

HISTORY OF FOREST MANAGEMENT IN PAKISTAN—II†

TEMPERATE CONIFEROUS FORESTS

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Reserved Forests of Murree Hills: The first working plan for the forests of the Murree Hills was prepared by Pigot (1888). May (1899) prescribed the working of the 'kail'—broad leaved forests under the selection system in which oak was to be favoured against 'kail'. Introduction of deodar was started for the first time in 1900 on an experimental scale. A mixed Working Circle was constituted for these areas by Jerram (1915) and continued later by Pring (1927) in which May's method of treatment was continued. Since broad-leaved forests were under a heavier biotic pressure for firewood and leaf fodder compared to 'kail', the latter was continuously gaining at the expense of the former (Khanna, 1942).

Khanna (1942) formed a Kail Working Circle for these forests to which he applied the modified selection system. Kail was to be preferred over chir-pine, and broad-leaved species over both these conifers. A year-wise programme of fellings was suggested for the next 10 years. Every year the Divisional Forest Officer was required to formulate a felling programme for the next 3 years and have it sanctioned by the Chief Conservator of Forests. The working plan gave the number of exploitable trees present in each year's coupe but these could only be felled if silviculturally available. Yield was prescribed by number of trees, by dividing the number of trees of exploitable size (24 inches d.b.h. and over) in the working circle by 30, which was assumed to be the time of passage from 20-24 inch d.b.h. class to the exploitable size. The assumption was based on data collected from 100 stumps during the preparation of the working plan and the opinion of the Imperial Silviculturist Forest Research Institute Dehra Dun. A 20% deviation was permissible in any one year.

Bashir Ahmad (1959) retained all the provisions of the previous working plan in respect of the Kail Working Circle. The growing stock, however, was enumerated down to 8 inches d.b.h. instead of 12 inches. Intermediate yield was controlled by area and volume of thinnings estimated from past experience.

Reserved Forests of Kagan: The first working plan for these forests was made by Monro in 1901 who distinguished two working circles: Deodar and Pine-Fir. Since only deodar was then economically exploitable, the prescriptions of the Deodar Working Circle only concerned this species; blue pine was to be removed in improvement fellings if it interfered with the growth of deodar. Deodar trees of exploitable size (30 inches d.b.h.

†Continued from Pakistan Journal of Forestry, April, 1976.

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and over) were to be removed in a cutting cycle of 15 years. The annual yield (by number of trees of exploitable size) was so calculated as to harvest the existing mature trees during the plan period leaving an adequate number for seed production. No fellings were prescribed in the Pine-Fir Working Circle.

Gotley (1932) divided the forests into three working circles: Selection, for the better stocked deodar, blue-pine and mixed forests on workable slopes; Fir, for the predominantly fir and spruce forests; and Protection, for bare grazing grounds and poorly stocked forests growing on steep slopes. The growing stock of the Selection Working Circle was enumerated into six inch diameter classes down to 12 inches d.b.h. Monro's exploitable size of 30 inches was retained. The annual final yield was prescribed by volume, dividing the volume of exploitable trees in the working circle by 35 (the number of years required by trees of 24-30 inch size to become exploitable). The average annual intermediate yield was estimated from the number of trees 18-30 inches in diameter which in the author's opinion were likely to be silviculturally available. The total yield so calculated was checked against the author's view that 'Normally with this class of forests 1.5% of the growing stock can be considered a reasonable yield'. The yield was also checked against that calculated by Simmon's formula. And it was prescribed separately for each compartment.

Originally no felling were provided for in the Fir Working Circle due to lack of demand, but in the second felling cycle the removal of 100,000 cubic feet of fir and spruce were permitted from trees 18 inches d.b.h. and over. No fellings were to be carried out in the Protection Working Circle. Its only use was for summer grazing.

Lughmani (1960) retained Gotley's three working circles. The modified selection system continued in the Selection Working Circle. Exploitable size was arbitrarily reduced to 28 inches. Growing stock was enumerated into 4 inch diameter classes down to 12 inches d.b.h. Annual yield prescribed was 50% of that calculated by von Mantel's formula on the arbitrary assumption that in Kagan forests the yield of deodar, kail, fir and spruce should be .7% of the enumerated growing stock in the moist zone and .6% in the dry zone.

