within the park.

METERIALS AND METHODS

Three forest sites depending on the degree of dieback were selected for detailed vegetation sampling. Totupolakanda was selected to represent a severe dieback site (Fig 1.).

Figure 1. Totupolakanda site

A site with moderate dieback (Anderson Site I,) was selected near the Ginihiriya (Anderson Bungalow) along the Ohiya Road

Figure. 2 Anderson Site I

Third sampling site (Anderson II) representing comparatively healthy forest patch (Fig. 3) was selected in an area between the Totupolanka and Anderson sites (Fig. 4).

Figure. 3 Anderson Site II

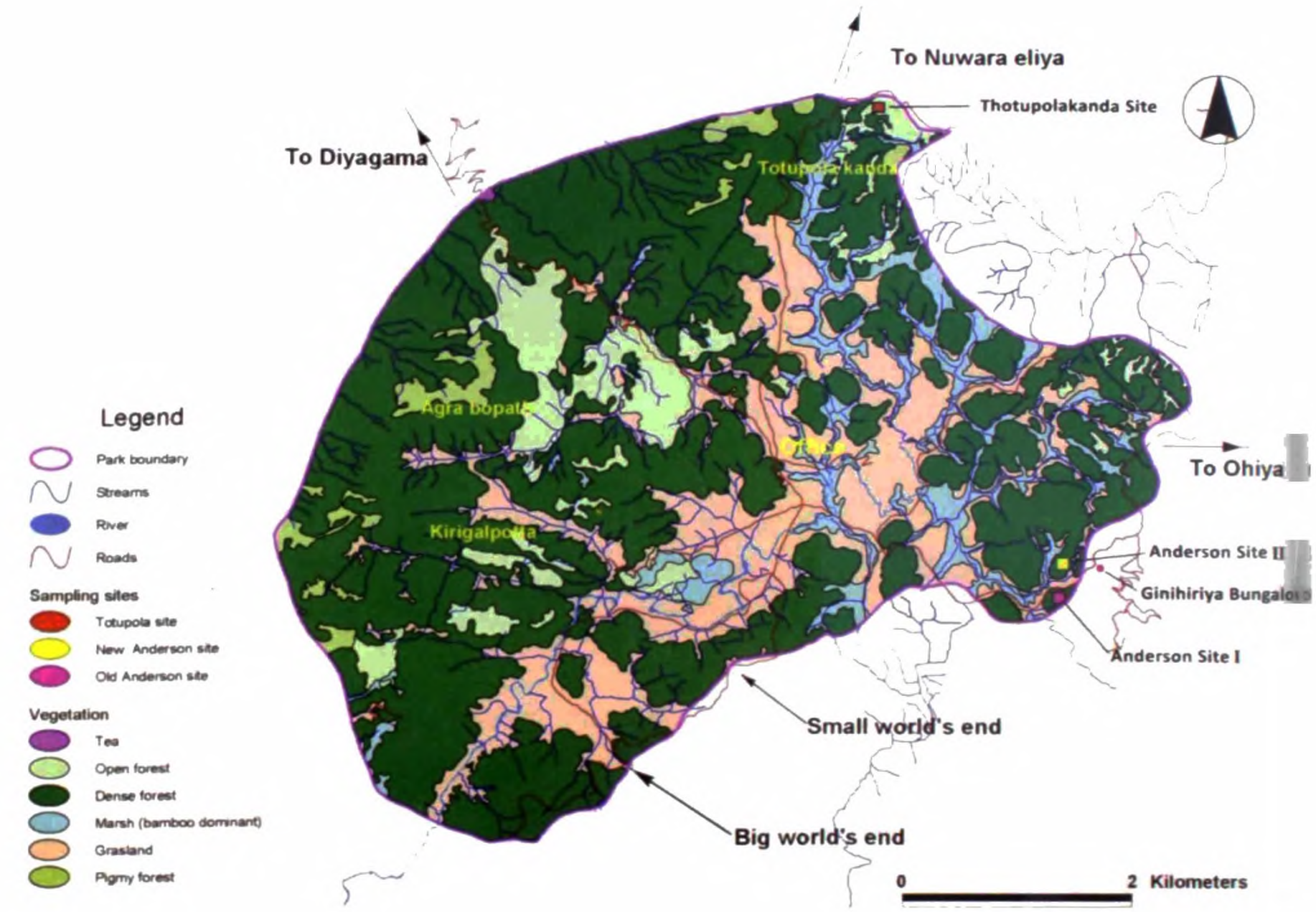

Figure 4. Map of Horton Plains National Park showing sampling sites

A number of dead trees in the canopy was used as a basis for selecting sampling sites at different levels of dieback. At each sampling site 1ha area of the forest was sampled. Every individual tree species (above 1m in height, and DBH > 2.5 cm) encountered in the sampling sites was identified, counted and the stratification (canopy or sub canopy) was noted. The trees were carefully examined to record their health conditions. Further, the number of live standing trees, dead standing trees, live fallen trees and dead fallen (logs) in each sampling plot was recorded. Trees that did not carry any of these defects were treated as healthy.

RESULTS AND DISCUSSION

A total number of 6094 trees belonging to 39 species in 26 genera and 17 families were recorded. Of the total number of trees recorded, 1348 were canopy dominant trees while 4641were in the sub-canopy layer. The most dominant families were Lauraceae, Myrtaceae and Symplocaceae. *Cinnamomum ovalifolium* and was the most abundant species in Anderson I site and *Symplocus cordifoliya* was the most abundant species in Anderson site II.. *Cinnamomum ovalifolium* and *Syzygium rotundifolium* were the dominant species in Totupolakanda site (Table 1)

Four factors namely foliage discoloration, defoliation, stem defect and bark damage which may lead to death of a tree were noted during sampling (Fig. 1 to 4).

