

IMPACT OF FIRE ON GRASSLAND VEGETATION AND DISTRIBUTION OF LARGE HERBIVORES IN WASGOMUWA NATIONAL PARK, SRI LANKA

U.K.L. PEIRIS¹ and U.K.G.K. PADMALAL²

¹*Department of Wildlife Conservation, Sri Lanka*

²*Open University of Sri Lanka*

ABSTRACT

Wasgomuwa National Park, located within Central and North central provinces of Sri Lanka, consist of seven major habitat types. Grasslands of the park are being burnt occasionally. This study was conducted to assess the effect of fire on regeneration of the vegetation and the distribution of large herbivore in different time periods after burning. Study was carried out at 6 grasslands by establishing 10mX10m plots and assessing the percentages of ground cover and animal distribution within the plots at six times after burning. Ground cover by monocot species reaches their maximum by 8 weeks after burning. After 12 weeks' time dicot species are spreading over monocot. Large herbivore, except Sambar, distribution is high at the 8 weeks after burning. Distribution of large herbivores and percentages of ground cover are positively correlated. In that context, burning of grasslands in Wasgomuwa National Park would facilitate to improve the quality of herbivore habitat. Therefore, controlled burning can be recommended. Burning intervals could be determined by considering the time taken for regeneration of the vegetation.

KEY WORDS: Grasslands, Burning, Regeneration, Ground cover, larger herbivore, Distribution

INTRODUCTION

Wasgomuwa National Park is located in dry and intermediate zones of Sri Lanka within Matale and Polonnaruwa administrative districts in Central and North Central provinces. The extent of the park is over 39000ha. The park boundaries mainly consist of perennial water bodies *i.e.* Kalu, Amban and Mahawali rivers in Western, Northern and Eastern respectively. Southern boundary lies along with the human habitations in Wilgamuwa Divisional Secretariat Division. The area was declared as a national park in 1984 with the major objective of providing suitable habitats for wild animals displaced by Mahawali Development Project (DWC 1998, IUCN 1990).

The park consists of seven major habitat types. Those are: Undisturbed forest, Scrub, Grasslands, Vegetation on Quartzite, Rock outcrop, Riverine forest and Water bodies (MENR 2006). Thick forest covers over two thirds of the park area. Rest of the area consists of grasslands and scrubs which form mosaic type distribution. Small tanks and river side creates wetlands. Recent investigations have recorded 42 species of fish with 12 endemic, 11 species of amphibians with 02 endemic, 29 species of reptiles with 08 endemic, 155 species of birds with 08 endemic and 42 species of mammals with 04 endemic. A total of 290 dominant plant species belonging to 77 families have been recorded (DWC 2008). Among them, 20 endemic plant species have been recorded (DWC 2008).

Large herbivores such as elephants, sambar, spotted Deer and buffalo depend mainly on the grasses and shrubs (Peiris 2010). Accidental or manmade fire occurs occasionally and distribute in the patches of grasslands and adjoining scrubs. It affects the availability of fodder grasses and the movement of herbivores, especially for searching foods. This will affect the distribution of herbivores and use of habitats by them. Therefore, specific study on impact of fire in different vegetation types and animal distribution is essential in order to develop suitable management guidelines for habitat improvements in Wasgomuwa National Park.

Research objectives are assess the regeneration of grassland and associated vegetation after the fire and determine the habitat use and distribution of large herbivores at the area where fire has occurred.

METERIALS AND METHODS

Selection of study sites

Vegetation map prepared by the GIS unit of DWC is used to identify the distribution of different vegetation types within the park. Field reconnaissance was also conducted to find out the vegetation distributions. Areas where fire occurs were located through communication with park staff and review of the records maintained at the park.

Sampling of vegetation

Thirty 10mX10m sample plots were established at randomly selected areas where fire occurred. Five 1mX1m quadrates were laid randomly in each plot and ground cover percentages in each quadrate were recorded as cover values. At the same time, fodder plant species were recognized and they were categorized as dicot and monocot plants. Sampling was done at six times as follows:

- a. Without burning for about one year (At normal condition)
- b. One week after burning
- c. Three weeks after burning
- d. Five weeks after burning
- e. Eight weeks after burning
- f. Twelve weeks after burning
- g. Twenty two weeks after burning

Animal distribution within sampling areas was assessed by collecting data on animal signs left at sampling plots. Foot prints, pellets & dung and forage signs were collected at the same time when vegetation samplings were done. Coefficients of linear correlation were measured to assess the relationship of two variables of animal distribution and ground cover percentage using Person's Product Moment r equation.

