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Management of afforestation in the light of intense open grazing in Kathua and Udhampur forest divisions of J&K

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ABSTRACT

In Jammu and Kashmir, intensive grazing causes huge loss to the plantations in Udhampur and Kathua forest divisions where nomadic graziers migrate from Doda and other upper parts of the state to the lower areas in winter. The present study was conducted at ten sites each in the two forest divisions wrt damage caused to the plantations and the management practices being adopted. The plant characters like plant height, diameter, survival and basal area were taken into consideration while investigating the before and after grazing affects. Relative frequency, density and dominance were also calculated to see the affect. In the study it was found that in both the forest divisions, the plant height and survival rate of plants were much affected due to grazing. In Udhampur forest division, the mean plant height before grazing ranged between 18.45 (Patnitop) and 70.50 cm (Thanoa) that was reduced to 24.66 (Sourap) and 39.76 cm (Thanoa) after grazing. The mean minimum and maximum survival that was 60.86 per cent (Gandala) and 94.66 per cent (Patnitop), respectively, dropped to 38.55 (Orkhal) and 88.66 per cent (Patnitop) as a result of grazing. Similarly in Kathua forest division the mean minimum and maximum plant height reduced from 19.44 cm (Sundrikot) to 16.72 cm (Androta) and from 101.33 cm (Sauhanda) to 93.72 cm (Sauhanda), respectively, due to grazing. Similarly, the mean minimum and maximum plant survival reduced from 79.16 (Krakha) to 29.38 per cent (Barwal) and from 90.00 (Androta) to 76.11 per cent (Sauhanda). The damage to the plantations was lower where barbed fencing was done or village forest committees were constituted.

Keywords: Grazing, plantations, afforestation, management

INTRODUCTION

Intensive grazing has remained a major hurdle for the success of any afforestation programme. Nomadic pressure is much in the districts of Udhampur and Kathua in Jammu and Kashmir. The nomadic graziers migrate from Doda and other upper regions of the state toward the lower areas in winter. The migration generally starts from Doda covering Udhampur on way and finally reaches Kathua. The nomads are generally Gujjars and Bakarwals.

The affect of migration of nomadic graziers on the forest plantations was studied in both the forest divisions at 10 sites in each

division. Besides, the management practices adopted at both the locations were also studied.

METHODOLOGY

Udhampur forest division that falls in the south of J&K and shares its boundaries with Doda, Kathua, Jammu and Reasi districts, ten sites, where intensive grazing by both local and migrant cattle takes place, Patnitop, Tikri, Mand, Gandala, Sourap, Rakhthanoa, Himbra, Thanoa, Ladden and Orkhal were selected for the present study.

In Kathua forest division, that falls in the southern part of Jammu and Kashmir and is the place where the nomads, who migrate from upper hills stay during the winters for two three months, has intensive pressure of grazing both by migratory as well as local graziers, ten sites viz Sauhanda, Dinga Aamb, Nanan, Barwal, Sundrikot, Manu, Krakha, Tank Di Ghari, Dilwan Doll and Androta were selected. At all the above locations plantation had been carried out. At the selected sites, at least five quadrates (10x10 m) were laid depending upon the density of plantation. The 'before' and 'after' grazing data on impact of grazing on survival percentage, plant height, diameter and basal area and management practices at afforestation sites were collected from all the quadrates. The data were tabulated and analyzed.

For calculating per cent frequency, the following formula given by Raunkiaer (1934) was used:

$$\text{Per cent frequency} = \frac{\text{No of quadrates in which the tree occured}}{\text{No of quadrates studied}}$$

Basal area was calculated using the following formula given by (Hanson and Churchill 1961) :

$$\text{Basal area} = \eth R^2$$

Where R = D/2, D= Diameter, D= G/ð, G = girth of tree, ð= 3.142

Relative frequency, relative density and relative dominance were calculated using following formulae as given by Phillips (1959):

$$\text{Per cent frequency} = \frac{\text{No of occurrence of the species}}{\text{No of occurrence of all the species}} \times 100$$

$$\text{Per cent density} = \frac{\text{No of individuals of the species}}{\text{No of individuals of all the species}} \times 100$$

$$\text{Per cent frequency} = \frac{\text{Basal area of the species}}{\text{Basal area of all the species}} \times 100$$

RESULTS AND DISCUSSION

The data on various plant factors before and after grazing recorded at different sites in Udhampur forest division are given in Table 1.

