



HIMALAYAN NEWSLETTER

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**From the
Director's Desk**

ICFRE-HIMALAYAN FOREST RESEARCH INSTITUTE, SHIMLA

ICFRE-Himalayan Forest Research Institute (HFRI), Shimla has responsibilities for conducting research in the state of Himachal Pradesh and Union Territories of Jammu & Kashmir and Ladakh. At HFRI, considerable importance is given for extension of research finding to their prospective users. The institute reaches out to the stakeholders through capacity building programmes, social media, TV talks and publication of extension material. Training programmes were conducted on different aspects like nursery technique, medicinal plants, biofertilizer, biopesticides, management of insect-pest and diseases etc.



The Himalayan Newsletter aims to enrich the reader's knowledge on the research and extension activities of the institute. I sincerely hope that the information provided in our Newsletter would be of interest of researchers. We sincerely look forward to your suggestions and feedback and seeks your support and cooperation.

**Dr. Sandeep Sharma
Director**

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HIMALAYAN NEWS LETTER

Research Articles

Euphorbia royleana Boiss.: A Mysterious Himalayan Succulent Plant

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Introduction

Euphorbia royleana is an important medicinal plant also known as Sullu Spurge, Danda Thor, Churee and Royle's Spurge. It belongs to family Euphorbiaceae. Euphorbiaceae as usually known as one of the largest families of flowering plants, contains 300 genera and 8,000 species (Webster et al 1994). The family is very diverse in variety, composed of all species of plants ranging from large woody trees, climbing lianas to creeping herbaceous weeds. The family consists of species of vast economic importance like *Ricinus communis* L. (Castor oil plant), *Manihot esculenta* Crantz (Cassava) and *Hevea brasiliensis* Willd. ex. A. Juss (Rubber tree) among others and also toxic weeds like *E. esula* L. and *E. maculata* L. (Schultes et al., 1987). Euphorbia is largest genus of family Euphorbiaceae and sixth largest genus among flowering plants consisting of 2000 species occurring worldwide (Andrea et al., 2014). This genus represents 84 species in India and all contain latex and have unique flower structures (Scholz et al., 1964). Latex bearing plants, namely *E. royleana* and *Trifolium repens* occur in the vicinity of the Shilajit bearing rocks and are thought to be the most likely source of Shilajit (Ghosal et al., 1976; Ghosal et al., 1988b) which is humus rich blackish-brown substance, useful in many diseases and also serves as a potent tonic. Due to high medicinal properties Sullu spurge has been used in Ayurvedic and Yunani medicine.

Common name

Chunn, Khyun (India), Siudi (Nepal), Dandathor, Dozakhimeva (Pakistan), Churu, Sru, Thor, Saru and Surai (Himachal Pradesh)

Synonyms

Euphorbia pentagona Royle

Nativity: Reg. Himal

Botanical Classification

Kingdom: Planate
Claude: Tracheophytes
Claude: Angiosperms
Claude: Eudicots
Claude: Rosids
Order: Malpighiales
Family: Euphorbiaceae
Genus: Euphorbia
Species: *E. royleana*

Habitat and Distribution



Photo-1: Flowers of *Euphorbia*

It is native to Himalaya and widely found in subtropical rain shadow valleys and dry slopes of the Himalayan range in India, Bhutan, Myanmar, Nepal, Bhutan, Pakistan, Indonesia, Taiwan, Myanmar, Yunnan and China between altitude 300-1500 meters (Bani *et al.*, 2005). In Himachal Pradesh it is found in Shimla, Solan, Hamirpur, Una, Bilaspur, Chamba, Kangra, Sirmaur, Kinnaur and Kullu districts. *Acacia catechu*, *Albizia chinensis*, *Cassia fistula*, *Quercus oblongata*, *Quercus glauca*, *Bombax ceiba*, *Bauhinia variegata*, *Grewia optiva*, *Cassia fistula*, *Erythrina suberosa*, *Sapium insigne*, *Holarrhena antidysenterica*, *Syzygium cumini*, *Aegle marmelos*, *Ficus* spp., *Pyrus pashia*, *Butea monosperma*, *Ziziphus jujuba*, *Mallotus philippinensis*, *Eucalyptus* spp., *Pinus roxburghii*, and *Dalbergia sissoo* are major associated tree species. Whereas *Bauhinia vahlii*, *Himalrandia tetrasperma*, *Agave americana*, *Carissa spinarum*, *Murraya koenigii*, *Justicia adhatoda*, *Opuntia* spp., *Reinwardtia indica*, *Rubus ellipticus*, *Desmodium* spp., *Lantana camara*, *Woodfordia fruticosa*, *Punica granatum*, and *Vitex negundo* are major shrubs and *Cassia tora*, *Solanum* spp., *Tagetes minuta*, *Oxalis corniculata*, *Cannabis sativa*, *Chenopodium* spp., *Rumex* spp and *Urtica dioica* are the major herbs.

Morphology

The plant has cactus like a habit with a thick, fleshy stem and leaves reduced to spines (**Photo-1**). The plants share the feature of having a milky, white, latex-like sap, and unusual and unique floral structures. It is an erect, spiny shrub growing up to 3 meters tall, or becoming a small tree up to 8 meters. The stems become leafless during hot and cold seasons and the leaves are fleshy, spoon shaped, 10-15cm long, alternate and apically clustered. The fresh stems are green cylindrical 40-50 cm in diameter, producing many branches up to 7 cm in diameter from its upper parts and release milk. The stems have spine 5-7 angles more or less undulate branches with rounded teeth/tubercles. The spine is paired and oriented downward. It has succulent segmented branches in spiral, which are green, 4-7 cm thick, with branching from the axial parts. When they are in bloom, they are usually invisible. The flowers are small and yellow-green. The flowers, are almost stalkless with 3 to 4 group in sub terminal cymes in leaf axils (**Photo-2**). It blooms in spring and summer. Fruits look like star shaped in reddish color. The seeds are light reddish brown, smooth and hairless. Flowering and fruiting occur in the month of May-July.



