

ToR for handmade paper making from Pine needles (Pirul) at Rural Technology Complex, GBPNIHE, Kosi-Katarmal, Almora in PPP Mode

Background:

Chir pine (*Pinus roxburghii*) is one of the most abundant forest forming tree species in the western Himalayan region, particularly Uttarakhand, between 1000 - 1800 m asl. and spread over appx. 16.4% of total forest area. This species has many traditional and commercial uses such as a source of resin and timber and bedding/thatching material in cattle sheds, etc. In Uttarakhand about 7-8 Mg resin is collected every year costing @ Rs. 6000-7000 per 100 kg. Pine is a hardy species and its non-palatability, drought tolerance, fast growth and early-successional nature promotes its preponderance in inhospitable area, where other broadleaf species such as Oak (*Quercus* spp.) does not grow. This species is considered inferior over socially valued Oak (*Quercus* spp.) forests that provide quality firewood, fodder and useful for soil and water conservation (Annex-I). The bad aspect of Pine forests is that they are poor in biodiversity and particularly prone to forest fire due to resin-rich leaf litter (Pirul) accumulation on the forest floor during every summer, and also during late winter. It causes emission of black carbon in the atmosphere and the smoke creates problem for asthmatic people. In Uttarakhand an estimated 1.8 million ton of Pirul is produced every year that poses serious fire hazards in the forests of Uttarakhand and cause immense loss to the forest wealth and environment in Uttarakhand state. Since the formation of Uttarakhand in 2000 up to June 2019 a total of 44,518 ha forest area has been burnt due to FF. For example, in 2016 summer 2069 major forest fire incidents occurred in the Chir Pine forests of Uttarakhand that affected 4423 ha and the loss was estimated at Rs. 4.62 million as per the scheduled rates of Forest Department. In the FY 2020-21, Rs. 16 crore has been allocated for fire fighting in Uttarakhand. Central Government deployed three National Disaster Response Forces and employed two IAF helicopters to control the FF in May 2016. The Forest Department has adopted a number of methods to prevent forest fires, deployment of fire watchers, creation and maintenance of fire lines, involvement of local communities for beating of forest fires and use of water to douse the fire and use of Remote Sensing and Moderate Resolution Imaging. But in spite of all these measures fire incidents have not significantly decreased in hill districts of the state. Fire is a major factor now in Uttarakhand that is responsible for the degradation of forests and poses a big challenge to the Forest Department and other concerned agencies.

In view of the above, in an attempt to find the environment-friendly use of Pine leaf litter (Pirul) to reduce the likelihood of forest fire the G.B. Pant National Institute of Himalayan Environment (GBPNIHE), Kosi-Katarmal, Almora (an autonomous Institute of Environment, Forest & Climate Change, Govt. of India) initiated a project and set up a Pine Processing Unit at Rural Technology Complex of the GBPNIHE (under the funding of National Mission on Himalayan Studies, MoEF&CC) in 2018 to convert the pine needle into paper and making useful products (e.g., file covers, file folders, carry bags, file folders, envelopes, note pad etc.) and involved the local communities in the supply chain by procuring Pirul from them that provided them additional livelihood opportunities and also contributed to reducing the fire hazards in their vicinity. Governor House, Ladakh UT, ICAR set ups, Pantnagar University, Deptts. of Forest, Agriculture and Horticulture and many others ordered for these items and they are using them. The Pirul based products are much in demand and we made over 8000 such products and earned appx. Rs. 1.75 lakh over these years. The final technical project report of all these activities is available for details.

Rationale of Making Pine Unit a Public Venture:

The afore mentioned effort of the Institute gathered appreciation from various corners and encouragement including the MoEF&CC apex bodies of GBPNIHE and visitors to our Institute. *However, the fact remains that how to create a business model on this environmentally rewarding venture and make this activity economically profitable that should lead to the socio-economic development of the people while utilizing the abundant Pirul resources around that is otherwise a big nuisance to the forests and ecology of the region.* Also, the Institute cannot continue running this small Pine Processing set-up of its own to compromise the larger interest of rural communities.

Using Pine Needles (Pirul) for Multi-products by GBP-NIHE- An Environment-friendly Option for Income Generation and Livelihood Promotion

In the GBPIHED campus 9.6 ha (32% of the total area) area is occupied by Pine forest of young age of about 30 years. The Pine tree density was computed 610 trees/ha (a review of literature puts this value at 742 trees/ha in the forests of Uttarakhand). Pirul production in the Institute Campus was estimated about 4.6 kg/tree that converts to ~ 54 ton/yr (or each ha of Pine forest can generate about 3413 kg of Pirul annually). Accounting for a loss factor of

