HILL BAMBOOS – SOCIO-ECONOMIC SIGNIFICANCE AND CONSERVATION IMPERATIVES : A CASE STUDY FROM HIMACHAL PRADESH

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Introduction

Hill bamboos (*Arundinaria* group *s.s.*), like other bamboo species, form a very versatile raw material that is put to varied uses. In Himachal Pradesh, this group of bamboos, locally called as 'Nirgal' or 'Naghal', is represented by two species i.e. *Sinarundinaria falcata* (=*Arundinaria falcata*) and *Thamnocalamus spathiflorus* (=*Arundinaria spathiflora*) (Collett, 1902; Chaudhery and Wadhwa, 1984; Polunin and Stainton, 1984). Both these bamboo species find a wide use in the state in the form of roofing material for temporary hutments, fodder, live hedges for protection and ornamental purposes and stakes for local cash crops. These are also planted to check soil erosion, to stabilize landslides and to recharge ground water. Hill bamboo culms are exported from the state for making fishing rods and 'hookah' pipes. The major local use of these bamboos, however, is in basketry that contributes significantly to the livelihood of poor rural households engaged in basket weaving.

These hill bamboos, forming very striking undergrowth amidst temperate and sub-alpine forests where they occupy moist and cool niches, have not attracted the desired attention towards their long-term conservation despite their significant ecological and socio-economic value. Except the random and very brief references about this 'Non-Timber Forest Produce' (NTFP) contained in the Working Plans of various Forest Divisions, systematic information about their species-wise distribution, extent of occurrence and population status in Himachal Pradesh is wanting. Similarly, data related to extent of annual removals from forests and estimation of annual demand is also not available. Inferences drawn from informal interaction with the local people and the forest managers point to large-scale reduction in area under hill bamboos over the years. With degradation and fragmentation of habitat of hill bamboos still continuing, sustenance of the traditional handicraft of basketry forming the economic mainstay of families engaged in basket weaving may come under threat.

Lack of management focus on hill bamboos may be linked to a general inadequacy of information on the socio-economic and ecological role of this group of plants in respect to Himachal Pradesh. This paper attempts to highlight the socio-economic relevance of this versatile resource and the related conservation issues to focus attention towards its long-term conservation.

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Material and Methods

Information about the usage of hill bamboos in the Sutlej catchment falling in Rampur and Narkanda sub-divisions in Shimla District of Himachal Pradesh was gathered by using a rapid survey method. Ten respondents each from the four major stakeholder categories i.e. the farmers, the basket makers, the traders and the forest managers were approached under this survey with a simple semi-structured questionnaire and information on the following broad issues was gathered :

- Usage of hill bamboos;
- The average number and variety of baskets (basket units) made of hill bamboo required per rural household per year;
- Mode of procurement;
- Average price per basket unit;
- Average raw material (culms) required per basket unit;
- Average number of basket units made per day per artisan;
- Other uses and quantity (culms) required per annum;
- General harvesting/ management practices;
- Status of raw material availability.

Census data for the area was used to estimate the total basket requirement for the study area. Information about the average quantum of raw material (culms) required per basket unit and the total number of baskets required in the study area was extrapolated to arrive at the total annual raw material requirement for basketry work alone. Similarly, information about other consumptive uses of hill bamboos was used to estimate annual requirement of hill bamboos.

Conservation issues were worked out on the basis of information derived as above and subjective interpretation of the damaging effect of various biotic activities observed during the study. Conservation strategies have been proposed mainly on the basis of information available in literature on hill bamboos and other bamboo species.

Results and Discussion

1. *Major Usage of Hill Bamboo Resource*

Hill bamboos form a very versatile local raw material associated with day today life of the rural households in the study area. Be it carriage of material, storage of grains, plucking of apples, winnowing of grains, forming live hedge, stakes for cash crops etc., these bamboos come in very handy. Major uses of hill bamboos in the study area are enumerated below :

(a) *Basketry* : Responses received from the respondents from all the four major stakeholder categories reveal that weaving of various kinds of baskets and other articles form the major use of hill bamboos in the study area. Collation of information from the respondents also resulted in listing of various types of baskets and their major uses. The use-wise detail of different basket types is presented below :

(i) Carriage of cow dung, manure, fuelwood, minor forest produce, leaf fodder, grass, ration, clothes for washing and other miscellaneous items ('Kilta' – a conical basket carried on back).
(ii) Carriage of water, milk etc. ('Panela'

– a specially shaped kilta for securing pitcher type container in it).

