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Impact of Protection on Forage Yield and Vegetation Cover in Suketar Valley of Mirpur (Azad Kashmir)

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Abstract: Vegetation survey of the lower and upper Suketar watershed was conducted to determine the vegetation cover, forage production and grazing capacity in protected and unprotected areas. Total vegetation cover was much higher inside the enclosures than outside. Forage production and grazing capacity was 4-40 times higher in protected areas than the areas open to grazing. It can be concluded that 3-4 years of protection can substantially increase the cover and forage yield and hence grazing capacity of the livestock.

Key words: Protection, plant cover, forage yield, vegetation cover, exclosure, Azad Kashmir

Introduction

Natural revegetation is a slow but effective method of rehabilitating the depleted rangelands. Protection from grazing can result in natural recovery of desirable vegetation through plant maturity and seed dispersion. Forage production and vegetation cover also increase substantially after protection. However, ecological recovery is effective only in the relatively high rainfall areas. Despite partial control of the biotic influences, the vegetation inside the exclosure was better and richer. There was an improvement in the vegetation by 26-28% in terms of coverage of trees and palatable grasses, particularly perennial ones, which were inside the exclosure. Ahmad *et al*. (1989) studied the effect of exclosure on vegetation composition and forage yield of Bannigala reserve forest and found significant increase in these parameters. Repp and Khan (1958) studied the effect of protection in Maslakh range in Balochistan. Baig (1978) compared the vegetation in protected Hazarganji National Park with that of grazed area. The presented study was carried out to determine the ecological recovery and forage production in Suketar watershed area of Azad Jammu and Kashmir.

Materials and Methods

Suketar watershed is located in the Mirpur district of the state of Azad Jammu and Kashmir. Ecologically the area is located in the sub-tropical, sub-humid and semi ever-green zone with average rainfall of 950 mm, most of which falls during the summer monsoon season. Total area of the Suketar watershed project is 31182 ha, out of which 939 ha. falls under forests, 4263 ha area is cultivated and rest of the area is uncultivated wasteland.

Suketar watershed is highly eroded area is Azad Jammu and Kashmir. As a result of heavy rains during July and August, huge amount of fertile soil is washed away due to splash and gulley erosion. As a result of unplanned grazing by livestock arid cutting of forests, the situation is further accentuated and the severe erosion results in threat to civil infrastructure as well. FAO/UNDP started a watershed management project in 1990 to overcome these problems and sizeable area has been reclaimed.

For the study of range improvement through natural vegetation enclosures were established in 1990 in various catchments areas where protection from grazing was exercised and secondary succession was allowed to take place. A detailed vegetation survey of the protected and unprotected area was conducted to quantify the changes in ecological recovery, vegetation composition, biomass production and grazing capacity. Following eight sites, four from each of the lower and upper Suketar were selected for study:

Upper Suketar	Lower Suketar
Kasguma	Chhapra
Potha	Bhindi Komela
Gojra	Chowki Jabber
Karali Bela	Barjah Bela

Three line transects, each having 30 m length were laid out in all the sites of protected as well as unprotected areas. Along each transect, at an interval of 6 m, five quadrats of 1 m^2 were placed (Khan, 1974). The vegetation within the quadrats including grasses, forbs and shrubs etc. were identified and listed. Nomenclature was followed after Stewart (Stewart, 1972). Later on cover of each species and the bare area were recorded.

For forage production all the palatable grasses and forbs were clipped leaving 2.5 cm stubble height. For browse, the young twigs (current year growth) up to 1.5 m height were also clipped. These samples were weighed and were later on, oven dried and their dry phytomass was recorded to determine forage production (kg/ha).

Results

Plant cover and frequency of various plant species including grasses, forbs and shrubs/trees for all the sites is given in Table 1. It is clear that plant cover in the protected areas was measurably higher than that in grazed area. Many desirable plant species e.g., *Cenchrus ciliaris, Cymbopogon jawenancusa, Cyperus rotundas, Pennisetum, Eleusine indica, Zizyphus nammularia* increased in cover. The ecological recovery in protected areas as cover was much higher than that in open areas.

