

NUMERICAL CHECK ON THINNINGS IN SHISHAM (*DALBERGIA SISSOO*)

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Shisham is the principal tree species being grown in the irrigated plantations of the Punjab for over a century. The main object of raising these plantations was to produce fuelwood initially for railway engines and later for meeting fuel requirements of the big cities of the province. The object of management was, in due course of time, modified to include timber production also.

At present almost all the plantations are being managed with this combined objective irrespective of the fact whether the objects are realised separately (11) or collectively (1 to 5).

Specific silvicultural treatments are prescribed by working plans for the up-bringing of young crop and systematic fulfilment of the objects of management. Thinning is one of the most important silvicultural operation in forest management. Its utility, though questioned by some is recognised by many (8). The persual of various working plans of shisham irrigated plantations would reveal that no hard and fast rule has been followed by the planners in prescribing the time at which thinning should be carried out. The age prescribed for the first thinning, varies from 5 to 7 years and for the second thinning from 10 to 14 years. One thing on which almost all the working plan officers agree is the grade/degree of thinning which is mechanical for the the first and ordinary C to D for the subsequent thinnings. The implementation of this prescription has always been subjective. Recent study on stand density in shisham has indicated that C grade thinnings in quantitative terms amount to removal of about 30 per cent of the basal area (8). Even to mark the trees for removal covering this limit of basal area is difficult for the forest technicians, who are generally entrusted with thinning marking work. They need a simple and practicable fool proof rule.

Thumb rules for this purpose were evolved in Indo-Pakistan forestry in the past for a number of species for the convenience of the field workers. Glover (6) advised a spacing of four times the girth in Deodar. Warren (17) recommended an intertree distance (feet) equal to $1\frac{1}{2}$ diameter (inches) for Sal. Howard (7) suggested an aver-

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age spacing of twice diameter (inches expressed in feet) for Shisham crop. Azam (12) worked out a "Diameter plus factor" for Chir pine in Hazara. Some of the working plan officers (1,5,14) have provided guidance by indicating the number of stems per acre to be kept after thinnings.

These rules or prescriptions may be based on long practical experience of the foresters or casual observations in the field but appear to have no scientific basis. It thus becomes imperative to provide a simple formula, having sound basis, to the field staff for carrying out thinnings judiciously at various stages of the stand development.

Method and procedure

The basic data were collected from the yield plots laid out and maintained in various irrigated shisham plantations of the Punjab. The basic data included the following:

- (i) Mean diameter (b.h.) overbark in inches of the stand before thinning (D)
- (ii) Number of trees per acre left after thinning (N)
- (iii) Stand basal area per acre in square feet before thinning (B. A.)
- (iv) Age of the stand in years at the time of thinning (A)

The following models were tried for developing regression equation fitting the data:

$$(i) N = a + b/D.$$

$$(ii) N = a + b/D + c/D^2$$

$$(iii) \log N = a + bD$$

$$(iv) \log N = a + b/\log D.$$

$$(v) \log N = a + b/\log D + c/\log D^2$$

$$(vi) N = a + \frac{b}{B. A.}$$

$$(vii) N = a + \frac{b}{A \times (B. A.)}$$

Where a, b and c are regression coefficients and N, D, B. A and A are symbols with connotations explained above.

Model (iii) i. e. $\log N = a + bD$ was found to give the best fit for the data. The equation worked out viz., $\log N = 2.8287 - 0.0920D$, has a high correlation coefficient of 0.9707 and a standard error of the estimate as 21.96 per cent.

Results and Discussion

Values for number of stems per acre by diameter classes were obtained from the equation $\log N = 2.8287 - 0.0920D$. A limit of ± 20 per cent about the mean was adopted for determining the extreme values of the range as it almost covered the variation in the basic data. The upper and lower extreme values of number per acre were thus determined for each diameter class. Inter-tree spacing for average and extreme values of the number of trees per acre was worked out by diameters. The figures for stem distribution and espacement are given in the following table:

Table:—Showing the range of stem distribution and inter-tree spacing by diameter classes

Serial No.	Mean diameter before thinning (inches)	Number of trees per acre after thinning		Inter-tree spacing after thinning (feet)	
		Average	Range	Average	Range
1	2	441	529—353	10	9—11
2	3	357	427—287	11	10—12
3	4	289	347—231	12	11—14
4	5	234	280—188	14	12—15
5	6	189	227—151	15	14—17
6	7	153	183—123	17	15—19
7	8	124	148—100	19	17—21
8	9	100	120—80	21	19—23
9	10	81	97—65	23	21—26
10	11	66	78—54	26	23—29
11	12	53	63—43	29	26—32
12	13	43	51—35	32	29—35
13	14	35	41—29	35	32—38
14	15	28	32—24	38	35—41

Formulae were developed to relate the inter-tree spacing with the diameter. The whole range of diameters was split into 3 parts on the basis of the rate of increase in espacement with respect to diameter. Separate relationships for each diameter range were worked out and are given below:

Serial No.	Diameter range (inches)	Espacement formulae for the average and extreme values of the No. of trees per acre retained		
		Average	Minimum	Maximum
1	2 to 6	$S = 1.33D + 7$	$S = 1.33D + 8$	$S = 1.33D + 6$
2	6 to 10	$S = 2D + 3$	$S = 2D + 5$	$S = 2D + 1$
3	10 to 15	$S = 3D - 7$	$S = 3D - 4$	$S = 3D - 10$

Where S is inter-tree distance in feet and D diameter in inches

Bibliography.