Photo-2: *Euphorbia royleana*

Traditional uses

E. royleana is a common folk medicinal plant of India. In areas of its distribution local communities traditionally use this plant parts such as stems, leaves, rhizome, bark, fruits, pulp and latex mainly to cure skin problems, asthma, jaundice, anemia, cough, constipation, paralysis, ear pain, and loose motions. In Himachal Pradesh it is used to reduce pain in body parts. Leaves are also used as vegetables and stem pulp is used as Raita. The latex is also filled in the cavities of decomposed teeth to verify infection to prevent the growth of cavities. In Nepal its latex is used as molluscicide. The fresh latex has a rich sweet odour. It is acrid and possesses cathartic and anthelmintic properties. It is liable to cause dermatitis and is reported to be injurious to the eyes.

Pharmacological activity

E. royleana stem bark and latex extract possess piscicidal, molluscicidal and anti-acetylcholinesterase activity (Tiwari *et al* 2004). The water-soluble fraction of *E. royleana* latex, showed dose-dependent anti-inflammatory properties. Ethanol extract of the latex of *E. royleana* was studied for analgesic and antipyretic properties (Bani *et al.*, 1997) and anti-arthritic effects in different acute and chronic test models in rats and mice (Bani *et al.*, 2000). The methanol, aqueous, hexane fraction of plant possess antioxidant, antimicrobial and cytotoxicity activity (Ashraf *et al.*, 2015). The powder stem of *E. royleana* provide Hepatoprotective activity (Kushwaha *et al.*, 2017). The ethyl acetate fraction of *E. royleana* has immunosuppressive properties (Bani *et al.*, 2004).

Conclusion

E. royleana, known by various names across different countries, stands as an evidence to the remarkable diversity and resilience of plant life. This succulent plant's ability to thrive in the arid landscapes of the Himalayan region, among other places, is an evidence to its adaptability and survival strategies. Its cactus-like appearance, milky latex, and inconspicuous blooms contribute to its mystique. This is an easy-to-grow plant that likes well-drained soil and plenty of sunlight hence sometime also grown as ornamental plant. Its role in traditional medicine further underscores its significance to local communities. For a long time, its different parts, from stems to latex, have been used to cure a broad range of diseases, which shows close connection of humans with this species. The plant is extracted from the wild due to its broad spectral medicinal properties is mainly used to cure inflammation and arthritis as well as asthma, cough, anemia and jaundice. High demand of *E. royleana* in pharmaceutical industries is one of the major causes for the over exploitation of its natural populations especially in Indian subcontinent. Disorganized and chaotic collection of the of this plant from the wild has led to its vulnerability and it has been listed in CITES Appendix-II and the trade is also prohibited (Thakar and Sharma, 2021). Therefore, the development of an appropriate strategy for the conservation and management of the species and habitats; development of value-added products, development of propagation protocols and establishment in *ex-situ* and *in-situ* conditions are urgently required.

References

- Andrea, V. and Judit, H., Euphorbia diterpenes: Isolation, structure, biological activity, and synthesis (2008–2012). *Chem. Rev.* 2014, 114, 8579–8612
- Ashraf, A., Sarfraz, R.A., Rashid, M.A. and Shahid, M. 2015. Antioxidant, antimicrobial, antitumor, and cytotoxic activities of an important medicinal plant (*Euphorbia royleana*) from Pakistan. *Journal of food and drug analysis*, 23(1), pp109-15.
- Bani, S., Kaul, A., Jaggi, B.S., Suri, K.A., Suri, O.P. and Sharma, O.P. 2000. Anti-inflammatory activity of the hydrosoluble fraction of *Euphorbia royleana* latex. *Fitoterapia*, 71(6), pp 655-62.
- Bani, S., Kaul, A., Khan, B., Ahmad, S.F., Suri, K.A., Satti, N.K., Amina, M. and Qazi, G.N. 2005. Immunosuppressive properties of an ethyl acetate fraction from *Euphorbia royleana*. *Journal of ethnopharmacology*, 99(2), 185-192.
- Bani, S., Suri, K.A., Suri, O.P. and Sharma, O.P. 1997. Analgesic and antipyretic properties of *Euphorbia royleana* latex. *Phytotherapy Research: An International Journal Devoted to Medical and Scientific Research on Plants and Plant Products*, 11(8), pp 597-599.
- Ghosal, S., Reddy, J.P. and Lal, V.K. 1976. Shilajit: Chemical constituents. *Journal of Pharmaceutical Sciences*, 65: pp772–773
- Ghosal, S., Singh, S.K. and Srivastava, R.S. 1988b. Shilajit part 2. Biphenyl metabolites from *Trifolium repens*. *Journal of Chemical Research*, 196: pp165–166
- Kushwaha, S., Semwal, B., Upadhyay, P.K., Yadav, H.N. and Vishwakarma, V.K. 2017. Hepatoprotective activity of ethanolic extract of *Euphorbia royleana* linn in carbon tetrachloride treated guinea pig. *Innovations in Pharmaceuticals and Pharmacotherapy*, 4(1), pp 22-32.
- Scholz, A. 1964. Euphorbiaceae. In *Syllabus der Pflanzenfamilien*; Engler, A., Ed.; Gebrüder Bornträger: Berlin, Germany, pp. 255–261.
- Schultes, R. E. 1987. Members of Euphorbiaceae in primitive and advanced societies. *Botanical Journal of the Linnean Society*, 94(1-2), pp79–95.
- Tiwari, S. and Singh, A. 2004. Piscicidal and anti-acetylcholinesterase activity of *Euphorbia royleana* stem bark extracts against freshwater common predatory fish *Channa punctatus*. *Environmental Toxicology and Pharmacology*, 18, pp 47-53.
- Thakur, M.K. and Sharma, T. 2021. Identification of CITES-Listed *Euphorbia royleana* through DNA Barcoding Technology: A New Facet in Wildlife Forensics. *Arab Journal of Forensic Sciences & Forensic Medicine*, 3(2), pp 260-272.
- Webster, G. L. 1994. Synopsis of the Genera and Suprageneric Taxa of Euphorbiaceae. *Annals of the Missouri Botanical Garden*, 81(1), p33.