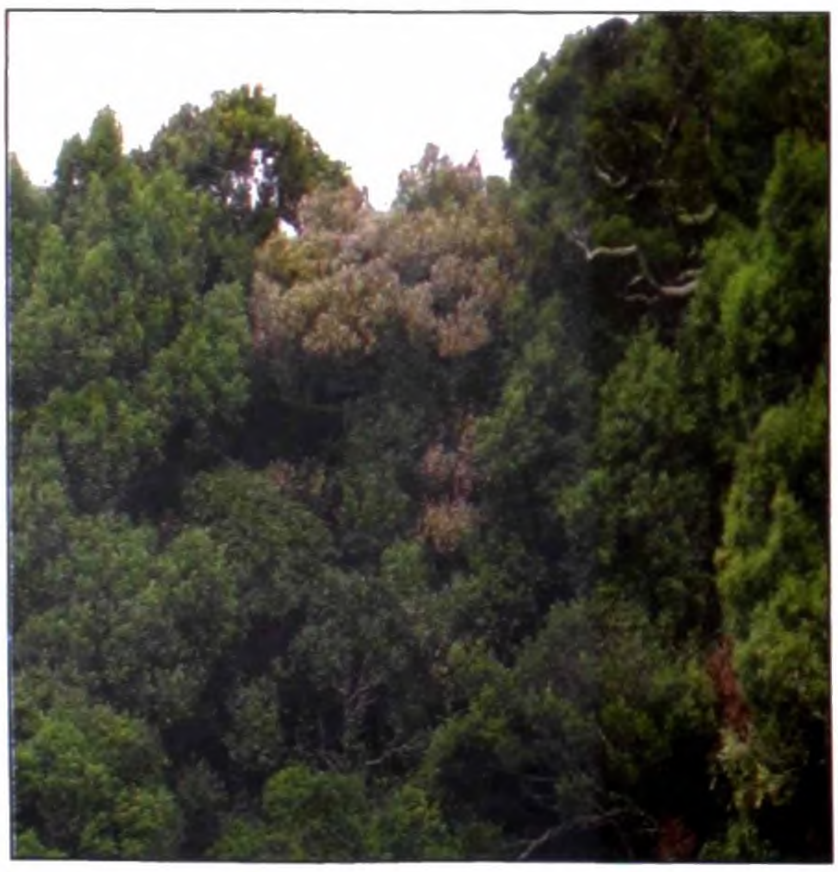

Figure.5 Foliage discoloration

Figure.6 Defoliation

Figure. 7 Bark damage

Figure. 8 Stem defect

Table 1: Relative densities of trees recorded in three sites

			Sampling Sites		
			Anderson 1	Anderson 2	Thotupolakanda
Family	**Species**	**Life form**	**Relative Density (%)**		
Aquifoliaceae	*Ilex walkeri*	Tree	5.04	1.32	5.98
Aquifoliaceae	*Ilex zeylanica*	Tree	-	-	0.08
Caprifoliaceae	*Virburnum coriaceum*	Small tree	0.05	0.11	-
Celastraceae	*Microtopic zeylanica*	Tree	4.21	12.39	3.86
Clusiaceae	*Calophyllum walkeri*	Tree	8.38	8.39	3.03
Eleocarpaceae	*Elaeocarpus montana*	Tree	0.58	0.14	0.68
Eleocarpaceae	*Elaeocarpus serrtus*	Tree	0.10	0.39	0.08
Ericaceae	*Vaccinium lachenaultii*	Small tree	4.70	2.86	-
Ericaceae	*Vaccinium symplocifolium*	Tree	-	-	3.63
Ericaceae	*Rhododendron arboreum*	Tree	0.10	0.29	1.82
Eurphorbiaceae	*Glochidion picnocarpum*	Tree	6.30	6.46	0.98
Lauraceae	*Cinnamomum ovalifolium*	Tree	17.43	6.43	18.93
Lauraceae	*Actinodaphne speciosa*	Tree	4.07	11.50	-
Lauraceae	*Neolitsea fuscata*	Tree	4.16	11.11	0.30

Lauraceae	*Litsea ovalifolia*	Tree	4.41	2.04	6.21
Lauraceae	*Actinodaphne molochina*	Small tree	3.54	0.57	-