25% as per the estimate of one study the net availability of Pirul is about 41 t/yr that is sufficient to produce ~ 20000 sq m of paper and prepare about 40000 items of Pirul that can be sold for Rs. 10,00,000 (@Rs. 25/-item). Each ha of Pine forest thus can generate 6825 items (@487 m² handmade paper). Cost of avoidance of forest fire from GBPNIHE Campus [(@ Rs. 1500/-ha the lowest rates of Forest Deptt. that does not include loss of medicinal and aromatic plants, wild edibles and forest regeneration)- 18.6 ha x 1500 = Rs. 27,900 and Cost of fodder (@ Rs. 1/kg) = 2.8 t/ha yield x 9.6] works Rs. 26,880/year. The Chir Pine forest has now grown mature enough and every summer accumulation of its needle leaves (Pirul) rich in resin on the forest floor become a concern of fire hazard to our Institute premises as the Pirul is inflammable in nature. In the past, few instances of FF occurred in the forests adjoining the Institute Campus across Ranikhet - Almora road. Hazards of FF are not only limited to our office complex in the Campus but also to the nurseries, experimental gardens, net / green houses, AWS tower, Dispensary etc. *This proposal presents an environment-friendly solution to this problem and proposes that the Pirul available annually in the forests of Institute premises is utilized for making certain environment-friendly products that would also demonstrate an example of sustainable utilization of this abundant bio-resource that will keep the fire hazard away from the Campus and would also enhance the forest ecosystem services and contribute to maintain a healthy environment in the locality.*

Production of handmade paper at pine processing unit

As mentioned earlier in the pine processing unit (PPU) at RTC of the institute handmade paper is being produced using Chir pine needle as a raw material collected from the surrounding areas involving women and other beneficiaries. This activity was largely viewed both as employment and income generating and more importantly reducing the likelihood of forest fire in the vicinity of project area. The composition and properties tests of handmade paper at PPU were conducted by National Handmade Institute, Jaipur. The paper obtained is environmental friendly and degradable. It is eco-friendly because it is used on fallen pine needles and do not cut tree to make paper. Sunlight is used for drying of paper sheets. So energy is consumed from nature and according to economic stand point it is profitable.

Quality of handmade paper produced in this process is marketable. It demands very light and simple operations that can be easily operated also by women. Strong industrial base for rural development can be developed around this project across the state. It will create jobs as well as remove hazardous pine needle from the forest floor. It will not only stop the people migrating from rural to urban areas but also gain community support for conserving pine forests in the state. The Govt. of Uttarakhand is promoting environment-friendly use of Pine needles and has brought out a Policy for the same (Annex. II). Thus, the institute has taken decision to lease out the pine processing unit under PPP (Public-Private Partnership) mode.

ToR for the PPP:

**A contract may be signed between the GBP-NIHE (First party) and the
(Second Party)**

1. The Second Party shall bear all the damage / replacement / maintenance cost of equipments installed in the Pine Processing Unit.
2. The 1st Party will not charge any rent of the PPU setup from the 2nd Party for a period of one year and will provide electricity and water to the 2nd Party free of cost for one year. However, continuous supply of electricity and water will depend upon the local supply system that is beyond the preview of the 1st Party. **Also, Institute will not be liable for damage caused by any unforeseen events / natural calamities.**
3. The 1st Party will provide all the technical know-how and knowledge relating to the operation of PPU and production of the Pirul based items. **A bilingual "TECHNICAL MANUAL" is available for details.**
4. Raw material (Pirul) available in the Institute campus appx. 55 t/year will be utilized free of charge **for the initial 1 year of the Pine leaf litter (Pirul) production cycle of the forests. Thereafter, charges on Pirul collection will be levied @Rs. 1/ kg as per the rates of Govt. of Uttarakhand.** Also, raw material will have to be procured from the nearby rural areas involving women self help groups (SHGs) following the guidelines of Govt. of Uttarakhand (Annex. II).
5. It will be mandatory to put the logo, address and contribution of the first party relating to this R&D process and product on the items prepared by 2nd Party at the PPU.

6. The 1st Party will not be responsible for any kind of accidents and loss of life in the PPU. **Standard Safety Protocols as per the guidelines of State / Central Govt. will have to be followed by the 2nd Party for operation of the PPU.**
7. Either party may terminate the Agreement by giving three (3) months prior notice to the other party.

(I.D. Bhatt)

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Various products made at Pine Processing Unit





Rag chopper



Hammering Machine



Digester



Beater



Hydraulic Press



Auto vet



Calendaring Machine



Paper cutter

Various machines installed in Pine Processing Unit

Multiple Uses of Pine Trees Promote its Existence ?

Chir Pine is the most important species in India covering an area of 8900 km², and has its roots in folklore and mythology. It forms a straight cylindrical bole, and among the most important timber trees in forestry plantations. Though, the Chir Pine was in the Himalayas since time immemorial, its mass-scale regeneration was promoted for resin tapping in the British period. Its non-palatability, drought tolerance, fast growth and early-successional nature promotes its preponderance in inhospitable area where other broadleaf species such as Oak (*Quercus* spp.) does not grow. Pine trees are also important as a source of valuable resin extracted from of its bole. India ranks 6th position among the top ten resin producing countries of the world. In Uttarakhand about 7-8 Mg resin is collected every year costing @ Rs. 6000-7000 per 100 kg. Resin yields an essential oil on distillation, turpentine, and non-volatile rosin which is used in pharmaceutical preparations, perfume industry, disinfectants, insecticides, denaturants, and in adhesives, paper, rubber, soap, cosmetics, paint, varnish, rubber and polish industries. Resin is used by local people for medicare against boils, swellings and cramps, and mature bole is used as torchwood. The seed is edible and produces edible oil. The thick and soft bark is easily carvable to make useful decorative items. Pine cones are also used as decorative items, and leaves are extensively used to make brooms, thatching roofs and making cattle-bed and FYM. In spite of all these utilities, Pine forests are accused for voracious use of soil water leading to drying up of streams and springs and suppress floral diversity of forest floor.