(iii) Carriage of bulky material like dry leafs, hay, grass etc. ('Shikrhha' – bigger version of kilta).

(iv) Carriage of food to fields ('Changaer/ Chhabri').

(v) Storage purposes like storage of grains ('Khelta' – a tightly woven big vessel plastered with cowdung and with a lid), wool ('Naoli/Woolety'), chappatis ('Chhaj').

(vi) Plucking of apples ('tokri').

Besides making baskets of different shapes and sizes, hill bamboos are also used to make woven articles for the following purposes :

(vii) Winnowing of grains ('Shupa').

(viii) Separating grains from Chaff ('Khedi/ Bhoti').

The study area being predominantly rural with more than 90% of the households engaged in agriculture, the above mentioned hill bamboo articles find use in the day today life of almost all the rural households with every family in this area maintaining a minimum stock of 'kiltas' and other baskets in their homes for day today use (Fig. 1).

Of all the various types of baskets, it is the 'kilta' that is reported to have the most common and versatile use. It is a common sight in the villages to find men and women with kiltas on their backs carrying different kinds of loads to and from their houses.

'Kilta' is a 75 cm - 90 cm approx (2.5 ft - 3ft) high conical basket used for carrying weight on human back. It is woven of hill bamboo splits and reinforced with sticks of *Salix* sp., *Spirea* sp., *Prinsepia utilis, Berberis* sp. etc. It is harnessed to the back with the help of rope/ strap. 'Kilta' is a

Fig. 1

Head of a local family with hill bamboo products used in his household

preferred mode of load carriage, it being light (only about 1.2 kg when dry and much lighter than similar baskets made from other materials), sturdy and locally available. Moreover, it enables the carrier to move with both hands free while negotiating narrow hill paths for optimum balance.

The study reveals that the number of 'kiltas' maintained per household varies from 2 to 20 depending upon the size of land holding, with an average of 5 'kiltas' in active use per household. With the life of 'kiltas' varying from six months when used for carrying fresh cow dung, manure or fuelwood to upto three years when used for carrying grass, dry material, fruit or miscellaneous household goods, an average supply of three 'kiltas' per household per annum is needed to replace the old 'kiltas'.

In addition to three 'kiltas', an average rural households needs to procure two miscellaneous basket units every year to maintain their assemblance of woven articles made of hill bamboo splits for carriage of dry grass/hay and for storage of grains, wool, food articles etc. Thus, an average rural household needs five basket units per year towards replacement of old, worn out 'kiltas' and other baskets.

The study also reveals that barring a negligible number of baskets that are brought to the study area from outside by vendors, most of the supplies are met from the local sources.

(b) *Stakes for Cash Crops* : Many farmers in the study area traditionally grow beans, peas and tomatoes, etc. as cash crops. These weak-stemmed plants need supports to climb upon and hill bamboos form the major source of stakes for this purpose. Hill bamboo sticks of lengths varying from about 1.25 m to 1.50 m are used for this purpose. These stakes, if taken from mature culms, can be used for two-three seasons. However, as the mature culms are harvested for basketry, it is the younger culms that are generally used as stakes. As such these supports not only need replacement for almost every crop, these also adversely affect the availability of mature culms for basketry.

(c) *Leaf Fodder* : Hill bamboos, remaining green during winter when all other fodder species become dry, start shedding their leaves only on the onset of spring when other species start getting a new flush of leaves. Foliage of hill bamboos, therefore, forms a very important source of fodder during pinch period and is therefore lopped to provide browse for cattle.

2. *Raw Material Requirement for Basketry and other Usage*

Quantitative assessment of annual raw material requirement for basket weaving has been made on the basis of responses received from 'naghalus' – the traditional basket weavers. 'Kilta' – corresponding to the average size of assorted basket-ware used per household – has been taken as one 'basket unit' for this assessment.