Conservation and Management of *Zanthoxylum armatum* DC

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Introduction:

Zanthoxylum armatum DC (Tirmir/Timur) is a shrubby thorny perennial plant belonging to family Rutaceae. The species is distributed throughout the world and mainly found in Pakistan, Nepal, Bhutan, Myanmar, Japan, Korea, Vietnam, Taiwan, Philippines, Malaya Peninsula, etc. In India, this species grows in the warm valleys of the sub-tropical Himalayas, such as in the hilly areas of Jammu up to an altitude of 600–1000 m, east of the Indus at an altitude of 1500 m, Uttarakhand up to an altitude of 1500–2100 m. It is also found in the Eastern Ghats and Andhra Pradesh up to an altitude of 1200 m. In Himachal Pradesh, this species is found up to an altitude of 600–2500 m. It



Leaves of *Zanthoxylum armatum*

grows well in loamy soil. The population of the species in the natural habitat is very less. The dry branch of this plant is very strong, due to which it is also used as a stick. Tirmir has also spiritual significance and its wood is considered very auspicious. Wood of this species is also used for offerings in temples. This plant is used in the treatment of many diseases.

Botanical Description

Tirmir is an evergreen plant up to 6 m in height, small, bushy and prickly. Its branches are up to 23 cm in diameter, the branches are forked, and the thorns are flat about 1.2 cm long. Its leaves are 3.8 cm long and straight. Flowers are polygamous, sessile, and yellow in colour, 5–15 cm long in bunches and calyx–6–8 mm. Fruits are generally single, 4–5 mm in diameter, oval and fragrant like black pepper. On the outer surface of the fruit there are oil-rich micro-glands and on the inner surface there is a paper-like thin layer. Seeds are single, 2.5 mm in diameter, spherical, shiny and black in colour. Flowering and fruiting period of this species is from June–August and October–November, respectively.

Medicinal Uses

- ♦ Tirmir plant is full of medicinal properties and these are described below:
- ♦ Tirmir is very useful in the teeth and gums health. It is also used to relieve toothache and also used in the treatment of pyorrhea.
- ♦ Its dry twigs create good pressure on the joints in the body; hence it is used for acupressure.
- ♦ Tirmir seeds are used as a mouth freshener; they also contain an antiseptic chemical.
- ♦ Seeds are used for stomach problems.
- ♦ Tirmir is also used in the treatment of fever. Leaves and fruits are boiled in water and that boiled water is taken/drunk to cure common cold.
- ♦ Its fruits are used to kill stomach worms.
- ♦ It is also used in many diseases like asthma, inflammation of lungs, cholera, fever, blood pressure, indigestion problem, rheumatism, skin diseases, toothache, tumor, cough, ulcer, intoxication swelling, leg cramps, etc.

Other Uses

Preservatives are used to increase the shelf-life of any item. This species itself is a preservative and is used to increase the shelf life of other things. If we put its leaves in the grain to be stored, it does not allow insects to enter. Tirmir twigs are used for teeth whitening. Tirmir wood is considered auspicious and used for offerings in temples. Its fruits are also used in place of asafetida. Leaves and fruits of Tirmir are also used as spices. Many types of decorative items are made from Tirmir stems. Sticks are also made from the branches of this plant.. Tirmir bush is also grown as a live-fence around the fields.

Propagation: In natural habitat, tirmir regenerates through seeds.



Zanthoxylum armatum

Conservation and Management

This species grows on community land, around farms and in open forest area. The population of the species has decreased significantly in the last two decades, because people are removing it from the agriculture fields, where horticultural plants are being planted. Besides, population of the species is also decreasing in its natural habitat due to biotic pressure. In many subtropical parts of the country; infestation of lantana has adversely affected its growth and number. Tirmir has many medicinal properties, so considering the high demand of this plant; various pharmaceutical companies usually buy it from the market. Increased demand for the species has led to over-harvesting and has resulted in severe reductions in native population of the species. The species is reported as "endangered" by the International Union for Conservation of Nature (IUCN). Considering the usefulness of this species, conservation and management of this species is very important. Nursery technique, especially through vegetative means should be developed. The forest department should include the species in the plantation program of the department. The species can be planted in marginal land, agricultural field boundaries, community and forest land. Besides, there is also need to create awareness among the people for the conservation of this species.

Distribution and conservation of *Rhododendron* species in India

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Introduction

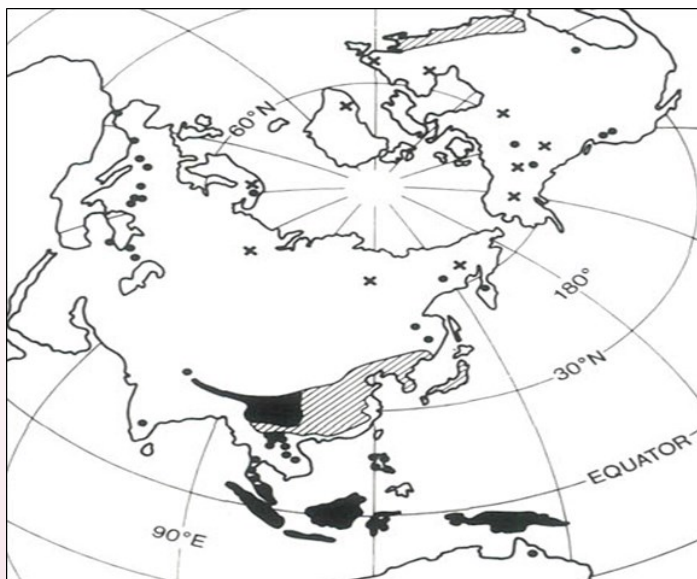
The genus *Rhododendron* was founded by Carl Linnaeus in 1753 belonging to the family Ericaceae. The term *Rhododendron* is derived from two Greek words, namely *rhodon* (Rose) and *dendron* (Tree), referring as Rose Tree. There are more than 1200 taxa recorded so far under it, mostly native to higher elevations in the Sino-Himalayan regions with majority in the western China. The history of Indian *Rhododendrons* began with the visit of Capt. Hardwich to the Sivalik mountain ranges in Kashmir in the year 1796 where he discovered *R. arboreum*. However, Sir Joseph D. Hooker's visit to the Sikkim Himalaya between 1848 and 1850 unfolded the *Rhododendron* wealth in Sikkim (Hooker 1849). The first appearance of the genus was mentioned in the book 'Species Plantarum' in 1753 by Carls Linnaeus and during this time only five species were known to the whole world. In 1919, *R. protistum* var. *giganteum*, was the species of the genus named and identified by George Forest and is one of the tallest and ancient *Rhododendron* trees in the world and called as 'King of *Rhododendron*'.