The mean plant height before grazing (Table 1a) ranged between 18.45 (Patnitop) and 70.50 cm (Thanoa) that ranged between 24.66 (Saurap) and 39.76 cm (Thanoa) after grazing (Table 1b) . The minimum and maximum heights were of *F palmata* (9.33 cm) at Gandala and *M alba* (180.33 cm) at Tikri before grazing (Table 1a) dropped to 8.00 and 71.33 cm, respectively, after grazing (Table 1b).

No pronounced affect was seen with respect to plant diameter. Before grazing (Table 1a) the minimum mean diameter that was 7.43 mm (Tikri) and maximum 15.97 mm (Patnitop) turned out to be 7.5 and 14.66 mm, respectively, after grazing (Table 1b). While talking of plants, before grazing the minimum diameter of 5.18 mm was recorded of that of *S cumini* at Tikri and maximum of that of 15.97 of *C deodara* at Patnitop (Table 1a) that changed to 4.46 mm (*D sissoo* at Tikri) and 16.23 mm (*A catechu* at Thanoa), respectively (Table 1b).

Drastic reduction was recorded in case of survival of plants before and after grazing. The mean minimum and maximum survival was 60.86 per cent (Gandala) and 94.66 per cent (Patnitop), respectively, before grazing (Table 1a) and 38.55 per cent (Orkhal) and 88.66 per cent (Patnitop), respectively, after grazing (Table 1b). Minimum survival of 10.33 per cent was recorded of that of *F palmata* (Gandala) and maximum 94.66 per cent of *C deodara* (Patnitop) before grazing (Table 1a). However, after grazing the minimum survival was recorded of that of *M alba* (13.33% at Tikri) and maximum of that of *C deodara* (88.66% at Patnitop) (Table 1b).

Like diameter, no prominent affect was studied in case of basal area of plants before and after grazing. The mean minimum and maximum basal area before grazing was 49.44 and 201.21 mm^2 (Tikri and Patnitop) with 25.80 (*D sissoo* at Tikri) and

201.21 mm^2 (*C deodara* at Patnitop), respectively (Table 1a). After grazing, however, mean basal area was minimum 47.73 mm^2 (Tikri) and maximum 168.70 (Patnitop) with *D sisso* (Tikri) having minimum (15.61 mm^2) and *A catechu* (Thanoa) maximum (206.39 mm^2) basal area (Table 1b).

The data pertaining to Kathua forest division are given in Table 2.

The mean minimum and maximum plant height before grazing was recorded in Sundrikot (19.44 cm) and Sauhanda (101.33 cm), respectively (Table 2a) and after grazing in Androta (16.72 cm) and Sauhanda (93.72 cm), respectively(Table 2b). The minimum plant height (17.00 cm) was that of *B variegate* (Sundrikot) and maximum (106.00 cm) of *A catechu* (Nanan), before grazing (Table 2a) and minimum (16.67 cm) of *D strictus* (Krakha) and maximum (99.67 cm) of *D sisso* (Nanan) after grazing (Table 2b).

The diameter and basal area of the plants before and after grazing did not differ much as it was found in Udhampur.

However, pronounced affect on survival of plants was seen in Kathua also as in case of Udhampur. The mean survival ranged between 79.16 (Krakha) and 90.00 per cent (Androta) before grazing (Table 2a) and 29.38 (Barwal) and 76.11 per cent (Sauhanda) after grazing (Table 2b). Minimum survival was recorded in case of *T grandis* and *D strictus* (71.66) at Manu and Krakha, respectively, before grazing (Table 2a) and in case of *A catechu* (27.42%) at Barwal and *A lebbeck* (85.66%) at Sauhanda.