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{(n-1)S_x S_y}$$

x is cover values and y is value of herbivore distribution

RESULTS AND DISCUSSION

Selection of study sites

By consulting with officials and park records, it was found that fire is not frequent in Wasgomuwa National Park. But, grasslands and adjoining scrubs were burnt occasionally. Following areas were selected as fire affected areas for study.

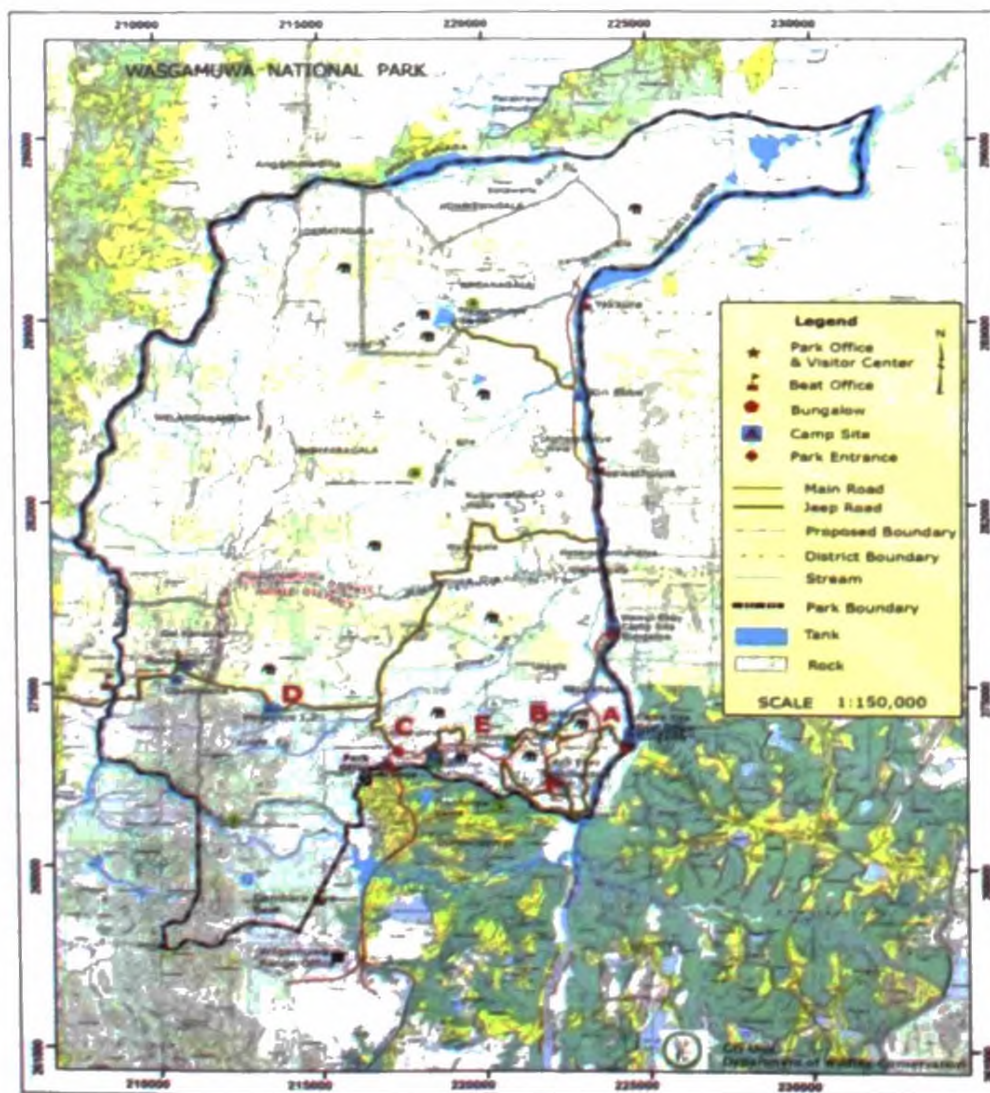


Figure 1. Locations of the sampling plots

Table 1. Selected study sites

Site	Reference Figure	Nature of Vegetation
YudaganaPitiya	A	Grass with scattered shrubs and trees
Digapitiya	B	Grass with scattered shrubs and trees
Kadurupitiya	C	Grass with scattered shrubs and trees
Medapitiya	D	Grass with scattered trees and shrubs
Mahapitiya	E	Grass with shrubs
Sansthapitiya	F	Grass