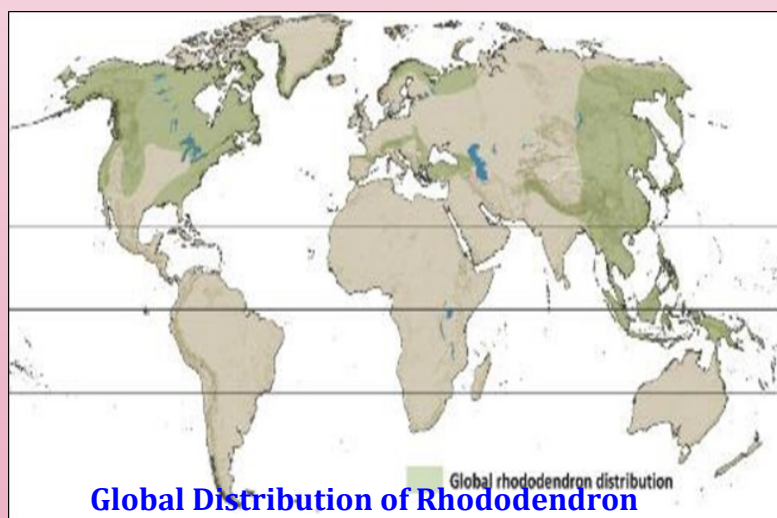
Rhododendron arboreum

Distribution of Rhododendrons in world

Rhododendron is the one of the largest and varied group among the plant kingdom having climatic limits in the high elevation with its noteworthy ecological and economical efficacy. The genus found widely distributed in between latitudes 80°N and 20°S in a saucer shaped area spreading from Southern Himalayas east into southwestern China. The genus covers a massive area of southeastern Asia extending from the northwestern Himalayas passing through Nepal, northeastern India, eastern Tibet, northern Burma, Bhutan, western and central China and south through Thailand, Vietnam, Malaysia, Indonesia, Philippines Islands, Papua and New Guinea to Australia. Approximately more than 90% population of the species is concentrated in the North Western Himalayan to Southeast-



ern Asia with an extension in the region of Nepal, northwestern India, eastern Tibet, northern Burma western and central China. Worldwide the genera have more than 1,200 species. The northern hemisphere hosts 850 species of the genus. Estimated 700 species are supposed to be present in the region of China, Tibet, Nepal, Myanmar and Assam, Northeast India. The rhododendrons are the best suited to elevation between 2000-4000m that extends from eastern Nepal to Yunnan. Approximately there are 580 species under six subgenera of *Rhododendron* have been reported from China

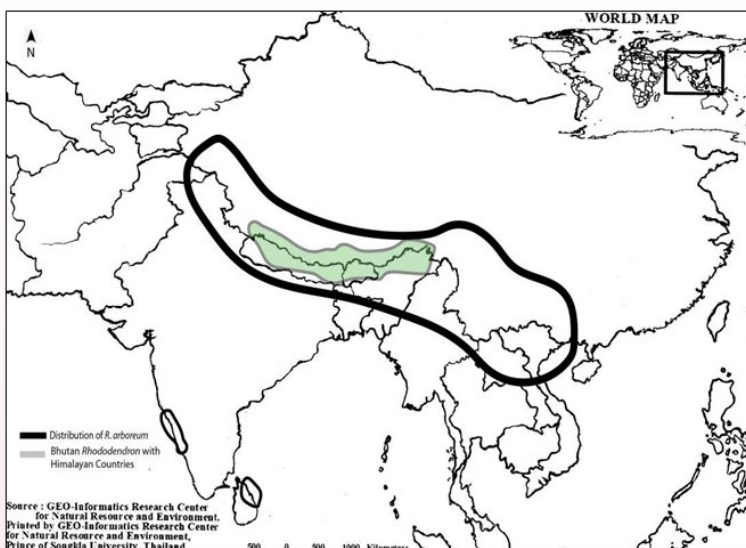


and is the largest genus of flowering plant in China. Of these provinces Yunnan, Sichuan and Tibet have the greatest diversity, with approximately 374, 255 and 227 *Rhododendron* species, respectively. 442 numbers of taxa are endemic in china followed by Indonesia (168), Papua New Guinea (64), Japan (58) and Malaysia (53). Albeit India and Myanmar have large number of taxa but 14 and 9 species respectively endemic to them but Philippines, USA and Taiwan have few taxa but

have more number of endemic species 30, 21 and 16 respectively. Two species are reported from Australia and there are no references of any species from Central and South America.

Distribution of Rhododendrons in India

Presently 102 species and 135 taxa of *Rhododendron* exist in India excluding 3 taxa, namely, *Rhododendron arboreum* subsp. *nilagiricum* in southern India and *Rhododendron colletti anum* Aitch. and Hemsl. and *Rhododendron rawatii* in Western Himalaya and 132 taxa (including 82 species, 25 subspecies and 25 varieties) are found in northeastern states. Out of these taxa found in India in (119) found in Arunachal Pradesh followed by Sikkim (42), Darjeeling hills in West Bengal (12), Nagaland (11), Manipur (10), Uttarakhand (6) Mizoram (4), Meghalaya (3), Himachal Pradesh (4) and Tamil Nadu (1), however no genus is reported from Assam and Tripura. About 14 species, 2 subspecies and 6 varieties are endemic to India and estimated 9 taxa in Arunachal Pradesh, 6 each in Manipur and Nagaland and 2 each in Mizoram, Meghalaya and Sikkim taxa endemic to these North east states. A total of 87 species, 12 sub-species, and 8 varieties of Rhododendrons are found in the Indian Himalayan Region. Among 87 species, *Rhododendron anthopogon*, *R. arboreum*, *R. barbatum*, *R. campanulatum*, *R. lepidotum* and *R. nivale* are found in western Himalayas while rest are located in eastern Himalayas. *R. anthopogon*, *R. arboreum*, *R. barbatum*, *R. campanulatum*, *R. lepidotum* and *R. nivale* are found in Uttarakhand. In addition to these a new species *Rhododendron rawatii* has been also reported in the state. *R. anthopogon*, *R. arboreum*, *R. campanulatum* and *R. lepidotum* are found in UT of Jammu & Kashmir. In Himachal Pradesh, genus Rhododendron is represented by four species viz., *Rhododendron arboreum*, *Rhododendron campanulatum*, *Rhododendron anthopogon* and *Rhododendron lepidotum*. *Rhododendron* is one plant that has acquired a special place in the cultural as well as economic life of the people.