Management practices adopted by the J&K forest department at Udhampur and Kathua forest divisions

In Kathua and Udhampur forest divisions only barbed wire fencing had been used as a measure to safeguard the plantations from grazing. In Udhampur forest division at Mand, Gandala and Tikri, village forest committees had been constituted for the management and protection of plantations.

Few groups of migratory graziers were also interviewed who revealed that most of them were illiterate and according to them construction works such as building, orchards, fencing of areas for afforestation etc diverted the route provided to them by the state forest department. They did not have any other option than to allow their cattle to enter the plantation areas for grazing. They were ready to divert their route if forest department provided them grass and fodder.

Going through the observations of this study it is concluded that open grazing has become a nuisance especially with the increasing cattle population and shrinking forest resources in Udhampur and Kathua

Table 1a . Effect of grazing on the planted tree species in Udhampur Forest Division (J&K)

Site	Species Plant	Before grazing						
		Diameter Height (cm)	Survival (mm)	Basal (%)	Relative area (mm^2)	Relative frequency	Relative density	dominance
Patnitop	*Cedrus deodara*	18.45	15.97	94.66	201.21	100.00	100.00	100.00
	Mean	18.45	15.97	94.66	201.21	100.00	100.00	100.00
Tikri	*Albizia lebbeck*	62.00	8.84	71.66	62.24	13.04	13.46	15.73
	Terminalia bellerica	43.66	6.71	71.33	36.14	13.04	16.34	9.13
	Emblica officinalis	54.66	7.15	71.00	40.66	17.39	14.42	10.28
	Terminalia chebula	47.66	5.99	60.66	28.46	8.69	4.80	7.19
	Syzygium cumini	36.66	5.18	66.00	21.50	8.69	6.73	5.43
	Dalbergia sissoo	67.33	5.72	62.33	25.80	8.69	7.69	6.52
	Morus alba	180.33	13.92	72.00	352.88	13.04	17.30	38.65
	Pinus roxburghii	24.00	5.93	71.66	27.81	17.39	19.23	7.03
	Mean	64.53	7.43	68.33	49.44	12.50	12.50	12.72
Mand	*Albizia lebbeck*	61.66	7.32	70.66	42.63	25.00	21.50	13.41
	Leucaena leucocephala	27.66	13.53	63.33	144.23	25.00	22.58	45.39
	Tectona grandis	29.33	8.42	72.00	55.70	16.66	16.12	17.52
	Acacia catechu	21.00	7.58	66.00	45.18	16.66	17.20	14.21
	Pinus roxburghii	26.00	6.13	72.00	30.01	16.66	22.58	9.44
	Mean	33.13	8.60	68.80	63.55	20.00	20.00	20.00
Gandala	*Morus alba*	75.66	9.85	77.33	76.33	25.00	34.21	18.14
	Leucaena leucocephala	18.33	13.48	71.66	143.11	18.75	17.10	34.02
	Dalbergia sissoo	61.66	10.27	74.00	83.45	18.75	25.00	19.84
	Ficus palmata	09.33	7.21	10.33	41.33	18.75	14.47	9.82
	Albizia lebbeck	58.00	9.81	71.00	76.38	18.75	9.21	18.15
	Mean	44.60	10.12	60.86	84.12	20.00	20.00	20.00
Sourap	*Pinus roxburghii*	20.66	9.32	68.66	68.59	40.00	35.78	18.35

