



## **Influence of rainfall, environmental temperature and ecological changes on mammal activity, at two habitats (secondary forest and Pinus plantation), Hanthana Mountain, Peradeniya, Sri Lanka**

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### **Abstract**

Trapability and activity of animals in a particular habitat will vary with time depending on various ecological factors. Here we mainly focused on effect of rainfall, environmental temperature and other environmental changes on mammal activity. Study was conducted in two habitats located in Hanthana mountain area: Pinus plantation and Natural secondary forest. Mammals were detected using hair tubes. Study was conducted five months from November - 2011 to March - 2012. Five small mammal species *Mus musculus*, *Rattus rattus*, *Rattus norvegicus*, *Bandicota indica* and *Ratufa macroura* were identified. Large number of hair samples was collected with high rainfall along with relatively high environmental temperature. Almost no hair samples were collected when high rainfall shared with low environmental temperature. As pinus plantation experienced forest fire, amount of trapped hair samples decreased. But following rainfall pinus ground vegetation reappeared and higher number of hair samples got trapped. These results suggest that small mammal activity is positively correlated with the environmental temperature and negatively correlated with the rainfall. It also shows that, small mammals prefer areas with high ground cover; vegetation or litter.

**Keywords :** Hair tubes, rainfall, temperature and ground cover

### **Introduction**

Fundamental to studies involving the determination of the abundance of animals by census techniques is the assumption that their detectability remains constant through the time. However environmental parameters may affect the behavior and therefore the detectability of animals, and this changed between sample periods as these parameters vary (Goldingay *et al.*, 1998).

For example terrestrial animals show increased activity on warm cloudy nights with even greater activity when these conditions are accompanied by rain (Golly *et al.*, 1975). Unfortunately only few studies have examined the effect of such factors (Brennan, 2006). In addition to weather affects abundance and 'trapability' of small mammals (Golly *et al.*, 1975). Usually the effect of weather on

small mammal activity is discussed in general terms or in respect to the most obvious weather variable. Though studies show that weather effects are difficult to isolate due to the correlation and interactions between variables such as rainfall, humidity, temperature, moon light, barometric pressure, season, habitat and species (Taylor, 2004).

Under this study we mainly concerned about effect of three variables on small mammal activity, including rainfall, air temperature and occasional forest fires. Rainfall is a key factor to consider, as a study site located in the central hills, where very high amount of rainfall is observed throughout the year. However responses to rain are well documented for several mammal species (Goldingay *et al.*, 1986). Even though most of the

studies observed increase in mammal activity following the rain, so far it is little understood. The animals may seek areas of shelter in which to forage rather it reflect an increase in activity (Knopf *et al.*, 1996). On the other hand some recent studies showed rainfall to be significantly related to the trepatibility of the yellow-footed Antechinus (Kavanagh *et al.*, 1998).

Air temperature has a direct impact on small mammals (Wright *et al.*, 1992). Because changes in air temperature will cause changes in the type of habitat selected and detain of daily activity of mammals (Brown, 1974). As sudden climatic changes are very common in the study site, this is a very important factor to assess.

Understanding how fire influences the distribution of biota in fire prone environments is essential for effective ecological and conservation management (Kelly, 2010). However, small mammal populations display variable responses to prescribed burning depending on species-specific habitat requirements (Brennan, 2006). There may affect small mammals in directly or indirectly through changes in environmental conditions (Knopf and Samson, 1996).

The objective of this study is to evaluate the effect of rainfall, environmental temperature and man-made forest fires on the distribution, abundance and activity of mammals in secondary forest habitat and pinus plantation.

### Materials and Methods

A Study was conducted in two habitat types located in Hantana mountain area: Pinus plantation (06°26'N, 80°25'E, elevation 460 m) and natural secondary forest (06°26'N, 80°25'E, elevation 460 m). Mammals were detected by using hair tubes which is an efficient and advantageous method of mammal censing compared to other methods (Entwistle *et al.*, 2000).

A total of 80 hair tubes, 40 in each habitat were placed every month for five consecutive

days each month from November 2011 to March 2012. Fried pieces of coconut were used as the bait. Trap locations were selected and tagged. Daily mean rainfall data on the study site for each trial was obtained from the Meteorological Department of Sri Lanka. Environmental temperature was recorded 4 times a day and daily mean temperature was calculated. Prominent ecological changes of the pinus plantation were recorded throughout the study. Collected hair samples were identified using Amerasinghe (1983).

### Results

In both secondary forest and pinus plantation five species of mammals were identified through collected hair samples, which include *Mus musculus*, *Ratufa macroura*, *Bandicota indica*, *Rattus norvegicus* and *Rattus rattus*.

