

QUALITY OF THE HERBIVORE HABITATS UNDER THE DIFFERENT ENVIRONMENTAL CONDITIONS AT WASGOMUWA NATIONAL PARK, SRI LANKA

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INTRODUCTION

The major components of a habitat are food, water, cover and suitable space for a particular animal species. Sum of the environmental conditions in which an organism, population, or community lives is also called a habitat (Swaminathan, 1992). Under the natural condition the different vegetations form a variety of habitats. In addition to that land formation and terrain, soil types and the water content in an area also decide the type of a habitat (Trefethen, 1964). A place where all these components are available in required manner for a species is called a preferred habitat. The spatial and temporal distribution of these components determines the habitat quality. The competition for habitat components among sympatric animals is another factor that affects the quality of habitats. Wasgomuwa National Park was established and now managed for the conservation of animals displaced by the development projects mainly the Accelerated Mahaweli Ganga Development Project. For long term conservation of animals, it is necessary to provide suitable habitats with adequate food. In this regard understanding the quality of habitats and the factors that affect the habitat quality is vital. The habitat quality is expressed in many ways. Among those, the Important Value Indices (IVI) of fodder trees express the quality of forestland habitat and the density values of shrubs and small trees would reflect the quality of scrublands. The quality of grassland habitats would be indicated by the presence of grasses and their abundance. The Average Height of grasses (AH) and the Cover Percentage of grasses (CP) in a quadrat and the Frequency of Occurrence (FO) of a particular grass species in a quadrat are the indicators of the quality of grassland habitat (Gunathilake, 1996).

METHODOLOGY

1. Study Area

The Wasgomuwa National Park falls within the districts of Matale and Polonnaruwa in the Central and North Central provinces of Sri Lanka. It is located approximately between the latitudes of 7° 36' & 7° 51' N and longitudes of 80° 52' & 81° 02' E. The total extent of the park is about 39400ha (DWC 2007). While the park falls within the protected area complex of the North Central and Eastern provinces of Sri Lanka, it provides suitable migratory destination for the elephants (*Elephas maximus*). Large mammalian herbivores such as Sambar (*Cervus unicolor*), spotted deer (*Axis axis*) and buffalos (*Bubalus bubalis*) are also present in the park.

2. Identification of fodder plants

The fodder plant species were identified through ground survey by observing the feeding signs of the animals. The parts of the fodder plants left after consumed by herbivores and the feeding signs such as teeth mark, debarking, foot prints were used to identify the consumed fodder plants. Some plants were identified while eating by the animal from a distance using binocular. The identification of the plant species was confirmed by matching them with reference samples present at the Herbarium Center in National Botanical Gardens of Sri Lanka.

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3. Assessing the feeding intensities

The feeding intensities were assessed by observing 200 food plants in the park. While walking along the randomly selected transect laid across the major habitats, the plants that feeding signs present were counted. The feeding intensities are derived from the relationship of the availability of a fodder species to its consumption by a particular animal and it was assessed by using formula described by Petrides 1975.

4. Assessing the abundance of food trees

To assess the abundance of trees, the Important Value Index (IVI) was calculated for each species of food plants under the different environmental conditions. Food trees were sampled by laying 20 plots in each habitat. The plot size was 20m X 20m. The IVI of each fodder species was calculated using the following equation Curtes & McIntosh (1950).

$$IVI = \frac{\text{Relative Density} + \text{Relative basal area} + \text{Relative frequency}}{3}$$

5. Assessing the abundance of fodder shrub/herbs

The density was calculated to assess the availability of shrub and herb species in different habitats of the protected area during different environmental conditions. The amounts of shrub species were assessed by laying 20 m X 20m plots (a total 20 plots) in each habitat.

6. Assessing the abundance of fodder grasses

The composition of the grasslands in the protected areas was determined by sampling of four grasslands in different locations. A total of 20 plots (25m X 25m) were sampled.

RESULTS AND DISCUSSION

Twenty species of fodder trees, 21 species of fodder shrub/herbs and 25 species of fodder grasses have been identified in Wasgomuwa National Park. Elephants consume all species of grasses, shrub/herbs and the trees (at the height of their browsing line). The direct observations have revealed that the elephants tend to consume grass species as a bulk without any selection. Sambar consumes tree leaves and barks that were available below the browsing line. The leaves of the young trees and all the species of shrub/herbs and 24 species of grasses are fodder for Sambar. The spotted deer consumes 24 species of grasses and all the shrub / herbs that identified as fodder for herbivores. The tree leaves and the bark were consumed by Sambar and spotted deer. The buffalo preferred to consume grasses. However they tend to consume shrub/herbs and tree leaves which are available within the accessible height.

Though all these plants were fodder their physical and chemical characteristics limit the consumption of them by herbivores. The height of a plant was a physical feature that limits the consumption of that particular plant. The saplings (trees at young stages) were preferred by the herbivores due to their soft texture and high nitrogen content. The herbivores prefer the fresh leaves of the fodder plants due to the soft texture and the low amount of fibers present (Peiris, Unpublished Data).

The herbivores consume plants with different feeding intensities. The feeding signs left at the plants were indices to categorize the feeding intensities of fodder plants. These categorizations could be adopted for trees and shrubs as well. But it was very difficult to identify a particular grass species through direct observation.