	Leucaena leucocephala	21.33	10.89	71.00	93.41	40.00	20.00	24.99
	Albizia lebbeck	31.66	10.13	79.00	81.40	20.00	26.31	21.78
	Bombax ceiba	30.00	12.88	62.00	130.29	30.00	17.89	34.86
	Mean	25.91	10.81	70.17	93.42	25.00	25.00	25.00
Rakhthnoa	*Leucaena leucocephala*	29.66	13.20	73.33	137.32	16.66	22.35	36.84
	Dalbergia sissoo	51.66	10.26	71.66	83.00	25.00	32.94	22.27
	Albizia lebbeck	60.00	8.07	79.66	51.26	33.33	30.58	13.75
	Bauhinia variegata	38.33	11.24	69.33	101.11	25.00	14.11	27.12
	Mean	44.91	10.69	73.50	93.17	25.00	25.00	25.00
Himbra	*Pinus roxburghii*	21.33	8.83	75.33	62.19	36.36	39.58	20.68
	Dalbergia sissoo	31.00	12.95	74.33	132.07	45.45	42.70	43.92
	Albizia lebbeck	48.00	11.59	73.33	106.44	18.18	17.70	35.39
	Mean	33.44	11.12	74.33	100.23	33.33	33.33	33.33
Thanoa	*Toona ciliata*	89.66	11.22	81.33	99.10	23.07	23.80	18.99
	Leucaena leucocephala	73.00	11.95	71.33	112.45	23.07	23.80	21.55
	Bauhinia variegata	58.66	12.77	66.66	131.80	23.07	22.85	25.26
	Acacia catechu	60.66	15.06	78.33	178.31	30.76	29.52	34.18
	Mean	70.50	12.75	74.41	130.42	25.00	25.00	25.00
Laddan	*Emblica officinalis*	49.66	8.56	69.66	57.76	26.67	27.47	16.05
	Syzygium cumini	40.66	7.07	71.33	39.63	26.67	39.56	11.05
	Acacia catechu	23.66	10.12	71.66	80.51	20.00	15.38	22.45
	Bauhinia variegata	38.66	11.09	75.00	96.95	13.33	9.89	27.03
	Dalbergia sissoo	67.33	10.32	71.00	83.74	13.33	7.69	23.53
	Mean	44.00	9.43	71.73	71.72	20.00	20.00	20.00
Orkhal	*Robinia pseudocacia*	94.33	13.13	67.66	135.55	16.66	19.13	24.92
	Leucaena leucocephala	42.33	13.56	61.66	144.86	16.66	16.52	26.63
	Morus alba	104.33	13.08	70.00	149.55	22.22	22.60	27.50
	Dalbergia sissoo	69.33	8.51	68.66	57.53	27.77	28.69	10.57
	Pinus roxburghii	39.00	8.44	69.66	56.29	16.66	13.04	10.35
	Mean	69.86	11.34	67.53	108.76	20.00	20.00	20.00

Table 1b. Effect of grazing on the planted tree species in Udhampur Forest Division (J&K)