Distribution of Rhododendron in India

Uses of Rhododendron

The genus produces in between 50-300 different natural products. The taxa have various medicinal uses viz., treatment in dysentery, to remove fishbone from stuck gullet, anti-tuberculosis property, and cough, cold, chronic bronchitis asthma, etc. The tender leaves of *R. arboreum* are used as a vegetable, and also used to relieve headache. Flowers are collected and processed into juice, which has gained market popularity as Rhodojuice. Flowers are edible and a sub-acidic jelly and preserve is made from the petals. They are also used to cure diarrhea and dysentery. The flowers and leaves are fitted in long ropes and tied around the houses and temples during Baisakhi (Bishoo) festival. Leaves of *R. campanulatum* are used in chronic rheumatism, syphilis and sciatica. The flowers of *R. arboreum* are considered sacred and offered frequently in the temples and monasteries. Local women decorate their hair bun with the flowers of Rhododendron. They are mixed with tobacco and used as snuff to

cure hemi crania and colds. The aesthetic beauty of fully blossomed flowers of the genus in its flowering period attracts the attention of the visitors. Different and enchanting colours of the petals of various species gives aesthetic look in different regions of the world like red depending upon the occurrence of the species. In India, *Rhododendron arboreum* is the state tree of Uttarakhand, whereas *Rhododendron campanulatum* and *Rhododendron arboreum* are the state flowers of Himachal Pradesh and Nagaland, respectively.

Threats to Rhododendron

In the present scenario of climate change, land use pattern and other anthropogenic activities, *Rhododendrons* are experiencing the impact of disruption to the ecosystem functioning. The fragile Himalayan region is witnessing mammoth change due to global warming in last 100 years, and is manifested through changes in the patterns of snowfall and melting, rainfall, soil moisture content and habitats of *Rhododendrons* which will directly have impact on the regeneration and establishment of the plant species in the future. In addition, the accelerating population growth and mounting stress on the natural resources



Flowers of Rhododendron



Wooden log of Rhododendron

through unsustainable harvesting of plant resources have put substantial pressure on the natural habitats of *Rhododendrons*. The species of upper altitudes are delicate and prone to various natural disturbances, like landslide and recurrent forest fires, etc. Most of the *Rhododendron's* epiphytic species are being on the verge of extinction due to the loss of their host plants. The *Rhododendron* species of the lower altitudes are exposed to various human disturbances, like deforestation, demand of fuelwood, enhanced demand for farming land, construction of roads, and the ever-expanding tourism

industry. According to the Red List of *Rhododendrons*-2011, exclusive assessment of the *Rhododendron* species of the world has reported that there are 1 Extinct, 1 Extinct in the wild, 36 Critically Endangered, 39 Endangered, 241 Vulnerable, 66 Near Threatened, 290 Data Deficient, and 483 species those have been assessed as the Least Concern. The conservation of the genus is a topical issue. Altogether, 715 species have been considered having one or more conservational problems. *Rhododendron retorsipilum* and *R. loezringii* are the two species which have been extinct. About 43 out of the total species of *Rhododendrons* found in north eastern states are endangered. Ac-



Clearing of Rhododendron Forest for Agricultural Activities

cording to CAMP conservation status all species of *Rhododendron* found in western Himalaya are vulnerable due to multiple treats.

Rhododendron and conservation strategies

First and foremost to conduct any futuristic studies, distribution maps of every *Rhododendron* species present in the India needs to be created. Much of the work has been done so far but there are few areas in the north east which are still to be explored due to inaccessibility due to very hilly terrain or boundary issues. The species needs to be reassessed for its conservational status and rare, endangered and vulnerable species need to be prioritize in the Indian context and after that *in-situ* and *ex-situ* conservation initiatives should be taken. Explicit modelling of the biodiversity's in relation to climate change is urgent need of the hour. Knowing the size and locations of the species distributions under current and projected climate scenarios will give conservationists a profound understanding of the type of strategy that should be implemented to protect the species from climate change. Rare, threatened, and endangered species must be considered for *in vitro* research. Establishment of Botanical garden or arboretum and gene banks should be promoted for long term securing and sustainace of *Rhododendron* diversity. All threatened species may be the subject of landscape genetics research to evaluate the effects of landscape composition, configuration, and matrix quality on gene flow and spatial variation for the survival of the species and to suggest conservation measures. *Rhododendron* as a research system in horticultural sciences, conservation biology, evolutionary biology, plant breeding, genetics, ethnobotany, and medicinal chemistry can be chalked out. The local communities' support is required for the conservation plan to be put into action and for that joint forest management, social forestry, village forest management community etc. will be involved proactively. *Rhododendron* plantation drives may be planned at the panchayat level under collaborative forest management or other related projects like carbon sequestration programs in partnership with other stakeholders. The collaboration between diverse members and researchers may be strengthened by holding a variety of seminars, conferences, etc. as part of the extension.

Conclusion:

Rhododendrons are the most common tree and shrub species, and they play a significant role in the Himalayas abundant biodiversity. The genus is among the most well-liked horticulture plants in western nations. The plant having 500 numbers of species as a threshold is considered as a 'Big Plant Genera'. So, being a 'Big Plant Genera' has prompted the scientific fraternity, as it has wide distributional range and numerous uses including horticultural values. *Rhododendron* being a 'Big Plant Genus' is the best candidate for developing scientific knowledge on its various morphological and physiological aspects for effective conservation. The species is being indiscriminately cut down for use as fuelwood, potentially endangering its continued existence. Human land use change and climate change are both thought to have a significant impact on species diversity and distribution. Many species of the rhododendron genus exist, however some are rare, keystone, endangered, or on the verge of extinction. The species of this genus need to be safeguarded by development using conventional, scientific, and molecular technologies. *Rhododendron* regeneration and conservation can be accomplished easily using plant tissue culture, vegetative propagation, seed germination, or air layering.

HIMALAYAN BLUE SHEEP (*Pseudois nayaur*) (Hodgson, 1833): A CAMOUFLAGE EXPERT CAPRINE

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Introduction:

THE HIMALAYAS are marvellous, magical, magnificent and mammoth mountains. The extensive, lofty and captivating mountains chains of Himalayas seems as kaleidoscope of nature embracing diverse ecosystems including verdant forests, river ecosystems, wetlands, cold-deserts areas etc. These ecosystems in the mighty Himalayas support spectacular biodiversity comprising of several rare and endemic species of plants and animals. There is wide altitudinal and climatic variations across the extremities and Himalayas are further divided into different ecological zones like Northern Himalayas, North- Western (NW) Himalayas, Western Himalayas, Eastern Himalayas and trans-Himalayas. The high altitudinal trans- Himalayas is a cold desert biome. It is characterised by array of special climatic, topographic, religious, cultural, floral and faunal features. The topography of cold-desert region is typically rugged and fragile. The climatic conditions are extremely harsh and landscape is dominated by vegetation less .