During the rainy periods, number of trapped hair samples decreased in both forest habitats (Fig. - 1), and pinus plantation (Fig. - 2). This is clearly illustrated in 2-Dec, 3-Dec, 3-Feb, 2-Apr and 3- Apr dates. During these days almost no hair samples were collected. But during drier periods with negligible amount of rainfall or without rainfall comparatively higher number of hair samples was detected. This is visibly evident in both forest and pinus plantation during January 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and march 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>. In forest habitat 53 hair samples were collected. From them only 3 (5.66 %) samples were collected during the rainy days. All of the other 50 (94.34 %) samples were collected when there was no or less rain. In Pinus habitat 38 samples were found. Out of 38, only 3 (7.89 %) samples were collected during the days with high rainfall. Remaining 35 (92.11 %) were collected during less or no rainfall days.

As the temperature increases number of collected hair samples also increased in both secondary forest and pinus plantation (Fig.-1 and 2). The maximum number of hair samples were trapped when high environmental temperature January 2<sup>nd</sup>, March 2<sup>nd</sup>, March 3<sup>rd</sup> and March 4<sup>th</sup>).

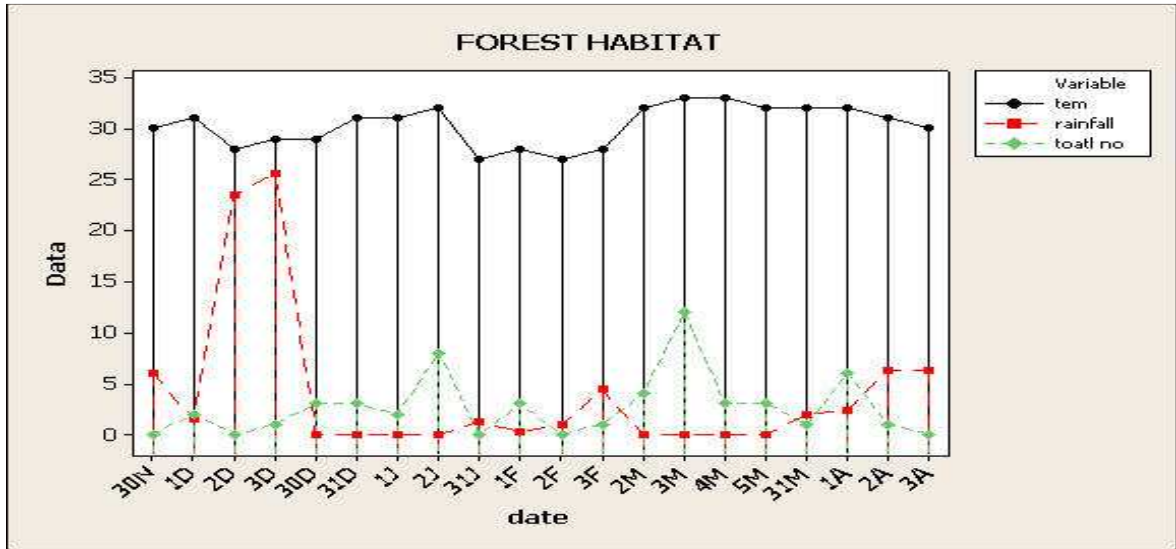


Fig. - 1. Variations of number of trapped hair samples with environmental temperature and rainfall in secondary forest habitat, Hanthana Mountain, Sri Lanka

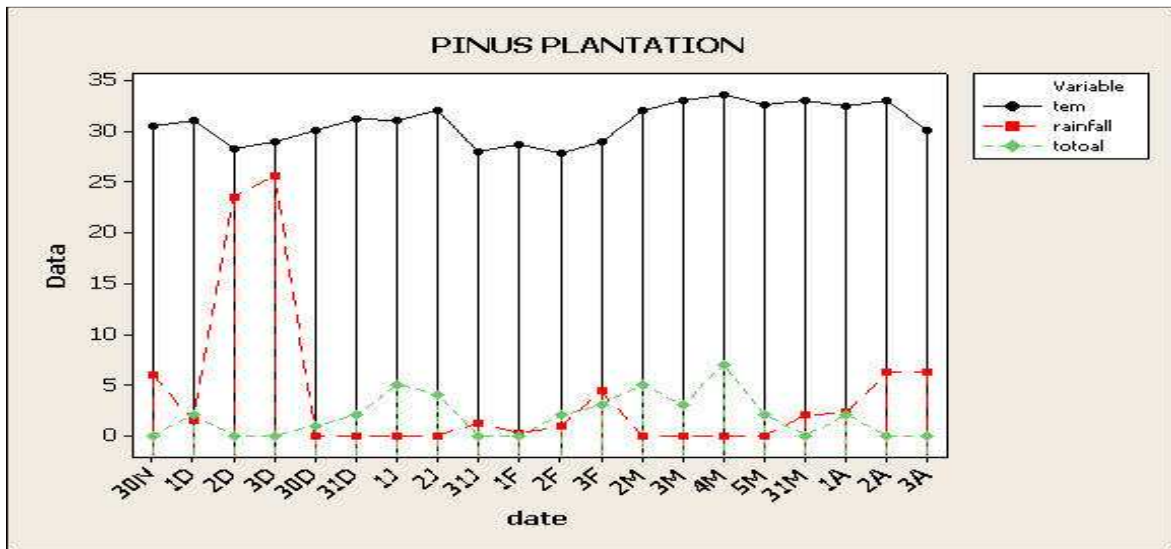
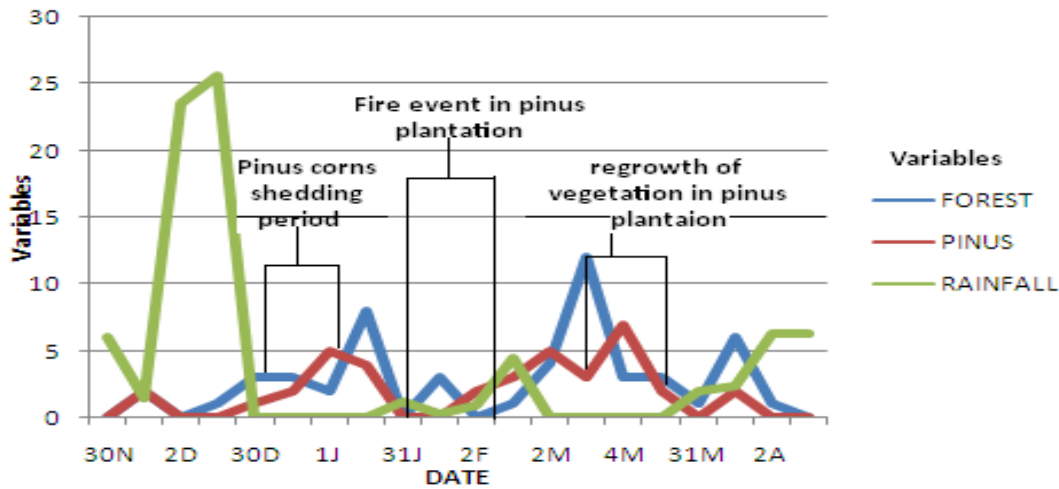