As fir and spruce had become marketable since the second felling cycle of Gotley's plan, Lughmani advocated felling in these forests under the modified selection system. The crop was enumerated in 4 inch classes down to 12 inches d.b.h. An exploitable size of 28 inches d.b.h. and a felling cycle of 15 years were prescribed. The annual yield of deodar, kail, fir and spruce was prescribed arbitrarily as .6% of the enumerated growing stock in the moist zone and .5% in the dry zone. This was about 50% of the yield as calculated by von Mantel's formula. The Protection Working Circle was not to be commercially exploited.

The yields prescribed in Lughmani's plan were reduced by 30% from 1966-67 when a check revealed that the original inventory had probably over-estimated the growing stock about 30-40%.

The first working plan for the Reserved Forests of Galis was prepared by A.V. Monro (1905). He constituted a Selection Working Circle for the coniferous forests with

three felling series to supply the markets of Jhelum, Abbottabad and Murree. The annual yield was controlled by number of trees. It was calculated by dividing the number of trees of exploitable size (30 inches d.b.h. and over) by the number of years in which a kail tree of 24 inches average diameter was expected to attain exploitable size. From data collected locally, this was found to be 24 years.

To overcome the problem of inadequate natural regeneration, Greswell (1924) provided concentrated natural regeneration in his revision of Monro's plan. By concentrating exploitation, it was hoped to overcome economic difficulties arising from the lack of adequate extraction facilities. He therefore distinguished three working circles: Pine, Fir and Hardwood, and Unregulated. The Pine Working Circle had two felling series and was to be worked under the uniform system on eighty years rotation divided into four periodic blocks, with final yield calculated by Cotta's formula. Increment used in this formula was taken from a yield table prepared by the author from 1364 trees in the working circle. Thinnings and improvement fellings were prescribed in the Fir and Hardwood Working Circle on a 10-year cycle. To the Unregulated Working Circle were relegated forests which could not be worked commercially. These were mainly to be protected or subjected to thinnings and improvement fellings if necessary.

The prescriptions of the Pine Working Circle were revised from 1932-33 under orders of the Chief Conservator of Forests. The revised rotation was 120 years and the regeneration period 30 years. Four periodic blocks could thus be formed but compartments were only allotted to periodic blocks I and II. Increment was deleted from yield calculation so that:

$$A.Y. = V/p$$

in each of the two felling series.

Because natural and artificial regeneration could not be secured under the uniform system, Burton (1940) therefore reverted to management under the selection system. He divided the area into the following working circles:

- (i) Working Circle 1 comprising commercially exploitable crops of kail and fir.
- (ii) Working Circle 2 including compartments in which regeneration had failed to become established after seeding fellings carried out under Greswell's prescriptions.
- (iii) Working Circle 3 for the rest of the area.

The modified selection system was prescribed for Working Circle 1. The crop in this working circle was enumerated into 4 inch diameter classes down to 8 inches d.b.h. An exploitable size of 24 inches and a felling cycle of 15 years were prescribed. The yields of kail, and fir were prescribed as 1.5% and 1.3% of their enumerated growing stock respectively on the recommendation of Sir Gerald Trevor, the then Inspector General of Forests. These were slightly lower than yields calculated by von Mantel's formula assuming a rotation of 120 years for kail and 150 years for fir. Deviations upto 10% were permissible, a higher deviation requiring the sanction of the Conservator of Forests. Deviations

were to be carried forward from year to year and reviewed at the end of 5-10 years to decide whether to write them off or to recalculate the yield.

In Working Circle 2, no felling of green trees was permitted. The major stress was on regenerating the area by natural and artificial means. Working Circle 3 was to be afforded protection to improve its stocking by natural regeneration. Thinnings, however, were provided in certain compartments with dense young growth of kail.

Shah (1966) retained the broad outlines of Burton's plan. The prescribed yield, however, was arbitrarily fixed at .7% of the enumerated growing stock of kail and .5% of fir, instead of Burton's 1.5 and 1.3% respectively.

Reserved Forests of Upper Siran. Monro in 1905 prepared the first working plan for these forests in which growing stock was enumerated down to 12 inches d.b.h. 8500 deodar trees 32 inches d.b.h. and over were counted and yield was prescribed as 200 trees of this size to be removed annually in selection fellings during 32 years. Subsequently removal of 200 trees of kail was also prescribed, chiefly in aid of deodar.