Fragile Mountain in Cold Dessert

In India, the rain shadow cold arid zone extends from Ladakh to Sikkim covering a large chunk of geographical area. The cold desert ecosystem harbours unique biota represented by many species of plants and wild animals having adaptations to survive suitably under the prevailing environment conditions and play their part in the perpetual existence of ecosystem. Among the various mammalian fauna, wild ungulates (hoofed animals) are prominent and well adapted to live in the rocky mountainous terrains. One such notable ungulate is **Himalayan Blue Sheep** (*Pseudois nayur*). In Hindi, it is called as Bharal. The other common names of the species are nabo, na or sna and naur, etc.

Bharal is one of the common ungulate species found in high Himalayas. The goat antelope is found near alpine meadows and treeless grassy slopes at heights between 3000m – 5000m above mean sea level. It has wide distributional range and occurs in upper reaches of Himalayas across Pakistan, India, Nepal, Bhutan, Myanmar, and China. In India, the species can be sighted in Spiti valley of Himachal Pradesh, Ladakh UT, Uttarakhand and some north eastern states. The English nomenclature of the species is slightly a misnomer as bharal does not look exactly blue in appearance. In addition to this, the morphological features resembles more closely with goat than sheep. Therefore, it is akin to genus *Capra* (goat) than *Ovis* (Sheep). Thus the generic epithet of scientific name *Pseudois nayaur* translates as false sheep. Blue Sheep is the sole member of genus *Pseudois* and taxonomically belongs to family Bovidae and sub-family caprinae under kingdom Animalia.

The Blue Sheep or Bharal are medium sized animals having a firm body. The male blue sheeps are

large and more massive than the female blue sheeps. In male blue sheeps, the horns are big rounded and curved side-wards or backwards. Horns of females are comparatively shorter and thinner. The tail of these ungulates is small and they have markings on the front limbs. The body colour of bharal varies from brown to grey and sometimes reflects bluish lustre enabling the animal to seamlessly mingle with the background landscape or surroundings. Thus, blue-sheep or bharal shows wonderful camouflage. These are gregarious creatures and prefer to live in groups. Usually, males and female blue sheeps form separate groups.



The Blue Sheep (Bharal)

Besides, the extraordinary camouflage ability, bharal is well adapted to swiftly climb on cliffs, steep slopes and stony rocks so as to escape the sight of on-lookers and the predators. As soon as these animal sense danger, blue sheep moves on to the rocks and blends with structure and texture of rocks.

Blue Sheeps or Bharals are active grazing animals. In daytime, these animals busy in grazing the grassy slopes and open grounds. They mostly survive on different types of herbaceous flora including forbs, sedges etc. Apart from this, they also eat lichens, mosses and thorny shrubs. Various alpine grasses and graminoids constitute the main food of Blue Sheep.

At present, Blue Sheep or bharal is categorised under **Least Concern (LC)** category as per the International Union for Conservation of Nature (**IUCN**) Red list. This is because the species is abundant in wild. Never the less, spotting a group of Bharal in the lonely deserted landscapes is everlasting joyful experience. It is worth mentioning that in the trans-Himalayan cold desert ecosystem, blue sheep or bharal plays an important ecological role as it is main prey of the elusive, elegant and endangered Snow leopard. Not to mention that Snow leopard is a keystone species of Cold-Desert ecosystem. Thus the existence of Snow leopard largely depends on the existence of bharal. Blue Sheeps or bharals also face some challenges or threats due to poaching, diseases and encroachment of its habitat by the domesticated grazing animals. In view of the significant role played by bharals in cold desert ecological setting, its continuous existence is very essential.



**Grasses and graminoids:
Staple food of Bharal**



**Hard to spot the herd of Blue Sheep: Excellent camouflage with background
(Changthang Plains, Ladakh)**

***Cordia dichotoma* G. Forst. (Lasura): An Ancient Wild Fruit with Health Benefits**

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Cordia dichotoma a relatively unknown tree to many is actually one of the most revered trees in India. It is also known as Indian Cherry or Gum Berry or Glue Berry, it is called as Lasura in the hilly state of Himachal Pradesh that grows throughout India in arid and semi-arid regions. The fruits, leaves, bark and seeds of this tree is rich in protein, fiber, fat, iron, phosphorus and calcium. The fruit is very useful and is used to treat various liver ailments, also manages blood pressure levels, relieve joint pain, cure migraine and headaches and improve the hair, the leaves are used to treat skin eruptions and joint pain and the bark is used to treat sore throats, lung infections, toothache, blisters and gingivitis.

Botanical Description

Cordia dichotoma is a small deciduous tree with a short bole and spreading crown. Usually a small tree growing 3 - 4 metres tall, though some specimens can reach a height of 20 metres or more. In larger specimens, such as found in Papua New Guinea, the bole can be 25 - 50cm in diameter and unbranched for up to 10 metre. Lasura is gathered from the wild for its many medicinal uses, the tree is also often cultivated for its fruits throughout the range of its natural distribution.

Geographical Distribution

Cordia dichotoma is found in tropical and subtropical regions. Lasura originates along the Himalayan tract up to 1,500 metres, with its natural habitat extending through the forests of India, Nepal and Myanmar. It is found in divers of forests ranging from the dry deciduous forests of Rajasthan to the moist deciduous forests of Western Ghats in India and tidal forests in Myanmar. In Maharashtra, it grows in moist monsoon forest. It does not grow gregariously, but is found growing singly in moist shady ravines and valleys. Today, *Cordia* trees are found in Taiwan, Thailand, Malaysia, China, Polynesia, Australia.

