https://doi.org/10.33451/florafauna.v28i1pp45-48
FLORA AND FAUNA ISSN 2456 - 9364 (Online)
2022 Vol. 28 No. 1 PP 45-48 ISSN 0971 - 6920 (Print)

Pine (*Pinus roxburghii*) can boost green economy post covid-19 in the Himalayan states

Paromita Ghosh

G. B. Pant National Institute of Himalayan Environment & Development,
KOSI - KATARMAL, ALMORA - 263643 (UK) INDIA
E- mail: paroghosh@rediffmail.com

Received **:** 11.01.2022; ***Accepted*** : 08.03.2022

ABSTRACT

This article describes how Pine (*Pinus roxburghii*) tree products can create opportunities for a green and inclusive economic recovery in Himalayan states hit by COVID - 19 pandemic, where Pine trees grow in abundance. A Pine based green economy can enhance the livelihood opportunities of the poor people and enhance the resilience of state economies and societies in the face of severe recession and bring about reduction in degradation of forests and prevent forest fires.

Figure : 00 References : 07 Tables : 02
KEY WORDS : Green economy, Himalayan states, Pine (*Pinus roxburghii*)

Introduction

The COVID-19 pandemic has become a major health crisis and has impacted the economy of the Himalayan states badly. The COVID-19 pandemic provides the impetus to further study the ecological counter measures like landscape based interventions to arrest the drivers of land use-induced zoonotic spill over that can also serve to recover the economy. The pandemic has led to loss of jobs of poor village people who had migrated to cities in search of better livelihood. They have now returned to their villages and are seeking some employment to sustain themselves. Various low cost green economic interventions can provide some relief to the financially distressed poor people with livelihood opportunities.

Green economy is a solution and an opportunity to advance sustainability and social justice as a function of a more stable and prosperous system[1]. A green economy has four interconnected and mutually dependent goals. 1. increasing economic growth 2. alleviating poverty by reducing unemployment 3. increasing social inclusion and equity and 4. reducing green house gas emissions. Achieving these goals will require existing education and vocational training systems to be capable of equipping future workers with requisite competencies needed to take full advantage of the employment opportunities being generated by the green economy. The strengthening of the green economy can be done by educational institutions through extracurricular activities as well as from the participation of people around the neighbourhood. Educational institutions should notably develop skills to increase income but also to improve lives. So far most governments have concentrated on promoting green energy and green surface transport. However green agriculture, forestry and waste management is yet to be explored to its full capacity. Many R&D organizations and NGOs have been promoting several rural technologies including Pine products as cottage industry to bring in a green economic transformation in the hills. But it needs a boost to foster green economy.

All state governments are trying to create economic recovery package that have the capacity to recover the economy and it is green and inclusive. Under such circumstances the rural people should be the target of green economic recovery who have suffered the maximum impact of COVID - 19 pandemic. This will lead to sustainable development of the region. There is no industry in the Himalayan states particularly in the poor mountain districts though districts of the plains are much better off. Therefore a thoroughly designed and properly implemented green stimulus measure in the form of generation of Pine products can generate income, create jobs and improve the well being and build resilience of mountain people.

General characteristics of Pine tree and Pine forests: Pine is locally known as “Chir ka ped **“**and covers

ACKNOWLEDGEMENT : The author is thankful to Director, GBNIHE, Almora for providing all necessary support.

TABLE-1: Facts on Pine needle generation and its potential for briquetting [4]

1.	6 tonnes of Pine needle is generated in one hectare of Pine forest.
2.	2-3 million tonnes of Pine needles are produced annually.
3.	Total Pine needle covered area 50-60000sq km
4.	Over 5 lakh ha of Pine forest in Uttarakhand (4-5 tonnes per ha)
5.	Approximately 165 million kg of accessible pine needles
6.	Pine needle collection charges Rupees 2 per Kg. potential to generate employment worth 330 million rupees.
7.	Briquettes rates 15 rupees per Kg. Potential to create micro entrepreneurship opportunities worth 2500 million rupees.

about 16% of forest area in Uttarakhand [2]. It is one of the six Pines in India that have maximum occurrence and area[2]. Chirpine is known as three needle Indian Pine and also spreads across Afghanistan, Pakistan and Nepal. There is a controversy regarding declaring Pine as a native or a naturalized species. It grows at elevations of 500 meters to 2,200 meters as pure Pine forests. Pine trees grow to a height of 30-50m with a trunk diameter of 2m. The bark is red brown, thick and flaky, leaves are needle like in fascicles of three. 20-35 cm long and yellowish green in colour. The cones are ovoid and 12 to 24 cm long and 5-8 cm broad at base when closed[3].