Ground cover sampling

Table 2. Ground Cover percentage and Fodder species recorded at normal condition

Site	Ground cover %				Number of fodder plants Species			
	Rainy Season		Dry Season		Rainy Season		Dry Season	
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
Yudaganapitiya	64	16	35	15	29	08	06	07
Digapitiya	72	18	43	16	32	18	07	10
Kadurupitiya	76	12	54	10	37	15	09	05
Medapitiya	72	18	42	16	38	28	07	10
Mahapitiya	65	16	39	09	31	21	08	08
Sansthapitiya	68	12	41	11	41	20	11	05

Table 2 shows the ground cover at normal conditions. During rainy season, ground cover exceeds up to about 90% with both monocot and dicot plant species. Dry season ground cover was reduced up to about 50%. Forty one Monocot species and twelve dicot species were recorded at normal condition.

Table 3. Ground Cover percentage in different time periods after burning

Site	Ground cover (%)											
	01 week		03 weeks		05 weeks		08 weeks		12 weeks		24 weeks	
	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C
Yudaganapitiya	08	01	20	03	35	16	62	16	64	18	55	20
Digapitiya	09	00	23	03	34	16	65	12	75	20	65	25
Kadurupitiya	08	00	18	02	40	14	60	19	74	24	55	24
Medapitiya	10	00	23	03	45	13	59	18	76	25	60	28
Mahapitiya	06	02	18	02	39	16	68	20	71	29	53	30
Sansthapitiya	06	00	21	03	45	13	65	23	73	30	61	30

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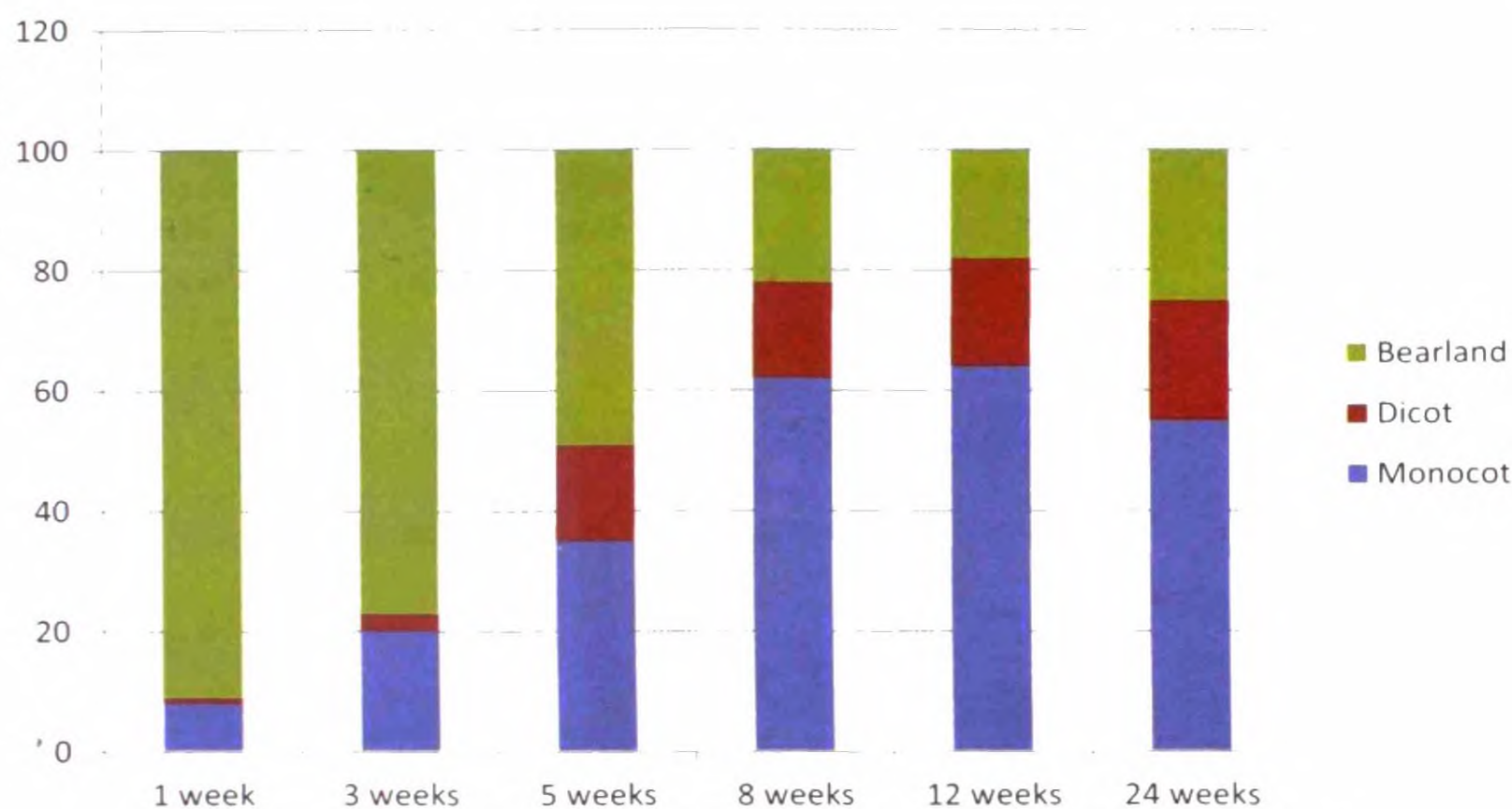