In India, it occurs mainly in Himachal Pradesh, Punjab, Uttarakhand, Maharashtra, Rajasthan etc. In season, unripe Lasura is found easily in its distribution area. Lasura has immense popularity in traditional dishes within Andhra Pradesh, Punjab, Gujarat, Maharashtra, Tamil Nadu and Himachal Pradesh. The unripe fruits transport well, making them prime for distribution to far-off

Herbal Remedies," the man regarded as the father of surgery in India, Sushutra, prescribed *Cordia* fruits as a coolant and astringent, to be used for biliousness, cough and internal haemorrhage. The bark paste was used for treatment on spider bites and eruptive boils. In Unani medi-



Pickle of *Cordia dichotoma*

markets. It's worth noting that the fruit has more recognition in the rural, traditional areas of India. Ripe Lasura is not a commonly sold fruit, most likely because of its difficulty to transport and its high perishability. When in season, children, birds and monkeys tend to be the greatest enthusiasts of the sticky pink fruit

Habitat

Cordia dichotoma is found in open woods on slopes, mountain stream sides. Found in a variety of forests ranging from the dry deciduous to moist deciduous and tidal forests as well as in moist monsoon forest. Grows singly in moist shady ravines and valleys.

Cultivation Details

It is a tree of tropical and subtropical regions, found at elevations from sea level to 1,500 metres. It grows in areas where the mean annual rainfall is in the range 250mm-3,000 mm. In areas with annual rainfall less than 500 mm, it thrives along streams or depressions where moisture is available. Thrives on a range of soils, but prefers deep moist sandy loams. When the tree reaches pole stage it prefers complete overhead light, but seedlings and saplings can withstand a fair amount of shade. The tree has escaped from cultivation in some areas and concerns have been raised that it could become invasive. Young seedlings are frost tender and also suffer from exposure to hot sun. They are susceptible to browsing and fire, but recover appreciably from these injuries. The tree coppices and pollards well. On good sites the trees reach a height of 4 metres in 4 years and a diameter of over 20 cm in 8 - 9 years.

Propagation

Seed - sow direct into containers, beds or trays. Germination starts in about 3 - 4 weeks and is complete in 6 weeks. The germination process can be accelerated if the seed is first scarified by lightly abrading the seed coat to allow easier ingress of water. Seedlings should be potted up as soon as the first pair of true leaves have formed. At lower altitudes, seedlings large enough to plant out can be obtained after 3 - 4 months in the nursery, but at higher altitudes, 9 - 12 months are needed. Germination is epigeous - 1 or 2 seedlings may appear from 1 stone. Seeds can store for at least a year in airtight containers. Raising plants from stumps has been carried out successfully. The stumps should be 8 - 13 mm thick at the root collar, with about 4 cm stem and 20 - 25 cm root. Such plants should be raised in beds for 12 - 15 months before stumping. Shading should be for only 1 week after seedlings have been pricked out, otherwise seedlings should have full light.

Disease and Pests

Several fungi attack *C. dichotoma* and *C. alliodora*, including *Phellinus noxius* which causes brown root rot and black bud rot, and *Phyllactinia thirumalachari* which causes powdery mildew on leaves. Insect pests recorded on *C. dichotoma* include the Mango mealy bug, the whitefly *Aleuroclava afrae* and the thrips *Austrothrips cochinchinensis*. Leaf galls of *C. dichotoma* are induced by the mite *Eriophyes cordiae*, those of *C. myxa* are caused by weevils (*Baris cordiae*), mites (*Eriophyes cordiae*) and thrips (*Aneurothrips*), and all 3 gall types can appear on the same leaf. The roots of *C. dichotoma* are attacked by the nematode *Meloidogyne incognita*.

Agroforestry Uses:

The plant is grown as a hedge. A quick-growing fruit tree, performing well under semi-arid conditions and suitable for planting along boundary and farm roads.

Health Benefits of Lasura

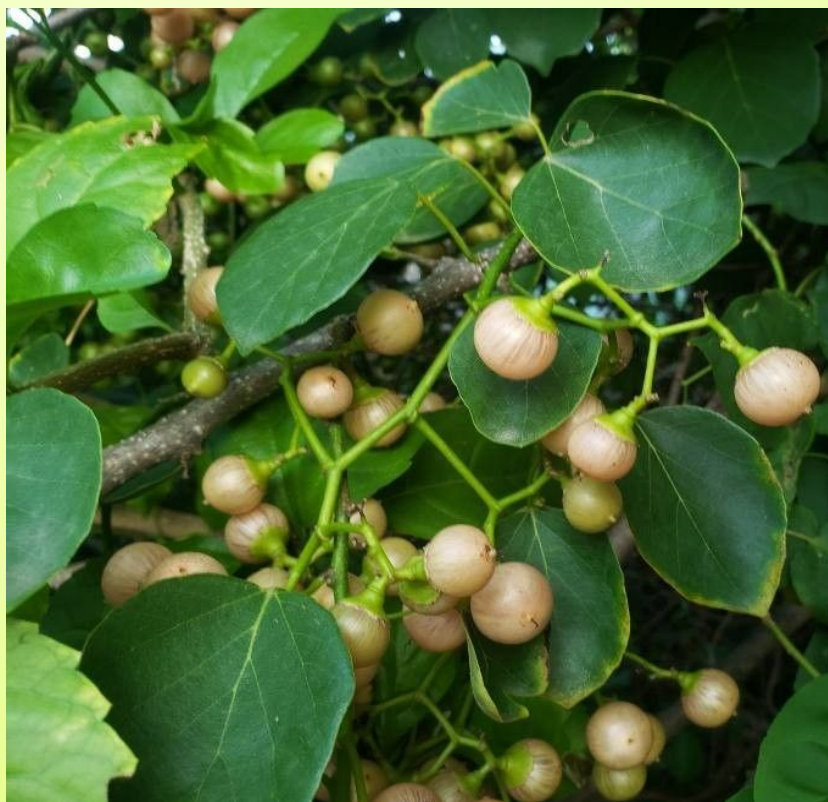
Cordia species have been used in medicinal remedies for centuries. According to the book, "Indian

cine, the fruit supplemented purgatives as a way of counteracting their bad side effects. Other properties of the fruit include acting as a demulcent, expectorant, diuretic and antihelmintic.

In Ayurveda, Lasura has been considered as a powerful fruit. Lasoda is rich in calcium and phosphorus which strengthens the bones and provides strength to the body. By eating this fruit, the body gets strength and the body gets relief from many other diseases. Greens and pickles are also made from raw Lasura. Cooked Lasura are sweet and inside it, there is smooth and sweet juice like gum. Lasura wood is very smooth and strong. Its planks are made for the construction work and it is also used in the butt of the gun. Along with this, many other useful things are made.