'Kiltas', in the study area, are made from either of the two species of hill bamboos found in the study area. Whereas artisans in the lower hills prefer *S. falcata* being softer of the two species, *T. spathiflorus* being sturdier one is preferred in the high altitude villages.

Raw material in the form of mature hill bamboo culms is collected from forests

either by the 'naghalus' themselves or by the farmers. As a general practice, mature culms (3-4 year old) are considered most suitable for basket weaving as the younger culms are reported to shrivel on splitting, the older ones are considered too hard for weaving. Usually the culms are harvested at the third internode from ground. The harvested bamboo culms are cut into sticks of about 2 m length for ease of carriage on the narrow hill paths. The upper leafy portion of the culms is either discarded on site itself or carried as fodder for the cattle.

An average of 20 bamboo sticks of 4-5 cm girth are required for making one standard kilta. A person can select, harvest and carry home material for 3-4 kiltas in a daylong visit to the forest. Each stick is then split into 4 to 8 longitudinal strips depending upon the culm thickness. These strips are then scraped to smoothen their edges and to have uniform thickness particularly at nodes. Weight of a freshly made 'kilta' comes to an average of 4.0 kg, out of which about one kg is on account of re-enforcement sticks of hardwood species like *Berberis* sp., *Prinsepia utilis, Salix* sp., *Spirea canescens* etc. On complete drying, the average weight of one 'kilta' comes down to 1.2 kg.

Considering that there is an average annual requirement of 1.3 lakh basket units (@ 5 basket units per rural household) in the study area (ref. section 3 below), a total of 26 lakh mature culms are needed to meet this requirement. With an average density of about 18,000 mature culms per hectare (Goraya, 2004), raw material from over 145 hectares is required to meet the basketry requirements alone. As far as biomass removal is concerned, 3 kg of fresh bamboo sticks on an average are needed to prepare one basket unit. Total annual biomass removal for meeting the raw material requirement for making baskets in the study area, therefore, comes to about 4,000 quintals.

The hill bamboo culms are also harvested for use as supports for cash crops. Each bamboo culm yields two stakes of lengths between 1.25 m to 1.50 m. Fixed at an average spacing of 2 stakes per square metre, the average per hectare requirement of stakes works out to 20,000, i.e. equivalent to 10,000 culms. It means that for every hectare of agriculture land brought under cash crops, hill bamboo culms from more than half hectare are required as stakes. Total biomass requirement on this account could not be worked out, as adequate data related to the total area under cash crops was not available.

Lopping of bamboo culms for browse for the cattle by local people and the migratory graziers is another mode of utilization of this resource. During the survey, 34% of the total bamboo clumps of *S. falcata* and 21% of those of *T. spathiflorus* were lopped at heights of 1 to 1.5 m giving the clumps bushy appearance.

Hill bamboos are also auctioned by the Forest Divisions for export from various forests in the study area. Eight numbers of truckloads were allowed export @ Rs. 4,200 per truck during 1997-98 and another eight truckloads were allowed export @ Rs. 10,500 per truck during 1999-2000 (Records of Rampur Forest Division). Converted in biomass terms, these removals come to about 1,000 quintals per year. In terms of area, it works out to more than 35 ha per year.

3. *Hill Bamboos – Socio-economic Significance*

The hill bamboos play a very significant role in the local economy. In addition to forming a readily available resource for roofing, stakes and fodder, these form a source of wage income to the basket makers. Moreover, the local people are saved from making higher investments in purchase of expensive substitutes of bamboo baskets.

Basketry in the study area has traditionally been restricted to only a few families per panchayat. Almost all members of these socially backward families pick up the skill of making kiltas and other woven material early in life and contribute to the basketry in one way or the other making it a family vocation. Families engaged in basketry are generally landless and basketry is the mainstay of their income.

If material is available, a 'naghalu' makes on an average 2 'kiltas' per day (@ 4 hours per 'kilta'). One 'kilta' sells for an average of Rs. 70 with sale rates varying from Rs. 50 in the villages in lean season to Rs.120 during peak agriculture season in the market.