Figure 2: Graphical expression of ground cover percentage at Yudaganapitiya area in different times after burning

The grasslands that are burnt have fully regenerated back by 8 weeks' time. Ground cover has increased up to about 80% by 8 weeks' time and after 12 weeks ground cover by monocot species was reduced while ground cover by dicot was increased. This indicates within 8 weeks monocot can fully regenerated. Regeneration of dicot is being continued and gradually spread.

Table 4. Number of different categories of fodder species recorded in different time periods after burning

Site	Number of fodder species recorded											
	01 week		03 weels		05 weeks		08 weeks		12 weeks		24 weeks	
	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C	M.c	D.C
Yudaganapitiya	02	01	06	04	28	09	28	08	29	10	29	10
Digapitiya	02	00	07	05	26	06	25	08	31	16	31	16
Kadurupitiya	03	00	07	04	18	05	28	19	35	12	37	14
Medapitiya	02	00	08	06	25	13	21	12	36	25	35	26
Mahapitiya	01	01	10	05	21	12	28	12	28	20	32	21
Sansthapitiya	02	00	10	06	28	11	26	16	40	20	40	24

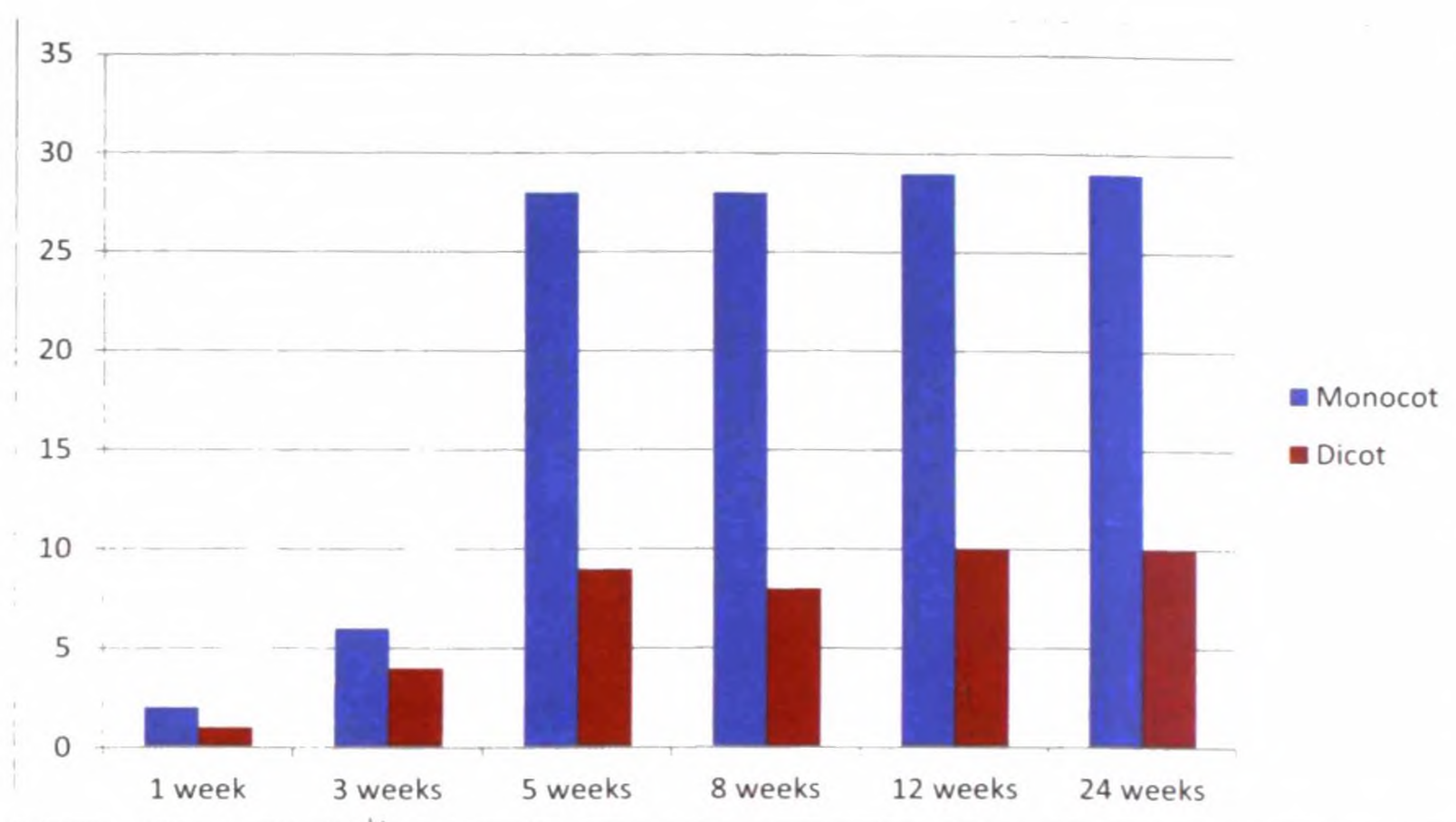