Total vegetation cover was measurably higher in the protected area than in area open to grazing. Total vegetation cover and forage production were significantly higher inside the protected area than area open to grazing. Data on plant frequency reveals that the flora were more uniformly distributed inside the exclosure as compared to open area. Several plant species (trees/shrubs, forbs and grasses) were observed only inside the protected area while these were absent in grazed area.

Dry matter yield (DMY) of forage and grazing capacity are given in Table 2. Dry matter yield of forage was significantly higher in protected areas as compared to

Table 1: Plant cover and percent frequency of plant species at different sites in protected and unprotected areas in Suketar

Range Site	Plant species	Plant cover (%)	Plant frequency (%)	Protected	Open ProtectedOpen
Kasguma					
(Lower Suketar)	**Grass Species**				
	Cenchrus ciliaris	2.5	-	-	10
	Chrysopogon aucheri	7.3	2.5	50	20
	Cymbopogon jwarancusa	8.0	4.5	50	40
	Cynodon dactylon	3.2	5.5	30	50
	Cyprus rotundus	0.2	0.3	10	20
	Dichanthiurn annulatum	7.5	3.5	40	30
	Elusine hirsutus	3.0	4.8	20	40
	Eragrastis superba	0.2	-	10	-
	Heteropogon contortus	6.7	8.0	50	70
	Pennisetum orientate	1.5	2.4	30	50
	Themeda anthers	4.0	1.5	20	20
	Forbs				
	Euphorbia spp.	-	1.7	-	20
	Ficus spp.	-	0.7	-	20
	Rumex spp.	-	0.1	-	10
	Glycine spp.	0.1	0.2	10	10
	Vicia spp.	3.2	3.2	20	20
	Shrubs				
	Acacia modesta	12.0	1.2	40	30
	Adhatoda vesica	5.5	-	20	-
	Morus spp.	0.2	-	10	-
	Ziziphus jajuba	-	6.5	-	20
Potha					
(Lower Suketar)	**Grass Species**				
	Cenchrus ciliaris	9.8	-	70	-
	Cymbopogon jwarancusa	0.5	-	10	-
	Capparis decidua	9.0	38.4	80	90
	Cyprus rotundus	1.0	-	10	-
	Euphorbia spp.	7.0	2.5	40	30
	Elusine hirsutus	7.5	-	50	-
	Heteropogon contortus	13.0	4.5	60	60
	Pennisetum orientate	4.7	-	50	
	Sacharus munja	0.5	0.3	10	10
	Forbs				
	Boerhavia diffuse	0.6	-	20	40
	Adhetoda vesica	2.0	2.1	20	30
	Euphorbia spp.	0.4	2.4	20	10
	Glycine spp.	2.0	0.5	10	20
	Paganum hermala	-	0.4	-	-
	Rumex spp.	0.4	-	10	-
	Siratro spp.	0.5	-	10	-
	Shrubs				
	Acacia nilotica	-	2.0	-	20
	Dalbergia sisso	1.5	-	20	-
	Ziziphus jajuba	6.5	6.0	40	20
Goira					
(lower Suketar)	**Grass species**				
	Cenchrus ciliaris	19.0	9.0	80	20
	Chrysopogon aucheri	9.0	4.0	20	10
	Cymbopogon jwarancusa	2.0	-	10	-
	Cynodon dactylon	14.0	32.0	80	90
	Cyprus rotundas	-	1.6	-	30
	Echinocloa spp.	1.0	-	10	-
	Elusine hirsutus	1.0	-	10	-
	Heteropogon contortus	2.0	1.0	20	10
	Pennisetum orientate	-	-	40	-
	Sacharus munja	3.0	2.2	10	30
	Forbs				
	Boerhavia spp.	0.1	-	10	-
	Artemisia vulgaris	2.0	3.0	20	70
	Euphorbia spp.	0.4	0.1	20	10
	Glycine spp.	0.2	-	10	-
	Lathyrus spp.	-	1.0	-	10
	Rumex spp.	0.1	-	10	-
	Shrubs				
	Acacia modesta	2.0	1.0	20	10
	Dllbergia sisso	2.0	-	20	-
	Gymnosporia roylaeana	0.2	-	10	-
	Murica monosperrna	0.2	-	20	-