Many 'naghalus' also make 'kiltas' on daily wage basis. In this mode they periodically visit various villages in their beat, where farmers engage them on daily wage basis for making 'kiltas' for their requirement. In this case the farmers generally keep the material ready in advance of the visit by 'naghalus' and pay them on an average of Rs. 50 per day in addition to providing food and shelter etc. The 'naghalus' shift their place of work after completing job at hand.

As per Census 2001 figures (Bisotra, 2001), a total human population of about 1,37,500 resides in the study area. Converting this population figure into households @ 5 heads per household, the study area has about 27,500 households of which about 26,000 households are rural and are engaged in agriculture. On the basis of an average annual requirement of five basket units (three kiltas and two miscellaneous baskets) per family, a total of 1.30 lakh basket units are consumed per year by the rural households in the area. At an average sale price of Rs. 70 per basket unit, the total worth of basketry vocation in the study area comes to Rs. 91,00,000 per year.

On the social front, major part of this income goes to the otherwise deprived households. Considering that one family of 'naghalus' can make and sell upto 50 basket units per month and 600 basket units per year, annual income per family only on this account comes to Rs. 42,000. This also means that more than 200 families spread across the study area are deriving their livelihood from this source alone.

Responses from the farmers and the basket weavers revealed that shrinking of the resource from near the villages and the amount of time needed to collect the raw material was dissuading many traditional artisans from this vocation. Most of the educated younger generation was gradually shifting focus to white collar jobs in the government sector. Some of the 'naghalu' families were reported to have taken to agriculture as a result of allocation of land to them by the state government under its policy of allocating land to all landless families in the State. Of late, some persons from families other than the

traditional 'naghalus' have, however, taken to making woven articles from hill bamboos.

4. *Hill Bamboos – Conservation Issues*

Inferences drawn from the responses received from the respondents point to a general reduction in the populations of both the species of hill bamboos in the study area. Major contributing factors towards this population degradation are enumerated below:

(a) *Unrestricted Access to Right Holders* : The forest settlements for the area recognize the rights of the local communities to freely access and harvest the minor forest produce, including hill bamboos, for their bonafide domestic use. Further, the record of rights of users for the demarcated forests of the Rampur tehsil allows the right holders "to collect 'Nirgal' bamboos and to sell baskets made therefrom" (Kapoor, 2001). Therefore, local communities enjoy unrestricted access to harvest hill bamboos for basketry and other purposes.

(b) *Inadequate Population Statistics and Management Prescriptions* : No information about the extent and density of occurrence of hill bamboos is contained in the forest working plans. Neither have the populations of these species been ever enumerated during preparation of working plans for the area nor any record of their removals from forests given in the working plans. Moreover, the Forest Working Plans for the Kotgarh Forest Division covering the area contain no specific prescriptions for management of hill bamboos and these species are treated as just one of the minor forest produce in these working plans (Sudhera, 1991; Kapoor, 2001). General guidelines for harvesting of minor forest produce on a four-year harvesting cycle are purported to cover harvesting of hill bamboos also. These general guidelines are, however, meant to regulate the commercial exploitation of minor forest produce, particularly when it has to be exported out of the area. No checks towards removals by local people for basketry, stakes and lopping for fodder have been incorporated in these working plans.

Another issue of concern where no management prescriptions have been provided relates to tending of hill bamboo populations after periodic gregarious flowering and seed fall. None of the working plans of the area even records the history of gregarious flowering of any of the two species.

(c) *High Harvesting Levels* : With no harvesting norms and standardized harvesting methods in place for harvesting of hill bamboos, these species are often over-harvested or badly harvested. Sample studies of the clump structure in the study area reveals a low recruitment rate, low percentage of dry culms and high percentage of cutting/lopping of >1 year old culms (Goraya, 2004). This is indicative of the high harvesting levels of the resource. Maximum damage is caused by harvesting for fodder when culms are cut at height of 1.5 m to lop the leafy portion of the culms. The growth of side branches from the left over lower parts of the culms causes the culms to get badly entangled and affecting the quality of new shoots.