Site	Species	After grazing						
		Plant Height (cm)	Diameter (mm)	Survival (%)	Basal area (mm^2)	Relative frequency	Relative density	Relative dominance
Patnitop	*Cedrus deodara*	16.53	14.66	88.66	168.70	100.00	100.00	100.00
	Mean	16.53	14.66	88.66	168.70	100.00	100.00	100.00
Tikri	*Albizia lebbeck*	41.66	9.80	52.00	75.39	13.04	15.68	19.74
	Terminalia bellerica	39.26	8.30	53.00	54.07	13.04	23.52	14.16
	Emblica officinalis	38.33	6.80	36.00	36.29	17.39	7.84	9.50
	Terminalia chebula	24.40	7.60	32.00	45.34	8.69	1.96	11.87
	Syzygium cumini	36.33	5.53	64.66	23.70	8.69	11.76	6.20
	Dalbergia sissoo	43.66	4.46	57.33	15.61	8.69	9.80	4.08
	Morus alba	71.33	11.40	13.33	102.01	13.04	11.76	26.71
	Pinus roxburghii	22.60	6.13	63.66	29.44	17.39	17.64	7.74
	Mean	38.45	7.50	46.50	47.73	12.50	12.50	12.50
Mand	*Albizia lebbeck*	36.66	9.00	19.00	63.58	25.00	10.81	15.18
	Leucaena leucocephala	23.66	15.66	5.33	192.50	25.00	8.11	45.86
	Tectona grandis	38.33	9.20	63.33	66.44	16.66	35.13	15.82
	Acacia catechu	14.26	9.20	19.50	66.44	16.66	5.40	15.82
	Pinus roxburghii	27.80	6.26	60.66	30.76	16.66	40.54	7.32
	Mean	28.14	9.86	53.56	83.94	20.00	20.00	20.00
Gandala	*Morus alba*	42.66	6.26	37.00	30.76	25.00	22.85	8.46
	Leucaena leucocephala	12.10	10.13	49.66	80.47	18.75	11.42	22.14
	Dalbergia sissoo	39.33	11.13	58.33	97.15	18.75	37.14	26.72
	Ficus palmata	8.00	6.98	9.66	38.24	18.75	8.57	10.52
	Albizia lebbeck	57.80	12.20	68.00	116.83	18.75	20.00	32.14
	Mean	31.98	9.34	42.73	72.69	20.00	20.00	20.00
Sourap	*Pinus roxburghii*	19.33	10.86	61.66	92.58	40.00	41.41	24.17

	Leucaena leucocephala	19.66	11.43	61.67	102.46	20.00	17.14	26.75
	Albizia lebbeck	31.33	10.10	70.00	80.07	20.00	21.42	20.90
	Bombax ceiba	28.33	11.73	59.00	107.91	20.00	20.00	28.17
	Mean	24.66	11.03	63.08	95.76	25.00	25.00	25.00
Rakhthnoa	*Leucaena leucocephala*	20.33	12.13	56.34	115.40	16.66	17.30	31.99
	Dalbergia sissoo	40.00	11.60	59.33	105.62	25.00	23.07	29.28
	Albizia lebbeck	55.00	9.20	68.00	66.44	33.33	44.23	18.42
	Bauhinia variegata	34.33	9.66	64.66	73.25	25.00	15.38	20.30
	Mean	37.42	10.65	62.08	91.15	25.00	25.00	25.00
Himbra	*Pinus roxburghii*	22.33	9.43	62.00	69.73	36.36	42.30	34.37
	Dalbergia sissoo	26.40	10.46	61.34	85.88	45.45	39.74	42.58
	Albizia lebbeck	35.00	7.66	64.34	46.06	18.18	17.94	22.83
	Mean	27.91	9.18	62.56	67.22	33.33	33.33	33.33
Thanoa	*Toona ciliata*	26.00	12.86	41.33	129.82	23.07	22.72	30.51
	Leucaena leucocephala	43.00	13.93	35.34	150.90	23.07	15.90	23.84
	Bauhinia variegata	49.38	13.66	51.34	145.83	23.07	38.63	23.04
	Acacia catechu	40.66	16.23	52.00	206.39	30.76	22.72	32.60
	Mean	39.76	14.17	45.00	158.24	25.00	25.00	25.00
Laddan	*Emblica officinalis*	29.00	6.53	41.66	32.80	26.67	10.00	13.32
	Syzygium cumini	38.00	7.80	58.67	47.75	26.67	15.00	19.39
	Acacia catechu	18.67	7.93	39.34	48.55	20.00	15.00	19.72
	Bauhinia variegata	31.67	9.23	60.33	66.80	13.33	25.00	27.13
	Dalbergia sissoo	37.29	8.00	39.67	50.24	13.33	35.00	20.41
	Mean	30.93	8.00	47.93	49.23	20.00	20.00	20.00
Orkhal	*Robinia pseudocacia*	22.34	8.06	38.00	50.99	16.66	12.50	18.44
	Leucaena leucocephala	25.42	8.26	35.42	53.55	16.66	10.00	19.36
	Morus alba	31.29	9.20	13.67	66.44	22.22	15.00	24.02
	Dalbergia sissoo	33.76	6.93	44.67	37.64	27.77	27.50	13.61
	Pinus roxburghii	38.25	9.30	61.00	67.89	16.66	35.00	24.55
	Mean	30.21	8.35	38.55	55.30	20.00	20.00	20.00