Figure 3. Graphical expression of different plant categories grown at Yudaganapitiya area in different time periods after burning

Total number of fodder species recorded in burnt areas was lower than in the area of normal conditions up to 5 weeks' time after burning. After 8 weeks' time maximum number of monocot species have come up. After 12 weeks' time vegetation composition is not significantly changed. This indicates vegetation regeneration is completed within 12 weeks after burning.

Table 5. Dominant fodder species recorded in the area are summarized as follows

Site	Fodder Species	
	3 weeks	12 weeks
Yudaganapitiya, Digapitiya, Kadurupitiya, Medapitiya, Mahapitiya, Sansthapitiya	<i>Panicum maximum</i> , <i>Tephrosiapurpurea</i> , <i>Heteropogoncontortus</i> , <i>Cyperusrotundus</i> , <i>Croton hirtus</i> , <i>Pancreatiumzylanicum</i> ,	<i>Panicum maximum</i> , <i>Tephrosiapurpurea</i> , <i>Heteropogoncontortus</i> , <i>Cyperusrotundus</i> , <i>Croton hirtus</i> , <i>Pancreatiumzylanicum</i> , <i>Aristolochia bracteolata</i> , <i>Bracchiariareptens</i> , <i>Dactylocteniumaegyptium</i> , <i>Desmodiumheterynedrellanodiflora</i> , <i>Sidacordata</i> , <i>Pavoniazylanica</i> , <i>Panucumrepens</i> ,