Lauraceae	*Actinodaphne ambigua*	Small tree	0.73	-	4.47
Lauraceae	*Actinodaphne galauca*	Small tree	0.24	0.68	-
Mangoliaceae	*Michelia nilagirica*	Tree	0.15	0.54	-
Meliaceae	*Toona sp.*	Tree	-	0.04	-
Myrtaceae	*Syzygium rotundifolium*	Tree	3.68	6.14	22.86
Myrtaceae	*Syzygium umbrosum*	Tree	1.31	-	-
Myrtaceae	*Eugenia thwaitesii*	Small tree	0.48	-	-
Myrtaceae	*Myrsin robusta*	Small tree	0.24	-	-
Myrtaceae	*Syzygium fergusoni*	Small tree	-	-	0.15
Oleaceae	*Olea poligamma*	Small tree	-	0.82	1.14
Pittisporaceae	*Pittesporum zelanicum*	Small tree	1.07	0.71	2.12
Pittisporaceae	*Pittesporum tetrapermum*	Small tree	0.10	-	-
Rubiaceae	*Pavetta involucrata*	Small tree	-	-	1.74
Rubiaceae	*Psycottria zeylanica*	Shrub	0.15	-	-
Rutaceae	*Melicope lunu ankenda*	Tree	0.77	0.25	-
Symplocaceae	*Symplocos cordifolia*	Tree	2.08	20.50	1.51
Symplocaceae	*Symplocos obtusa*	Small tree	11.23	1.75	10.52
Symplocaceae	*Symplocos elegans*	Small tree	4.94	0.50	2.35
Symplocaceae	*Symplocos cochinchinensis*	Tree	1.50	1.46	0.08
Symplocaceae	*Symplocos bractalis*	Small tree	0.73	-	-
Theaceae	*Eurya chinensis*	Small tree	4.84	2.39	7.49
Theaceae	*Adinandra lasiopetala*	Small tree	2.62	0.21	-
Theaceae	*Gordonia ceylanika*	Tree	0.10	-	-