Fig. - 2: Variations of number of trapped hair samples with environmental temperature and rainfall in pinus plantation, Hanthana Mountain, Sri Lanka.

Table - 1. Foremost ecological changes observed in Pinus plantation during each trial from November 2011 to April 2012.

Trial period	Major Ecological Change
Trial 1 (Nov-30, Dec-1, Dec-02, Dec-03)	High rainfall, Tree falling
Trial 2 (Dec-30, Dec-31, Jan-01, Jan-02)	Pinus corns and leaves falling
Trial 3 (Jan-31, Feb-1, Feb-2, Feb-3)	Man made fire, bare ground with no cover
Trial 4 (Mar-2, Mar-3, Mar-4, Mar-5)	Ground vegetation re-growth and ground covered by pinus leaves
Trial 5 (Mar-31, Apr-1, Apr-2, Apr-3)	No major changes observed



**Fig. - 3: Variation of total number of hair samples trapped with the ecological changes in secondary forest habitat and pinus plantation, Hantana Mountain, Sri Lanka.**

But when low environmental temperatures combined with high rainfall, hardly any hair samples were trapped (December 2<sup>nd</sup>, December 3<sup>rd</sup>, April 2<sup>nd</sup> and April 3<sup>rd</sup>) (Fig.-1 and 2). Significant variations of a number of trapped hair samples due to ecological changes were mainly observed in a pinus plantation. Between 30<sup>th</sup> December and 1<sup>st</sup> January shedding of leaves and corns of pinus plants were observed (Fig.- 3 and Table - 1). During that period higher number of hair samples was trapped. But between January 31<sup>st</sup> and February 2<sup>nd</sup> pinus plantation was subjected to a man made forest fire. During this period only few hair samples were trapped. Nevertheless due to the rainfall between February 2<sup>nd</sup> and March 2<sup>nd</sup> re-growth of ground vegetation was observed (Table - 1). In the same time number of trapped hair samples were also increased.

### Discussion

Little is known about abundance-climate relationships for animals because few long term studies address the issue (Golley *et al.*, 1975). Effects of climate on abundance can be mediated by many factors. Short term weather extremes lasting a few days can be ameliorated or exploited by altering behavior. This may display by increasing

or decreasing activity of mammals. This study indicates decrease of mammal activity during high rainfall and low temperature. But just after the rainfall mammals show a sudden incensement of their activity. This may probably since they remain starve throughout the rainy period. Just after that they swiftly move around habitat in searching for the food. But if rainfall associated with low temperatures, it will reduce small mammal activity. They tend to remain in their burrows, where they able to use stored food supplies.

Small mammals are very sensitive to the ecological changes. In the pinus plantation during the leaves and corn shedding period sudden incensement of mammal activity can be observed. During this period large number of pinus corns and ground cover generate by pinus leaves, provide suitable habitats for small mammal food sources such as small insects. Due to that within a short period large number of mammals is attracted to the pinus plantation. But as a pinus plantation undertaken by forest fire, mammal activities descend into a very low level. But between February and March due to high rain fall, ground vegetation of the pinus plantation begins to re-grow and pinus habitat again becomes hospitable to mammals. Because of that in the consecutive

month after the fire (March), mammals re-colonize the pinus habitat.

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