Salrnatia malabarica		0.1	-	10	-
Ziziphus jajuba		5.7	-	70	-
Kalari Bela					
(Lower Suketar)					
Grass species	**Grass species**				
	Aristida depressa	0.2	-	10	-
	Cenchrus ciliaris	18.0	9.5	80	40
	Chrysopogon aucheri	5.0	-	50	-
	Cynodon dactylon	10.3	23.6	40	100
	Dichanthium annulatum	0.3	-	10	-
	Echinocloa spp.	-	0.2	-	10
	Elusine hirsutus	1.5	2.0	20	20
	Heteropogon contortus	7.5	2.0	60	20
	Panicum maximum	0.2	0.5	10	10
	Pennisetum orientate	1.2	0.2	20	10
	Forbs				
	Borhavia spp	0.1	-	10	-
	Calotropics spp	1.0	-	10	-
	Artemesia vulgaris	2.0	7.0	10	70
	Euphorbia spp.	0.1	1.5	10	20
	Mutica monosperma	-	2.5	-	10
	Rurnex spp.	0.2	-	10	-
	Shrubs				
	Adhatoda vesica	1.0	-	10	-
	Tribulus terristris	0.5	-	10	-
	Ziziphus iajuba	32.0	18.0	70	50
Chhapra					
(Upper Suketar)	**Grass Species**				
	Chrysopogon aucheri	35.0	17.1	90	70
	Cymbopogon jwarancusa	4.0	5.2	30	40
	Cynodon dactylon	2.5	11.0	20	30
	Cyprus rotundus	-	1.7	-	40
	Echinocloa spp.	-	0.6	-	10
	Heteropogon dactylon	1.0	-	10	-
	Imperata cyllnderica	-	7.0	-	20
	Pennisetum orientate	0.4	1.5	10	10
	Forbs				
	Borhavia spp.	-	0.2	-	10
	Convoivuius app.	-	0.1	-	10
	Euphorbia spp.	0.7	0.5	20	30
	Glycine app.	0.1	-	10	-
	Gymnosporia roylaeana	6.0	-	20	-
	Lathyrus spp.	0.5	-	10	-
	Medicago spp.	-	0.2	-	20
	Polygonum spp.	-	0.2	-	10
	Rumex spp.	-	0.1	-	10
	Shrubs				
	Acacia modesta	0.9	-	20	-
	Adhatoda vesica	0.2	-	10	-
	Chrysopogon aucheri	1.0	-	10	-
	Dilbergia sissoo	1.0	0.7	10	10
	Zizyphus jujuba	-	0.5	-	10
Bhindi Komela					
(Upper Suketar)	**Grass Species**				
	Chrysopogon aucheri	16.30	3.4	80	40
	Cymbopogon jwarancusa	7.0	-	30	-
	Cydon dactylon	6.0	20.5	10	60
	Cyprus rotundas	0.5	0.5	10	10
	Echinochloa spp.	0.5	-	10	-
	Eleusine hirsutus	-	1.0	-	10
	Heteropogon dactylon	16.0	-	40	-
	Imperata cylindrica	14.5	9.6	40	10
	Penniseturn orientate	2.5	-	30	-
	Forbs				
	Euphorbia spp.	0.2	1.5	10	20
	Gymnosporia roylaeana	0.5	1.2	10	20
	Polygonum spp.	0.5	-	10	-
	Vicia spp.	1.0	-	10	-
	Shrubs				
	Dalbergia sissoo	1.0	-	10	-
Chowki Jabber					
(Upper Suketar)	**Grass Species**				
	Chrysopogon aucheri	21.0	3.8	70	30
	Cymbopogon jwarancusa	12.5	6.7	40	20
	Cynodon dactylon	7.5	23.3	30	40
	Cyprus rotundus	5.9	2.5	40	10
	Desrnostachia bipinnata	1.0	-	10	-
	Heteropogon contortus	6.0	-	30	-