Table 2a. Effect of grazing on the planted tree species in Kathua Forest Division (J&K)

Site	Species	Before grazing						
		Plant Height (cm)	Diameter (mm)	Survival (%)	Basal area (mm^2)	Relative frequency	Relative density	Relative dominance
Sauhanda	*Melia azedarach*	94.00	7.52	86.66	44.72	38.46	33.33	28.31
	Dalbergia sissoo	104.33	8.21	91.66	53.72	30.76	29.62	34.01
	Albizia lebbeck	105.66	8.62	90.00	59.47	30.76	37.03	37.66
	Mean	101.33	8.12	89.44	52.64	33.33	33.33	33.33
Dinga Amb	*Emblica officinalis*	54.00	6.28	81.66	31.32	37.50	26.53	24.02
	Terminalia belerica	52.00	8.07	90.00	53.75	25.00	24.48	41.21
	Dalbergia sissoo	42.33	7.51	83.33	45.33	37.50	48.97	34.76
	Mean	49.44	7.29	85.00	43.47	33.33	33.33	33.33
Nanan	*Dalbergia sissoo*	96.66	16.93	90.00	227.43	55.55	54.16	69.30
	Acacia catechu	106.00	1.91	86.66	10.74	44.44	45.83	30.69
	Mean	101.33	13.92	88.33	164.09	50.00	50.00	50.00
Barwal	*Dalbergia sissoo*	85.66	20.92	85.00	352.51	60.00	59.25	51.52
	Acacia catechu	75.00	20.49	84.66	331.69	40.00	40.74	48.47
	Mean	80.33	20.71	84.83	342.10	50.00	50.00	50.00
Sundrikot	*Dalbergia sissoo*	21.33	11.62	8666	107.23	41.66	41.17	28.63
	Bauhinia variegata	17.00	13.96	83.33	153.16	41.66	44.70	40.89
	Syzygium cumini	20.00	12.00	81.66	114.15	16.66	14.12	30.47
	Mean	19.44	12.53	83.88	124.85	33.33	33.33	33.33

Manu	*Dalbergia sissoo*	28.66	13.83	86.33	152.61	30.00	34.94	35.11
	Bauhinia variegata	20.66	12.17	81.66	119.58	50.00	48.19	27.51
	Tectona grandis	19.66	14.30	71.66	162.44	20.00	16.86	37.37
	Mean	22.99	13.43	79.88	144.88	33.33	33.33	33.33
Krakha	*Dalbergia sissoo*	41.00	11.65	86.66	108.13	55.55	82.43	29.19
	Dendrocalamus strictus	23.00	18.25	71.66	262.21	44.44	17.56	70.80
	Mean	32.00	14.95	79.16	185.17	50.00	50.00	50.00
Tank di ghari	*Acacia catechu*	29.66	15.35	83.33	188.91	66.66	78.95	65.34
	Syzygium cumini	18.00	11.26	75.00	100.22	33.33	21.05	34.66
	Mean	23.83	13.31	79.17	144.57	50.00	50.00	50.00
Dilwan Doll	*Dalbergia sissoo*	20.66	10.87	81.33	94.07	38.46	50.00	26.20
	Acacia catechu	20.00	13.00	81.66	134.54	38.40	36.59	37.48
	Bauhinia variegata	19.33	12.84	80.00	130.37	23.08	13.41	36.31
	Mean	20.00	12.24	81.00	119.66	50.00	50.00	50.00
Androta	*Dalbergia sissoo*	19.66	12.28	90.00	118.88	100.00	100.00	100.00
	Mean	19.66	12.28	90.00	118.88	100.00	100.00	100.00