In his revision of Monro's plan, Greswell (1927) divided the area into the Regular and Unregulated Working Circles. The uniform system was prescribed for the Regular Working Circle with a rotation of 120 years, a regeneration period of 24 years, and five nominal periodic blocks with allotment of compartments to P.B.I. only. The area of P.B.I. was about one fifth of the area of the working circle. The growing stock in P.B.I. was enumerated down to 12 inches d.b.h. and the annual final yield was calculated by Cotta's formula for which increment data was taken from Trevor's working plan for Kulu. Increment was excluded from yield calculations under orders of the Chief Conservator of Forests Punjab and N.W.F.P. with effect from 1932-33 (Khan, 1955). The final yield was to comprise all trees 12 inches d.b.h. and over, whether dead or alive, removed from P.B.I. A deviation in actual yield exceeding 10% required sanction of the higher authority, all deviations to be carried forward and adjusted in the following years. No order of felling was laid down but seeding fellings once started in any sub-compartment had to be completed to the extent silviculturally necessary. Secondary fellings were to be carried out strictly in accordance with the needs of regeneration. Thinnings and improvement fellings were prescribed in the unallotted area on a 10 year's cycle and the areas to be thinned were indicated in the working plan for the years of its currency.

Only protection was prescribed for the Unregulated Working Circle. But thinnings and improvement fellings could be carried out if considered necessary, along with fellings in the adjoining compartments of the Regular Working Circle.

Khan (1955) divided the area into three working circles—Selection, Plantation, and Protection as in Burton's plan for Galis. The growing stock of the Selection Working Circle was enumerated into four-inch diameter classes down to 12 inches d.b.h. An exploitable size of 24 inches was prescribed and a felling cycle of 15 years. Annual yield was prescribed as .7 and .5 of that calculated by Simmon's formula for deodar and kail, and fir and spruce respectively, using a nominal rotation of 150 years for all the species

and assuming on the basis of data from Kulu that deodar and kail would attain an average d.b.h. of 12 inches in 45 years and fir and spruce in 65. Deviation of 10% from the prescribed yield was permissible, higher deviations requiring the sanction of the Conservator of Forests. All deviations were to be carried forward and the prescribed yield assessed periodically to determine if it needed revision. Fellings were to be conducted according to the modified selection system.

Artificial regeneration was provided in the Plantation Working Circle where sowings of kail and sowing and planting of deodar were prescribed. Broad leaved species were to be introduced where coniferous species were not likely to thrive. To this working circle were allotted areas where seeding fellings had been carried out under Greswell's plan but regeneration had failed to get established. Only cleaning and thinning and improvement felling were to be carried out in this working circle along with felling in the adjacent compartments of the Selection Working Circle.

Saeed (1968) in his revision of Khan's working plan retained all his major prescriptions. But yield was arbitrarily prescribed as .7% of the enumerated growing stock for kail and deodar and .5% for fir and spruce.

Forests of the Malakand Civil Division. The management of the temperate forests of the Malakand Civil Division (former the princely States of Dir, Swat and Chitral) started under regular working plans in 1964. The forests of Swat Kohistan and Lower Indus Kohistan had been under un-controlled fellings for export since the early seventies of the last century. The brunt of the fellings was borne by the best and the largest deodar trees growing close to the river. At the instance of the then Political Agent Dir, Swat and Chitral, Mr. Parnel, a special Conservator from the Government of India, prepared a scheme for the exploitation of these forests, recommending an annual yield not exceeding 400 deodar trees over 36 inches d.b.h. to be taken out in selection felling. A maximum of 600 dead and dying trees of 24-36 inch size could also be removed in improvement felling. The first marking for exploitation was carried out by him personally in 1928 (Khan, 1966).

A working plan for these forests was prepared by Allah Yar Khan in 1931 in which a Selection and a Protection Working Circle were recognized. The modified selection system was applied to the Selection Working Circle. All deodar trees were enumerated in 6 inch diameter classes down to 6 inches d.b.h. The annual yield was prescribed by the number of trees as Follows:

$$A.Y. = \frac{2/3rd N_1 + 1/3rd N_2}{p}$$

Where

A.Y. = annual yield, in number of trees

N_1 = number of trees of exploitable size (30 inches d.b.h. and over)

N_2 = number of trees in 24-30 inches d.b.h. class

- p = number of years in which trees of 24-30 inch class were expected to attain exploitable size, assumed to be 40 years from experience in Kulu deodar forests.