During wet environmental conditions, grass species were available with highest values of FO, CP and AH. The lowest values for grasses were observed during the extreme dry conditions. All the abundance parameters of grasses significantly reduced from wet to extreme dry conditions ($P <$

0.05). The density values of shrubs/herbs were high during the wet environmental condition. The highest values of herbs density were observed during dry condition. The lowest values were recorded during the extreme dry condition. However, the differences of the shrub densities during wet and dry conditions are not significant. But under extreme dry condition densities are significantly low ($P < 0.05$).

The wildlife habitat provides food, water, cover and suitable spaces for wild animals to survive (Ramachandran, 1986). Among all, food and water are prime requirements of the animals. The animals adopt to fulfill their nutritional requirements in different environmental conditions with different feeding behaviors. In terms of foraging behavior, the herbivores can be classified into "browsers", who fed predominantly upon woody materials and leaves of trees and shrubs or "grazers", who fed primarily on grasses and herbaceous vegetation (Putman 1988). While feeding on fodder plants herbivore left some feeding signs in the plants they consume. The signs will be helpful to identify the food plants present in an area. A similar kind of fodder identification study was done by (McNaughton 1979) in Grazing as an optimization process: Grass ungulate relationships in the Serangiti.

The environmental conditions and the availability of ground moisture directly affect the presence of plant species. It was also evident that those factors were crucial on the abundance of shrubs and grasses. In this study remarkable differences have been observed in the availability of fodder scrubs and grasses with the change in environmental conditions and soil moisture. During wet environmental conditions, plants grow in lush and the fresh leaves with a palatable texture attract herbivores. Though there is little water in the surface in the dry conditions the water content is adequate in the soil after the rains occur. The soil moisture content retains for some period (Few weeks or even for some months). Therefore the conditions were favorable to grow or retain the fodder plants in lush condition, especially the grasses. In this context, three distinct environmental conditions were identified namely wet, dry and extreme dry. However, most of other environmental studies considered two types of environmental conditions such as rainy and dry. A similar observation has been made by Padmalal 1993 and Rajapaksha 2003 at Horton Plains National Park.

The abundance of woody trees was assessed by performing the IVI values. Basically the IVI values are depicted by relative density, relative frequency and relative basal area of a tree species. These values did not change with the changes of the environmental conditions. Therefore, IVI values of a particular tree species is quite the same under different environmental conditions.

The typical IVI calculations were more suitable to assess the timber value of a plant. But for the purpose of wildlife conservation the values were not much important. For the conservation of animals in the wild, the plants were important as sources of food. The leaves and the bark are the main components of a plant that animals consume as their food. The availability of leaves in a plant could be assessed by assessing foliage cover at the browsing levels of a plant species. Apart from the relative basal area, the foliage cover at browsing level could be used to assess the availability of food.

CONCLUSIONS AND RECOMMENDATIONS

It can be suggested that these kinds of food assessment techniques could be used for future studies. During the dry and extreme dry conditions, leaves of some tree species fall down. Therefore the availability of leaves in trees was low during the dry and extreme dry environmental conditions and the animals tend to consume barks and woody parts of trees. A similar kind of observation has been made by (Santhiapillai et al 1981) in Ruhuna National Park. The debarking and eating of tree branches could be clearly observed during these environmental conditions. These findings were similar to the findings in the study conducted by (Rajapaksha 2003) in Ecology of Sambar deer in relation to habitat requirements and predator pressure by the

leopard at the Horton Plains National Park and (Padmalal 1993) in Studies on food habits and habitats relations of two cervids: Sika deer in Japan and Sambar deer in Sri Lanka.

The perennial woody shrubs are important sources of food for most herbivores. During all environmental conditions it is observed that the animals are closely associated with woody shrubs. The abundance of shrubs was quite different with environmental changes from wet to extreme dry. The favorable environment prevails during wet conditions facilitates the growth of shrub species in high densities. But when the environmental condition becomes dry the densities of live scrubs are reducing. At the same time the amount of leaves in shrub species were reducing and the animals tend to consume barks and woody parts of shrub species to fulfill their nutritional requirements (Peiris 2005). This was in line with the studies conducted by (Santhiapillai 1981) on a preliminary study of bark damage by Cervids in the Ruhuna National Park & (Korthage et al 1980) on species specific population dynamics of cervids in a multi predator ecosystem.

The environmental changes directly affect the abundance of grass species. The availability of grasses in the areas under the study depends on availability of ground water. This is in line with the study conducted by (Spedding 1971) on Grassland Ecology. If the soil moisture is enough, the grasses grow up to their maximum. The abundance values such as Frequency of Occurrence, Average Height and Cover Percentages are very high during that environmental condition. When the soil moisture reduces the abundance values also reduce. Fleshy grasses which demand water totally dry up due to scarcity of water and some species which could tolerate the environmental stress remain with low abundances values. These results have revealed that the availability of food grass species and their diversity depend on availability of water. The findings are similar to the findings of the study conducted by (Putman 1986) on Grazing intensity in temperate Ecosystems.

In this context, during wet environmental condition the quality of all habitats ie: Forestland, Scrubland and grassland is favorable for the herbivores with high abundance of fodder plants. During dry environmental condition quality of shrub and forestland is high compared to grasslands. Animal distribution and the food habits of herbivores are critically correlated with the quality of habitats. This is in line with the study carried out by Peiris (2005) in habitat use by large mammalian herbivores in Udawalawe, Wasgomuwa and Bundala National Parks in Sri Lanka.

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