Table 2b. Effect of grazing on the planted tree species in Kathua Forest Division (J&K)

Site	Species	After grazing						
		Plant Height (cm)	Diameter (mm)	Survival (%)	Basal area (mm^2)	Relative frequency	Relative density	Relative dominance
Sauhanda	*Melia azedarach*	84.33	8.53	58.00	55.05	38.46	27.27	30.68
	Dalbergia sissoo	99.24	9.26	84.66	67.31	30.76	31.82	37.51
	Albizia lebbeck	97.60	8.53	85.66	57.05	30.76	40.90	31.79
	Mean	93.72	8.77	76.11	59.80	33.33	33.33	33.33
Dinga Amb	*Emblica officinalis*	47.80	7.67	67.34	46.12	37.50	23.07	29.68
	Terminalia belerica	41.67	8.74	72.33	59.96	25.00	23.07	38.58
	Dalbergia sissoo	28.00	7.93	71.00	49.30	37.50	53.84	31.72
	Mean	39.16	8.11	70.22	51.79	33.33	33.33	33.33
Nanan	*Dalbergia sissoo*	99.67	12.54	37.00	123.44	55.55	44.00	56.51
	Acacia catechu	67.33	11.00	61.34	94.98	44.44	56.00	43.48
	Mean	83.50	11.77	49.17	109.21	50.00	50.00	50.00
Barwal	*Dalbergia sissoo*	72.33	24.34	31.33	465.06	60.00	54.54	58.82
	Acacia catechu	57.40	20.37	27.42	325.56	40.00	45.45	41.18
	Mean		43.24	22.36	29.38	395.31	50.00	50.00 50.00
Sundrikot	*Dalbergia sissoo*	16.73	13.00	68.00	132.67	41.66	51.02	33.33
	Bauhinia variegata	17.60	13.20	37.00	136.77	41.66	32.65	34.36
	Syzygium cumini	18.46	12.80	64.00	128.61	16.66	16.33	32.31
	Mean	17.00	13.00	56.33	132.68	33.33	33.33	33.33

Manu	*Dalbergia sissoo*	23.53	17.00	69.00	226.86	30.00	31.88	43.20
	Bauhinia variegata	19.26	12.80	58.00	128.61	50.00	40.98	24.49
	Tectona grandis	16.80	14.70	70.50	169.63	20.00	22.95	32.30
	Mean	19.86	14.83	65.83	175.03	33.33	33.33	33.33
Krakha	*Dalbergia sissoo*	27.33	14.06	55.67	155.18	55.55	79.55	27.20
	Dendrocalamus strictus	16.67	23.00	67.50	415.26	44.44	20.45	72.79
	Mean	22.00	18.53	61.59	285.22	50.00	50.00	50.00
Tank di ghari	*Acacia catechu*	22.00	16.42	74.00	211.64	66.66	69.23	62.20
	Syzygium cumini	17.50	12.80	52.40	128.61	33.33	30.76	37.79
	Mean	19.75	14.61	63.20	170.25	50.00	50.00	50.00
Dilwan Doll	*Dalbergia sissoo*	18.55	12.50	80.00	122.65	38.46	52.23	27.84
	Acacia catechu	17.30	14.26	67.00	159.62	38.46	31.34	36.23
	Bauhinia variegata	17.00	14.20	78.00	158.28	23.08	16.41	35.92
	Mean	17.62	13.65	75.00	147.02	50.00	50.00	50.00
Androta	*Dalbergia sissoo*	16.72	13.73	34.45	147.87	100.00	100.00	100.00
	Mean	16.72	13.73	34.45	147.87	100.00	100.00	100.00

forest divisions. In the light of these observations it is strongly felt that fencing alone could not alleviate the ever mounting pressure of intense open grazing. A holistic approach that gives due consideration to the graziers as well as plantations needs to be adopted to save the plantations from being destroyed.

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