Two separate working plans have now been prepared for the forests of Lower Swat and Buner, and Swat Kohistan by Faqir Muhammad Khan (1965) and Abdul Qadeer Khan (1966) respectively. Both of them have constituted two working circles—Selection and Protection. Modified selection system has been applied to the former prescribing 28 inches d.b.h. as the exploitable size. The growing stock in the Selection Working Circle was enumerated into 4 inch diameter classes down to 12 inches d.b.h. by sampling of about 10% intensity. For both Indus Kohistan and Buner, and Swat and Swat Kohistan forests the intermediate yield is controlled by area. The final yield has been prescribed by volume as 75% of that worked out by von Mantel's formula. The 25% reduction has been made to allow for errors in estimation of growing stock by sampling.

The first working plan for the forests of the former Chitral State was prepared by Ayaz (1966) who allotted the forests to Selection and Protection Working Circles. The modified selection system has been applied to the former, adopting 28 inches d.b.h. as the exploitable size. Yield was calculated by von Mantel's formula assuming a rotation of 200 years, and then reduced by multiplying it with the factor V_a/V_d , arbitrarily assuming 5,000 cubic feet as the desired growing stock volume per acre.

Guzara forests. The first working plans for the guzara forests of Galis, Siran, and Upper and Lower Kagan forests were made during 1966 and 1967 (Khalid, 1966; Rahim, 1967; Khalid, 1968; Khan, 1970). All of them have distinguished two working circles—Selection and Protection. The growing stock of the Selection Working Circle was inventoried by sampling at 10% intensity, into 4 inch diameter classes down to 8 inches d.b.h. An exploitable size of 28 inches d.b.h. has been prescribed for kail and deodar, and 32 inches for fir and spruce. These excessively large exploitable size limits have been prescribed to exploit over-mature stock and conserve the younger trees. The prescribed yields have been calculated in the following ways:

- (1) Calculating yield by Simmon's formula and then reducing it in view of the poor stocking of guzara forests and their vulnerability to heavy illicit cutting: Khalid's (1968) yield by Simmon's formula worked out to 1.4% of the volume of enumerated growing stock for 'kail' and 'deodar', and 1% for fir. He actually prescribed the yield at 1% of the volume of enumerated growing stock for 'deodar' and 'kail', and .5% for fir. Rahim (1967) arrived at his prescribed yield by multiplying the yield by Simmon's formula with the factor V_a/V_d , assuming 5,000 cubic feet as the desired volume (V_d) of growing stock per acre. The reduced yield came to about .6% of the volume of enumerated growing stock. This was further reduced to .5% as an additional measure of safety.
- (2) Calculating yield by von Mantel's formula and reducing it by multiplication with the factor V_a/V_d , assuming 5,000 cubic feet per acre as the desired volume

of growing stock for kail and deodar, and 6,850 cubic feet per acre for fir and spruce. For calculating yield by von Mantel's formula, a rotation of 150 years was assumed for kail and deodar for attaining the exploitable size of 28 inches d.b.h. and 200 years for fir and spruce for reaching a minimum d.b.h. of 32 inches. To safeguard against inaccuracies in the estimation of growing stock volume by sampling, the prescribed yield was further reduced by ten percent (Khalid, 1966; Khan, 1970).

Summary. The temperate coniferous forests of Pakistan and of Azad Kashmir have all along been mostly worked under the selection system since their management was initiated in 1900. The uniform system was briefly tried in Galis (1924 to 1939) and Upper Siran (1927 to 1954) but could not be made to work under the conditions then prevailing. Currently all these forests are being worked under the selection system as applied to Pakistan (Champion, Seth and Khattak, 1965). Yield has been prescribed in a variety of ways:

- (i) by number of trees = total number of exploitable trees divided by assumed time of passage from the class next below the exploitable, to the exploitable size.
- (ii) by volume = volume of exploitable trees divided by assumed time of passage from the class next below the exploitable, to the exploitable size.
- (iii) by an arbitrary percentage of the volume of enumerated growing stock—most commonly varying from .5 to .7%

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