Pine was planted extensively in the states of Uttarakhand and Himachal Pradesh in the past century for supporting the laying of railway tracks by Indian Railways and for resin tapping during colonial era. Even today resin tapping earns a revenue of approximately 70 crore per annum to the state of Uttarakhand. Pine tree is sun loving and has very little water requirement due to shallow root system. Pine forests usually grow on dry slopes so needles that fall under the trees decompose very slowly. The Pine trees are evergreen and tough, they can thrive at difficult places where other species find difficult to survive. Pine tree bears seeds at very early stage and in plenty round the year and dispersed by wind. The Pine needles decomposition rate is very slow as a result the pine needles keep on accumulating round the year.

However Pine trees are seen as a species that have negative impact on the environment due to the following reasons [2]

1. It causes forest fires as needles are highly inflamable which leads to loss of biodiversity both flora and fauna.
2. It reduces water level and does not support healthy microbial flora.
3. Pine needles are acidic and render the forest floor acidic and therefore not consumed by livestock.

Pine trees contribute to air pollution in the Himalayas. They give off gases like isoprene (Volatile organic gases) that react with airborne chemicals creating tiny invisible particles that muddy the air. The air that people breathe becomes full of particles called aerosols.

Uses of Pine are described below:

1. Pine wood and bark:

Pine tree is extensively used for resin tapping used for producing turpentine oil. Chir Pine oleoresin yields approximately 70 percent turpentine and 17% rosin which is extensively used in soap, paper, paints, varnishes, pinoleums, sealing waxes, oil cloth, inks and disinfectancts. Turpentine is widely used for preparation of paints and varnishes other chemicals and pharmaceuticals. Scientific resin tapping by borehole method can help to minimize spread of resin on tree trunk.

The wood is used as firewood by locals and as timber for construction of houses, furnitures, farm implements *etc.* Pine is a coniferous wood that can be used in manufacturing and carpentering and can be found in many building in the form of flooring, windows, furniture and so on. The bark is a source of charcoal, resin and coal tar.

Pine needles for electricity generation: Electricity can be generated from Pine needles by

biomass gassification technology for conversion to electricity. In 2009 an NGO located in Uttarakhand, Avani Bio Energy established a small scale gassifier of 9KW capacity[7]. 1.5KW was used for running the system and rest was used in welding and calendaring industry. Today the NGO has become Avani Bio Energy an independent power generating company. It sells electricity to the Uttarakhand state grid through a 20 year power purchase agreement with Uttarakhand power corporation limited. A 100 KW gasifier running 24 hours need 4500 kg of pine needles. 1350 tonnes of Pine needles are required per year. Avani Bio-Energy has obtained pine needle collection rights from Van Panchayats (village forest administrative body). Pine needles are collected mostly in summer season from April to June by women who are paid rupees 1 for a kg of pine needle. Collection of pine needle provides employment to approximately 100 people from the villages[7]. The high energy content residue of biomass gassification is converted to briquettes and sold in local market for smoke less cooking and heating in winters. It also saves precious time of the women who otherwise have to spend time in the forest collecting fuel wood and fodder. Residue from a 120KW gasifier system is sufficient to meet the cooking fuel needs of 100 households[7].

Pine needles for bio- briquettes: Pine needle briquettes are prepared using the piston press mould with clay as binder in the ratio of 80:20. The Pine needles are considered as good source of briquetting as they have very low moisture content (9.76%)[6]. Facts on natural generation of Pine needles and its potential in biobrequetting is presented in Table-1. The number of holes in the briquettes help to increase the efficiency of the briquettes to 27.01% which is higher than fuelwood (15.55%). The briquettes do not emit smoke which is an advantage for its use in cooking and space heating by the rural population in the mountains[6]. The properties of Pine briquette are presented in Table 2. The Pine needle briquette can be popularized and promoted as a renewable fuel with combustion characteristics (5230KCal/Kg) very similar to fire wood[6].

Pine needles for paper manufacturing: Chemical content of Pine needles varies from one geographical location to the other[5]. The Himalayan Pine needles contain 43% lignin, 52% holocellulose and 5.8% extractive content. Pine needles contain more than 50% holocellulose and therefore can be used for production of pulp and paper. The Pine needles can be used for semi bleached grade pulp, unbleached kraft paper, filter or paper board. Pine needles are collected and chopped to uniform size and stored in polythylene bags to obtain uniform moisture level. Kraft cooking of pine needles is done using 24% active alkali (alkaline sulphite process). This results in pulp yield of 24% and unbleached pulp of kappa number 28. The kappa number is high due to higher lignin content. DEpD bleacing results in 75% ISO[5].