1. Ahmad, Bashir .. 1957 Revised working plan of Khanewal irrigated plantation of Multan Forest Division 1951-52 to 1969-70
Government Printing, Lahore
2. Ahmad, Mushtaq .. 1938 Working Plan for Daphar irrigated plantation 1938-1958
Government Printing, Lahore
3. Ahmad, Mushtaq .. 1935 Working Plan for Khanewal irrigated plantation 1933-34 to 1948-49
Government Printing, Lahore
4. Afzal, Khan Mohammad .. 1961 Revised working plan of Daphar irrigated plantation and Pakhowal forests of Gujrat West Forest Division for 1959-70
Government Printing, Lahore
5. Chopra, R. S. .. 1949 Revised working plan for the Changa-Manga irrigated plantation
Government Printing, Lahore
6. Glover, H. M. .. 1932 "Punjab Forest leaflet No. 1"
7. Howard, S. H. .. 1939 "Mechanical rules for thinnings"
Indian Forester April, 1939.

8. Hussain, Raja Walayat and Qazi, Ishtiaq Ahmad 1972 "Optimum Stand density in shisham (under print)
9. Jaspal, Sardar Narayin Singh 1945 Working Plan for Chichawatni irrigated plantation 1944-45 to 1963-64
Government Printing, Lahore
10. Laurie, M. V. 1938 "A rough guide to thinning teak based on average spacing for a given mean diameter
Indian Forester July, 1938
11. Muhammad, Ch. Khan 1962 Revised working plan for Chichawatni irrigated plantation 1959-60 to 1974-75
Government Printing, Lahore
12. Malik, Muhammad Azam 1965 Revised working plan of Chir Reserved forests of lower Siran and Agror Valley 1963-64 to 1973-74
Government Printing, Peshawar.
13. Parsad, Jagdamba 1946 "Tree classification" Proceedings of 7th Silvicultural Conference 1946
Forest Research Institute, Dehra Dun, 1951
14. Qazi, Ishtiaq Ahmad 1967 Working plan for the plantation of Bahawalpur forest division 1964-65 to 1983-84
Government Printing, Bahawalpur
15. Sagreiya, K. P. 1946 "Single Stem Silviculture". Proceedings of 7th Silvicultural Conference 1946
Forest Research Institute, Dehra Dun, 1951
16. Singh, Partap 1946 "Basic Thinning".
Conservator of Forests, South Circle, Ambala.
17. Warren, W. D. M. 1938 "Crown ratio in Indian trees".
Indian Forester July, 1938

THE ASTORE MARKHOR

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The Astore Markhor (*Capra falconeri falconeri*) which is known as 'bom' locally, is the most important game animal of Gilgit Agency and Northern Area. It belongs to genus *Capra*, family *Bovidae* and sub-order *Artiodactyla*. The word Markhor is derived from the two persian words 'Mar' means snake and 'Khor' means eater the snake eater. The legend is that Markhor eats snake which is killed by the powerful strokes of its hoofs.

Distinctive Characters:—

The mature male Astore Markhor has great cock screw horns, which diverge widely and form an open spiral. Its Coat is of long gray hair almost to its knee. Markhor has a tufted beard and small yellow eyes. The upper part from head to tail is dark gray, the breast is light gray. During winter season its colour becomes rusty iron grey. With the advancement of the season, Astore Markhor sheds its hair and during the hottest season it becomes bare and seeks shelter in the dense forests or in the caves against the attack of horse-fly. The age of this animal is determined from each screw of its spiral horns. With the advancement in the age screws are added to the horns and each screw is about 9" in length. The record horn length of Markhor shot in Astor area is 53 inch. The life span of Astore Markhor is 18-20 years.

The mature females have straight horns of short size slightly bent towards the back. They are dark fawn with whitishgrey with a short beard which is located in the middle of chin. Females change colour from birth to maturity. When they cease breeding, the colour becomes dark-grey making it easy to locate them in the herd. The total number of rings on the horns of a female give its age in years because one ring is added annually to the horns.

Habits:—Except for the winter movements for shelter and food, Astore Markhor is non-migratory and generally remains within its habitat. In the hot summer months it approaches the alpine pastures, seldom going above snow line in the cold season it descends to low levels. Markhor takes shelter in the most inaccessible places in the rocks during night and starts grazing early in the morning. It rests and sleeps during the day rushing to the water points before sun set. It is a sensitive

animal with acute power of smell and hearing and a good eye sight. In danger, it gives loud alarming snorts and strikes its hoof against the stone to alert the herd.