In all three sites most of the trees were in the sub-canopy layer and a small number of trees were seen in the understory layer. The proportion of unhealthy trees in the sampling sites is greater than proportion of healthy trees indicating that most of the trees in three sites are showing some signs of dieback. The percentage of healthy tree is less than 10% in Anderson I and Thotupolakanda sites and in Anderson II site it is about 20%. The highest percentage of healthy trees as well as unhealthy trees was found in Anderson II site. Bark damages and stem defects were less than 25% in the sites. Least percentage of healthy trees and the highest percentage unhealthy tree was found in Thotupolakanda site indicating the severity of dieback in the area (Table 2).

Table 2: Summary table of tree characteristics

Category		Sites		
		Anderson I	**Anderson II**	**Totupolakanda**
		Percentage occurrence		
Stratum	Canopy	32.63	15.71	19.37
	Sub-Canopy	62.78	84	80.32
	Understory	4.59	0.29	0.31
Tree Condition	Unhealthy	91.97	79.91	96.7
	Healthy	8.03	20.09	3.3
Bark damage (%)	0	69.85	84.82	50.35
	1.0-25.0	17.56	11.68	28.15
	25.0-50.0	7.75	2.97	14.01
	50.0-75.0	4.37	0.43	5.52
	75.0-100.0	0.48	0.09	1.97
Stem defect (%)	0	87.09	95.57	76.79
	1.0-25.0	7.79	2.88	11.86
	25.0-50.0	2.78	1.3	7.29
	50.0-75.0	1.99	0.19	2.73
	75.0-100.0	0.36	0.06	1.33
Tree stature	Dead Fallen	7.91	7.62	6.85
	Dead standing	10.09	5.61	9.38
	Live Fallen	1.03	1.18	0.95
	Live Standing	80.97	85.59	82.82

During this study 39 woody plant species were recorded in the three sampling sites. Majority of the species were belonging to three dominant families namely Lauraceae, Myrtaceae and Symplocaceae.The most abundant species include *Cinnamomum ovalifolium, Syzygium rotundifolium* and *Symplocus cordifoliya*. More than 80% of trees in the sampling sites has shown some sign of dieback.A survey carried out using transects method across the park during 1997-1999 also confirms these findings.However, the previous study showed that only 38% of 6532 individuals sampled carried some sign of dieback(Adikaram *et. al.*, 1999). Therefore, the present study indicates the forest dieback in the park is in the increase.

Most of *Cinnamomum ovalifolium*, *Syzygium rotundifolium* and *Neolitsea fuscata*trees encountered in the sample carried stem defects. These three species together with *Symplocos obtuse* are also susceptible to bark damage by sambar. It can be concluded that bark damage will initiate the decay of woody trunk of trees thereby weakening a tree leading to a 'dead standing' tree. A tree with heavily damaged trunk (stem defect) will be subjected to break under heavy winds. This may be a one reason for recording considerable portion of dead fallen trees in the

park. It has been identified that sambar had a considerable impact on the vegetation of Horton Plains (Adikaram *et. al.*, 1999).

However, causes of foliage discoloration, defoliation or crown dieback (Fig.9) could not be determined during the study. There may be a combination of environmental factors affecting the tree heal in Horton Plains and other upper montane regions of the country. Therefore, detailed studies should be initiated to understand the problem, to evaluate the extent of dieback and finally to find ways to control the forest dieback conditions.

Figure.9 Crown dieback

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