(d) *Change in Land Use* : Natural habitat of hill bamboos in the State, i.e. the inner, cool and moist niches in the sub-tropical, temperate and sub-alpine zones, has undergone large-scale land use changes

over the years. Hill bamboo populations from private lands have been almost completely exterminated due to conversion of such lands for agriculture and horticulture purposes. The populations of hill bamboos in the forests are facing acute pressure of infrastructural development, especially on account of dumping of debris along depressions during construction of roads and buildings, and adversely affecting the moisture regime of hill bamboo habitats due to indiscriminate harvesting of water from concerned streams.

5. *Hill Bamboos – Conservation Strategies*

Conservation of hill bamboos in the study area is imperative in view of their socio-economic and ecological significance and conservation concerns brought out above. However, any conservation strategy for this group of species would require adequate research backup related to issues like the optimum felling cycle, the felling intensity, method and time of harvesting, flowering cycles, recovery of populations after flowering and augmentation of populations by planting. Answers to many of these issues are yet to be found and should form basis for further studies into the subject. For the present, related information available for major commercial bamboo species has been collated and used, along with insights gained during the present study, to propose conservation action for these species.

(a) *Management of Regeneration* : Flowering of bamboos is a periodic phenomenon occurring after gap of 28-30 years in case of *S. falcata* and about 60 years in case of *T. spathiflorus*. Populations of these bamboos are known to completely collapse consequent to gregarious flowering and this withering away of dry bamboo culms causes gaps at patches previously occupied by bamboo clumps. The hitherto suppressed herbaceous and shrubby species as well as tree seedlings get released from competition due to this gap formation and get a chance to respond to this space availability. However, their long-term effect on the establishment of bamboo seedlings and *vice versa* is a matter of further study. Response of hill bamboo seedlings and its associate species to the accumulated culm litter with high C : N ratio also needs investigation (Singh, 2000).

Recovery of hill bamboo populations after mass flowering is usually left to nature. Both the species of hill bamboos recorded from the study area are known to produce seed in abundance and it is not uncommon to find seedlings 'in quantity around the parent clumps and in places where the seed has been washed by rain' (Troup, 1921). Jalal (2002) has reported a higher mean seedling number in case of *S. falcata* in areas with comparatively open canopy. He has also found that the maximum seed fall and germination is within the clump and the number of seedlings keeps on diminishing with increase of distance from the clump. However, issues related to the size of newly established population and time required for full recovery (?) of original population are still matters of speculation.

In addition to the intrinsic and habitat related factors, recovery of hill bamboo populations is also dependent upon biotic influence, especially on account of grazing, grass removal and fire. Whereas the extent to which these biotic factors affect the

establishment of regeneration would vary from site to site, it is assumed that damage on account of these factors would be very high during the first year following the seed germination due to non-formation of rhizome proper.

Based on the information available for major commercial bamboo species and assuming its applicability to the hill bamboos, the following management prescriptions for treating regeneration of hill bamboos may be of use :

- Incorporate the anticipated mass flowering dates of hill bamboo species in the Forest Working Plans so that special measures to handle post-flowering treatment of these species could be planned in advance. Using the past flowering record and lengths of mass flowering cycles as criteria (Prasad *et al.*, 1989), the next mass flowering of *S. falcata* and *T. spathiflorus* in the study area is expected during the years 2027-29 and 2060 A.D. respectively.

- Prohibit harvesting of flowering culms to enable the species to produce the maximum seed for better recovery of populations. Sizeable removals of even the withering seed bearing culms for future use were observed during the study. Flowering of hill bamboos and their subsequent drying definitely is a cause of concern, especially to the households dependent upon this raw material for basket making. However, this natural phenomenon should not be taken as a panic signal to collect as much raw material as one can to keep the vocation going. This action may cause irreparable damage to the succeeding population size.

- Dissuade graziers from feeding the inflorescence of hill bamboos to sheep and goats. It was noted during the study that inflorescence of these bamboos formed a favoured food of sheep and goat. Flowering culms of *T. spathiflorus* were more prone to this damage during January to March when other sources of fodder were scarce. Extent of damage to the flowering culms on this account, however, needs further investigation.

- Close the flowered areas for grazing as bamboo seedlings are highly prone to damage due to grazing. The extent of damage is particularly high during the first year of germination when the rhizomes have not yet fully formed and the seedling have little reserve to spring back. Prasad and Gadgil (1981) have reported a twofold seedling survival and better seedling growth in ungrazed plots vis-à-vis grazed plots in case of *Dendrocalamus strictus*.