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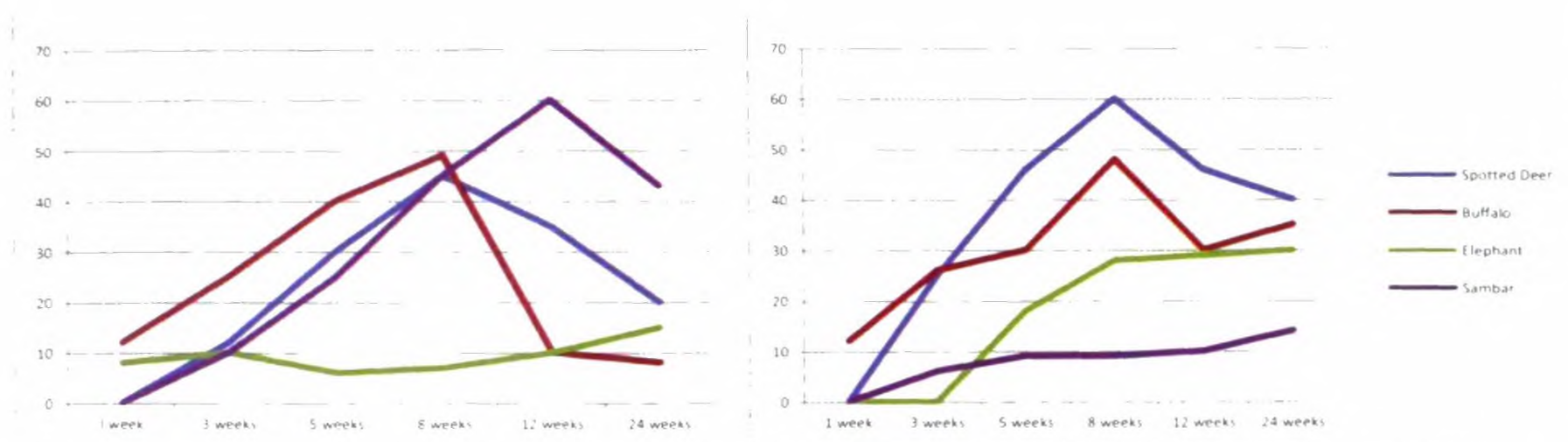


Figure 4. Distribution of large herbivores at Yudaganapitiya and Digapitiya areas in different time periods after burning

The figure 4 shows the large animal distribution in grasslands in different time periods after burning. It indicates that up to 8 weeks after burning the number of herbivores such as spotted deer, buffalo and elephants are gradually increased. After 8 weeks, distribution of spotted deer and buffalo is decreased. Numbers of elephant are still increased up to 12 weeks and then the number will increase or remain stable. Sambar distribution is less but increases slightly even up to 24 weeks after burning.

High Positive correlation were observed in the distribution of spotted deer, buffalo and elephant with ground cover, thus the value $r = 0.79$, 0.68 and 0.53 respectively. For the distribution of Sambar, $r = 0.06$ indicates positive but not high correlation.

Occasional burning of grasslands may not cause a significant adverse impact on large herbivores. This is in line with the findings of the study conducted at Udawalawe National Park on Impact of fire on biodiversity (Perera GAD, 2007). Burning of grasslands facilitate the growth of young sprouts of monocot species. Distribution of large herbivore is influenced by these fresh grasses. After 12 weeks spotted deer, buffalo and elephant do not prefer the areas where dicot species are spreading, replacing the monocot species. Occasional burning may facilitate regeneration of fresh grasses and high distribution of herbivores, Study conducted by Perera, 2007 at Udawalawe National Park concluded that the frequent burning may lead to the change of species composition in the area and undesirable plant species can invade the area.

CONCLUTIONS AND RECOMMENDATIONS

Occasional burning or systematic control burning of grasslands in Wasgomuwa National Park facilitates the growing of young sprouts of grass species while increasing fodder availability for large herbivores. Regeneration of monocot in burnt areas reaches their maximum availability in 8weeks' time which provides optimum preferred fodder availability for spotted deer, buffalo and elephant. Therefore, controlled burning of grasslands can be recommended for the improvement of

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herbivore habitats. Burning intervals could be determined according to the time that needs fully regeneration of vegetation.

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