	Imperata cylinderica	9.0	9.2	10	40
	Pennisetum orientale	3.0	1.7	30	10
	Forbs				
	Euphorbia spp.	0.4	0.7	20	20
	Polygonum spp.	0.2	-	10	-
	Rumex spp	-	2.0	-	20
	Shrubs				
	Acacia modesty	5.2	-	40	-
Barjah Bela					
(Upper Suketar)	**Grass species**				
	Chrysopogon aucheri	34.7	14.2	83	70
	Cymbopogon jwarancusa	8.8	3.3	33	17
	Cynodon dactylon	0.8	12.5	-	33
	Cyprus rotundus	0.8	4.2	17	17
	Desmostachya bipinnata	-	1.5	-	17
	Elusine hirsutus	-	0.8	-	17
	Heteropogon contortus	8.3	5.0	17	33
	Pennisetum orientale	1.2	1.3	33	33
	Themeda anathera	5.8	2.5	33	17
	Forbs				
	Artemesia vulgaris	-	3.7	-	50
	Euphorbia spp.	0.3	1.0	33	67
	Gymnosporia roylaeana	3.3	2.5	33	33
	Medicago Spp.	-	0.8	-	17
	Shrubs				
	Acacia nilotica	1.7	-	17	-
	Dodonia viscose	0.7	-	17	-

Table 2: Production data, DM yield and carrying capacity of the protected and unprotected range sites at Suketar watershed areas

		Kasguma	Potha	Gojra	Kurali Bela
Upper Suketar					
DM Yield Ton/ha	Protected	2.17	1.66	0.86	0.74
LSD-0.26	Unprotected	0.33	0.40	0.04	0.04
Carrying capacity	Protected	5.17	3.95	2.05	1.77
AUM	Unprotected	0.78	0.95	0.08	0.09
LSD =1.08					
Lower Suketar		Chhapra	Bhindi Komela	Chowki Jabber	Barjah Bela
DM Yield Ton/ha	Protected	1.28	0.57	0.76	1.18
	Unprotected	0.12	0.18	0.04	0.03
LSD =0.26					
Carrying capacity					
AUM	Protected	2.98	1.36	1.82	2.80
LSD =1.08	Unprotected	0.28	0.44	0.08	0.07

grazed area in upper and lower Suketar catchments. This increase could be as much as 40 times at Chowk Jabber to four times increase in Chhapra in lower Suketar.

Discussion

The increase in plant cover and frequency of occurrence may be attributed to the biotic factor, which plays a dominant role in plant species composition and ecological recovery. In a study at Ziarat, Khan (1977) reported that forage species such as *Prunus ebuenea, Lonicera hypolines* and *Babel balnclistaric* were present only inside the exclosure. Because of the low level of human disturbance, these are due to internal dynamics owing to interspecific and intraspecific competition among species, populations and communities of the areas are formed (Metz, 1997). Total vegetation cover, which leads to increased forage production, was found to be higher inside the exclosure. Earlier, similar studies were carried out in the area in spring and summer of 1991 and almost similar results were obtained (Mohammad *et al*., 1993). Similar effects of protection were reported at Banda Daud Shah where 30% increase in plant cover was reported in alpine pastures after protection (Noor, 1981).

Uniformity and frequency of occurrence was much less in open area than in close area. It could be attributed that some desirable species have been grazed or cut from open area whereas inside the exclosure these were present and evenly distributed. Also in 1991 data on vegetation composition inside the protected area showed an increase in diversity of native plant species of this area.

The increase in the DMY of palatable plant species is due to protection. Four times increase in forage yield was recorded from same area during 1991 by Mohammad *et al*. (1993). Five times increase in forage production in Himalayan forest grazinglands at Muzaffarabad. Baig (1978) reported three times increase in forage production in protected areas of Sair Page in Kaghan valley. It must be emphasized that purely quantitative approach to species diversity by comparison is not unsatisfactory. The information concerning the autecology of individual species and the role played by animals in *their* ecology are the probable venues of research for future (Schmidt-Vogt, 1998).

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