- Adopt appropriate fire protection measures at least for the first two years of regeneration. Even as fire *per se* has not been found to make significant impact on the survival of seedlings (Prasad and Gadgil, 1981), it definitely sets back the growth of seedlings and delays the population recovery process.

- Keep clear an area of about one metre around the flowered parent clump from the competing shrubby growth as the flowered clump and their immediate surroundings provide the most suitable microhabitat for regeneration of hill bamboos. Jalal

(2002) has reported the maximum seed fall and germination of *S. falcata* within the clump. This study corroborates the observations made by Troup (1921) on the basis of 1916 flowering in the same species. Prasad and Gadgil (1981) also obtained similar results in case of *Bambusa arundinacea*. If the hill bamboo seedlings could be provided healthy and competition free microhabitat, likelihood of early revival of the population will increase.

- Take moisture conservation measures around the flowered clumps, as adequate soil moisture is required for germination of hill bamboo seed and its establishment.

(b) *Strengthening of Populations* : Flowering of hill bamboos provides a good opportunity to strengthen its dwindling populations. Both, *S. falcata* and *T. spathiflorus*, produce large quantities of seed with profuse germination under favourable moisture conditions. Major proportion of this regeneration, which otherwise gets competed out and withers away, can be used for stocking the deficient as well as new areas with these species. For this purpose, one-year-old seedlings can be carefully uprooted on the onset of monsoon, wrapped in moist gunny bags, transported to the planting sites and planted during monsoons. The second approach involves collection of seed, raising of nurseries and using the nursery stock for immediate plantation. The nursery stock can also be maintained for vegetative propagation for future use. The Forest Working Plans, therefore, need to incorporate a crash programme for hill bamboo planting following their gregarious flowering.

(c) *Management of Hill Bamboo Populations* : Management of bamboo areas, in general, needs consideration on two major aspects i.e. 'felling cycle' and 'felling intensity' (Varmah and Bahadur, 1980). In the absence of adequate data on both these counts in case of *S. falcata* and *T. spathiflorus*, an attempt has been made to work out the felling cycle and felling intensity on the basis of field data.

In both *S. falcata* and *T. spathiflorus*, the culms come to maturity at 3 years and remain commercially useful for another 2 to 3 years after which these dry out. On an average, the life of culms in case of both these species is 5 to 6 years. Major use of hill bamboos being in basketry, it is the mature culms (3-5 year old) that are the most suitable for the purpose. A felling cycle of 3 to 4 years to sustainably harvest hill bamboos can, therefore, be adopted.

As far as felling intensity is concerned, average clump structure in terms of number of culms in case of *S. falcata* and *T. spathiflorus* comprises of 18% & 16% of recruits, 24% & 22% of 1-3 year old culms, 43% & 41% of 3-5 year old culms and 15% & 21% of dry culms. About half of the mature culms were already cut or lopped leaving only the remaining half of the mature culms for harvesting. However, keeping in view the relatively low recruitment rate, harvesting of mature culms needs to be restricted by the number of new recruits. With the average number of culms per hill bamboo clump being 44.48 in case of *S. falcata* and 61.48 in case of *T. spathiflorus*, a maximum of 8 culms should be harvested per clump per year.

Both the hill bamboo species show a tendency wherein two or more seedlings establish very close to or intertwined with

each other, making the structure of clumps very complicated. This makes the harvesting of mature culms very difficult as younger shoots of one bamboo clump merge with the mature culms of the second bamboo clump. The difficulty to harvest gets multiplied when the younger shoots are harvested for use as stakes for cash crops or for fodder, making the left over bamboo clumps more congested and unsuitable for basketry and other commercial purposes. Careful manipulation methods for such hill bamboo clumps need to be evolved.

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SUMMARY

Hill bamboos, locally called 'Nirgal', form a very important vegetation component in the Sutlej catchment falling under the Rampur Forest Division and Kotgarh Forest Division of Shimla District in Himachal Pradesh. Two species of this bamboo group *viz. Sinarundinaria falcata* and *Thamnocalamus spathiflorus* have been reported from these forest divisions. This paper, on the basis of empirical data, highlights the socio-economic significance of these bamboo species in the study area. Major threats to the wild populations of these species and conservation strategies for better management of this resource have also been discussed in this paper.