Distribution:—

Astore Markhor has a wide range of distribution. Its natural habitat is 6000' above sea level and upwards, the zone of *Artemisia*-steppe and semi-arid open forests. This area comprises lower Astore beyond Mesekin Nallah on the right bank of Astore River, Kargah Nallah at Gilgit, area between Nomal and Nalter, Bagrote Nallah, Haramosh Nallah, Sai Nallah, Yasin and Gupis in the Political Districts, area between Nomal and Chalt, Chilas Darel and Tangir. Good heads of Markhor are still available in Astore area at Mushkin, Burmai, Mayardass, Shelter, Burduchi, Garay Nallahs, Chilas, Darel and Tangir. The predominating vegetation in this zone is *Artemisia maritima*, *Eurotia ceratolies*, *Kochia* species and *Astragalus* species *Juniperus macropoda*, *Fraxinus xanthoxyloides* and wild almonds, *Quercus ilex* and *Pinus gerardianii*. The ground is rocky and precipitous towards the upper limits. The slopes are gentle lower down.

Food:—

Astore Markhor eats almost all the grasses and bushes found in its habitat *Artemisia maritima* and *Fraxinus xanthoxyloides* are however much relished. In scarcity period the Markhor can live on leathery oak leaves and dead bark of Juniper trees. The young ones can be brought up on the milk of domestic goats. Markhor derives its salt requirements from saline earth and rocks.

Reproduction:—

Rut season starts with the advent of winter. The male and female herds get closer, mating starts on about 21st December and continues to the end of January, peak of rut is in late December. Males show no evidence of being territorial but they chase the intruders to the periphery or away from the estrous female. Except for the rut season the males and females remain separate. When the mating season is over the males become weak and try to remain aloof. They gradually move towards the upper limits while the females remain around till the breeding season is over.

The period of gestation is 5 months. Breeding starts from the last week of June to the end of July. Usually twins are born but only one young one is not uncommon. Fawns are able to walk soon after their birth and can be caught easily in the first week after which it is impossible to capture them. Young ones remain with their mothers till next mating. A female attains maturity and starts breeding after two years.

Cross Breeding:—

Astore Markhor cross breeds fairly well in captivity. The experiments carried out by Khan (6) in his reserve at Nalter have given encouraging results. He crossed the As-



Fig. 1 Astore Markhor (*Capra falconeri*)
(Photo by author)



Fig. 2 Hybrid 'Markhor' (F-1 generation)
(Photo by author)



Fig. 3 Hybrid 'Markhor' Goat with kids (F-2 generation)
(Photo by author)

tore Markhor (Plate. I) with the domestic goat. The resultant F-1 is seen in Plate. 2. It has inherited the fluctural characters and the modification is much. It has a stunted body and has lost spiral horns. Instead it has crescent shaped resembling Ibex. The male and female produced in the first generation were again crossed (intra-species hybridization) and the second generation is seen in (plate 3). Further observations on the F-2 generation are continuing.

Population Status:—

Before 1947 every Nallah Valley in Gilgit was full of Astore Markhor and numerous herds were seen moving from one place to the other during the rut season. At places it was a pest for the agricultural crops. With the increase in human population and the introduction of modern arms followed by the indiscriminate shooting its population has declined. The present population of Markhor is 1500 in the Gilgit Agency (2). In some protected areas the population is increasing.

Hunting Control:—

Astore Markhor has suffered much in the past due to indiscriminate shooting by the V. I. Ps. Hunting by 'Hunka' also named as 'Damdaruh' has been most destructive. Hunka is now banned. The control over the illicit shooting is inadequate. The Government has now transferred the Wildlife conservation from the Gilgit Scouts to the Forest Department in the Northern area.

Predators:—

Snow leopard (*Panthera uncia*) is the common predator of Astore Markhor but since the population of Markhor is declining snow leopard is also getting extinct.

Diseases:—

The common disease so far noticed is anthrax which is introduced by the domestic goats into the wild herds of Markhor (1).

Uses:—

The people have been shooting Markhor for food since times immemorial. Skins are used for making a footwear. The fine wool obtained from the Astore Markhor is used for making gloves and pullovers. The horns are used as trophies for decoration, tool handles, hookas, and bugle horns. The skin and horns also give a repellent smell which is said to keep the snakes away. It is an important game animal and attracts sports men from all over the world. The froth it ruminates is said to cure snake bites.

References:—

1. Mountfort Guy (1969). The Vanishing Jungle.
2. Khan, B. A. (1970) Pak. stan J. For. 20 (4), 1970.
3. Big Game Register of Gilgit Agency 1910-70.
4. The Jammu and Kashmir Game Preservation Act, 1998 Bikrimi.
5. Repp, G. I. Technical Report No. 6 Vegetation Studies in arid zones of river catchment in Karakoram.
6. Wing Commander Shah Khan. Markhor Breeding in Captivity (un-published).