Pine needle has also been explored to create textile and scented paper but it needs more research before it can be used for commercial production.

Pine needle and other benefits: The needles make excellent fire starters, flavouring for teas and vinegars, grill smoke to season meats, air freshners and soil mulch. The needles are used for livestock bedding and field mulching. Acid loving plants like Rhododendron can be mulched with Pine needles. They are widely used as mulches in agricultural fields in the mountains to conserve moisture. Long Pine needles can be soaked in warm water to make them pliable and weave into baskets. Pine nuts and inner barks are consumed by tribal community in Himalayan region during harsh winters.

Scientists in India have already developed uses of Pine needles for compost, boards, tiles, briquettes and Pine papers from which file folders, carry bags and invitation cards are being made these days. Chir Pine needles and cones are being used for preparing show pieces, rakhis (decorative bracelets tied by sister to brother on the festival of Raksha Bandhan that falls in the month of August) and jewelleries.

Pine needle and health benefits: Pine needle oil is a natural remedy to many ailments and also keeps insects at bay. Pine is antibacterial and homemade soaps can be made from Pine essential oils. Pine needles can be used for warm foot bath to cure athletes foot. Pine needle concoction is used for disinfecting counter tops and floors.

The needles are rich in vitamin C, A and carotenoides. They are good for eyesight. Pine needle tea is good for anaemia and relieves respiratory problems. They have antioxidants and prevent aging. Turpentine oil

TABLE-2: Properties of Pine briquette

Calorific value	> 4000 K Cal/Kg
Moisture Content	< 5%
Ash Content	< 5%
Sulphur emission	Nil
Production cost	4-5 Rupees /Kg
Sale rate	10-15 Rupees/ Kg

when applied topically relieves pain and swelling due to arthritis and rheumatism.

Conclusion: Promoting Pine product manufacturing can be a transitioning to green economy as short as well as long term response to the global Covid -19 pandemic. It can be a long term strategy for sustainable development and poverty alleviation.

To promote green economy of Pine as an economic recovery measure of post Covid pandemic central and state government agencies should:

1. Grant loans and provide tax reliefs to initiate green business with Pine
2. Financial support to households and provide incentives for installation of renewal energy.
3. Invest more in R&D towards improvement of Pine based products. Because innovation drives productivity and economic growth.
4. Apart from well tested protected cultivation (Polyhouse, polytunnel, polymulching), bee keeping and poultry farming, Pine products like bio briquetting, paper and paper products like file folders, envelopes *etc,* Pine decorative items and jewellery and rakhis and traditional folk art like "aipan" can be employed to train local youth under green skill building programme.
5. Challenges are high cost of production which needs to be brought down to make the product viable in a competitive market.
6. Other challenges are market linkages, shelf life and transportation of delicate finished goods.
7. Identification and creation of young change leaders who will be able to apply innovations and become entrepreneurs.

The use of raw materials from natural resources like Pine bark and needles have environmentally economically and socially impacting consequences beyond national boundaries and have the potential to counter sudden economic crisis arising out of COVID-19 pandemic.

Competing interest: The author declares no competing interests associated with this manuscript.

Funding: The work was supported by In House Project -2, five year plan (2019-2023) GBPNIHE, Almora.

References

1. Dechezlepretre A, Martin R, Bassi S. Policy Brief on climate change policy, innovation and growth. 2016; p30.
2. Dobriyal MJR, Bijalwan A. Why cutting down chirpine is not a solution to Uttarakhand forest fires. Down to Earth, 30 September, 2015 ; https://www.downtoearth.org.in/blog/forests/why-cutting-down-chirpine-is-not-a solution-to-uttarakhand-forest-fires- 51178.
3. Farjon A. "*Pinus roxburghii*". IUCN Red List of threatened species. IUCN. 2013.
4. https://www.nccf.in (National Foundation for Credit Counselling).
5. Lal SP, Sharma A, Bisht V. Pine needle: An evaluation of pulp and paper making potential. *Journal of Forest Products and Industries.* 2013 : **2**(3) : 42-47.
6. Pandey S, Dhakal RP. Pine needle briquettes: A renewable source of energy. *International Journal of Energy Science.* 2013; **3**(3) : 254-260.
7. Vikaspedia. Electricity generation using Pine needles in Uttarakhand. 2018, Vikaspedia.in/energy/best-practices/electricity-generation-using-pine-needles-in Uttarakhand.