Key words **: Hill bamboos, *Sinarundinaria falcata, Thamnocalamus spathiflorus,* Socio-economic significance, Protection, Production, Utilization, Himachal Pradesh.**

पर्वतीय बांस : समाजार्थिक महत्व और संरक्षण बाध्यताएं : हिमाचल प्रदेश में किया गया विशेष अध्ययन

जी०एस० गोरया, मोहिन्दर पाल, के०एस० कपूर व विनीत जिष्टु

सारांश

पर्वतीय बांस जिन्हें स्थानीय व्यवहार में निर्गल कहा जाता है, हिमाचल प्रदेश के जिला शिमला के रामपुर वन मण्डल और कोटगढ वन मण्डल में पडते सतलुज प्रस्रवण क्षेत्र की वनस्पति सम्पदा के बहुत महत्वपूर्ण भाग हैं। इस बांस वर्ग की दो जातियां अर्थात *सिनअरुण्डिनेरिया फाल्काटा* और *थैम्नोकैलेमस स्पैथिलोरस* इन वन मण्डलों में होते सूचित किए गए हैं। अनुभवजनित आंकड़ों के आधार पर यह अभिपत्र इस अधीत क्षेत्र में इन बांस जातियों के समाजार्थिक महत्व पर प्रकाश डालता है। इन बांस जातियों के जंगली बांसों के प्रधान खतरों और इस संसाधन के श्रेष्ठतर प्रबन्ध के लिए संरक्षण की समरनीतियों का विवेचन भी इस अभिपत्र में किया गया है।

References

Bisotra, R.L. (2001). *Census of India: Series-3, Himachal Pradesh*. Controller, Printing & Stationery Department, Himachal Pradesh, Shimla.

Chaudhery, H.J. and B.M. Wadhwa (1984). *Flora of Himachal Pradesh (Vol.-III).* Botanical Survey of India, Howrah.

Collett, H. (1902). *Flora Simlensis: A Handbook of the Flowering Plants of Simla and the Neighbourhood* (repr. 1971). Bishen Singh Mahendra Pal Singh, Dehra Dun.

Goraya, G.S. (2004): Species and habitat diversity of hill bamboos (*Arundinaria* spp.) in Sutlej catchment of Shimla District. *Ph.D. Thesis*, FRI Deemed University, Dehra Dun.

Jalal, J.S. (2002). Re-establishment of *Drepanostachyum falcatum* population following mass flowering and mortality in open canopied forests. *M.Sc. Dissertation*. Department of Botany, Kumaon University, Nainital.

Kapoor, R.K. (2001). *Revised Working Plan for the forests of Kotgarh / Rampur Forest Divisions (1993-94 to 2007-08) – Vols. I & II.* Forest Department, Govt. of Himachal Pradesh, Shimla.

Polunin, O. and A. Stainton (1984). *Flowers of the Himalaya.* Oxford University Press, New Delhi.

Prasad, S.N. and M. Gadgil (1981). *Conservation of Bamboo Resources of Karnataka – Final Report*. Karnataka State Council for Science & Technology, Bangalore.

Prasad, S.N., S. Sathya Kumar, G.S. Rawat and A.J.T. Johnsingh (1989). The Conservation of Montane Bamboo in Western Himalayas, India. *Proc. Intl. Symposium on Conservation Phytoecology*.

Singh, S.P. (2000). Mass flowering in the Himalayan dwarf bamboo. *Curr. Sci*., **79** (6): 694.

Sudhera, C.L. (1991). *Revised Working Plan for Kotgarh Forest Division (1978-79 to 1992-93): Parts I & II*. Forest Department, Govt. of Himachal Pradesh, Shimla.

Troup, R.S. (1921). *The Silviculture of Indian Trees*. Clarendon Press, Oxford. **3** : 977-1001.

Varmah, J.C. and K.N. Bahadur (1980). Country Report and Status of Research on Bamboos in India. *Indian Forest Records*, **6** (1): 1-28.