Cordia dichotoma - Tree



Cordia dichotoma - Fruits

Soil Microbes: The Eco-friendly Fertilizers

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The world population is expected to reach 9.7 billion in 2050 (UN report, 2019). This will subsequently increase the requirement of food to survive and space to live. The chemical fertilizers have played a significant role in the green revolution, but their injudicious application has resulted in reduction of soil fertility and pollution of underground water. Now, more emphasis is being placed on the development of sustainable agriculture, in which agricultural productivity is maximized while causing the least amount of disruption to the environment (Noble and Ruaysoongnern, 2010). Microbes present in soil can serve as natural biofertilizers, offering an eco-friendly and sustainable way to enhance soil fertility and promote plant growth. . These beneficial microorganisms can be harnessed to improve crop yield while reducing the reliance on synthetic chemical fertilizers. Microbes have ability to fix atmospheric nitrogen, solubilize and mobilize phosphorus, synthesize antibiotics and disease suppressing molecules. Due to these properties, they are used in agriculture as biofertilizers and biopesticides.

Introduction

Biofertilizers are ready-to-use live formulations of beneficial microbes that, when applied to seeds, roots, or soil, increase the availability of nutrients to plants via biological activity. Bio-fertilizers colonize the rhizosphere or the inside of the plant and encourage growth by increasing the host plant's supply of primary nutrients. Bio-fertilizer microorganisms restore the soil's natural nutrient cycle and increase soil organic matter. They contribute nutrients by natural processes such as nitrogen fixation, phosphorus solubilization, and plant growth stimulation via the synthesis of growth-promoting chemicals. Biofertilizer is well-known as a promising, cost-effective, eco-friendly, renewable source of plant nutrients for supplementing chemical fertilizers (Kannaiyan, 2002) as well as being helpful for the remediation of polluted soils.

Types of bio-fertilizers

S. No.	Type of Bio-Fertilizer	Characteristics	Associated Microorganism	Few trade name
1.	Nitrogen Fixing Bio-fertilizers	Converts elemental nitrogen into a usable form for the plants	<i>Rhizobium</i>	Rhizo-won, Bio-Rhizo
			<i>Azospirillum</i>	Aadhar, Azosper
			<i>Azotobacter</i>	Effect-grow, Azab Azotobacter



S. No.	Type of Bio-Fertilizer	Characteristics	Associated Microorganism	Few trade name
2.		Solubilize inorganic Phosphorous from insoluble compounds and provide it for plant uptake.	<i>Bacillus</i>	Bacila
			<i>Pseudomonas</i>	Bio-guard, Pseudozone, Pseudo-pep, Almonas
			<i>Aspergillus</i>	Green Awamori
3.	Phosphate mobilizing Bio-Fertilizer	Symbiotic association between host plants and certain group of fungi at the root system	<i>Mycorrhiza</i>	Him Mrida Sanjeevani 1
4.	Plant Growth Promoting Bio-Fertilizers	Increases the growth and yield of the crop	<i>Rhizobacteria</i>	Gmax PGPR
			<i>Trichoderma</i>	Tricho-h


Nitrogen Fixing Biofertilizer

Nitrogen is a critical element for plant growth, impacting various physiological and metabolic processes. Adequate availability of nitrogen in the soil is essential for healthy plant development and optimal crop yields. Although there is enough elemental nitrogen in the atmosphere, plants are unable to use it. Nitrogen fixing bacteria fix nitrogen into ammonia by the action of nitrogenase enzymes, either symbiotically or non-symbiotically, and help to balance nitrogen levels in the soil. Plants require a specific amount of nitrogen in the soil to thrive, hence nitrogen is a limiting factor for plant growth. Because different biofertilizers work best in different soils, the choice of nitrogen biofertilizer to utilise is determined by the cultivated crop. *Rhizobia* is used for legume crops, *Azotobacter* or *Azospirillum* is used for non-legume crops, *Acetobacter* is used for sugarcane and blue green algae, and *Azolla* is used for low land rice paddies.

Azotobacter: It is free-living nitrogen-fixing bacteria, which convert atmospheric nitrogen into ammonium ions and releases into the soil to make it available to plants. *Azotobacter* is beneficial in the cultivation of a variety of non-leguminous and vegetable crops. It stimulates the plant to produce beneficial hormones such as IAA, GA, Cytokines, and numerous vitamins. It also boosts plant synthesis of antibiotics, which protect the plants from soil borne and other infections. It can be used in the cultivation of wheat, maize, cotton, mustard, and vegetable (potato, onion, tomato, brinjal, and others).

Cyanobacteria: Cyanobacteria improves the solubilization and mobility of nutrients, and increase essential microelements in soil that are necessary for ion uptake, as well as stimulate plant growth due to their ability to produce bioactive compounds, such as phytohormones and other plant growth regulator substances, such as amino acids and polysaccharides. It is suitable for usage in rice fields.





Rhizobium: *Rhizobium* is a gram negative, soil dwelling bacterium which lives in a symbiotic relationship with the roots of leguminous plants. Root nodules of leguminous plants contain rhizobium, which adds nitrogen to the soil that is supplied to the plants to enhance growth. It is suitable for growing leguminous crops.

Azospirillum: *Azospirillum* is a gram-negative bacteria that aids in nitrogen fixation via a biological fixation process. *Azospirillum* transforms atmospheric nitrogen into plant-absorbable ammonium. Under both normal and drought conditions, *Azospirillum* promotes seedling growth. It is suitable for growing cereal crops such as wheat, maize, millets, sorghum, barley, and sugarcane.

Phosphorus Biofertilizers

Phosphorus is most important nutrient after nitrogen and potassium due to its unique role in energy production and transfer. In general, the phosphorus occurs in soil as soluble or insoluble forms. A great portion of chemical fertilizers applied in soil transforms into insoluble form by chemical fixation into compounds of phosphorus. The phosphate solubilizing microorganisms by the activity of phosphatase enzyme convert insoluble phosphorus to soluble/ available form. The phosphate biofertilizers can be grouped into phosphorous solubilizing biofertilizers and phosphorus mobilizing biofertilizers

a) Phosphorus Solubilizing Biofertilizers: They solubilize the insoluble phosphate from organic and inorganic phosphate sources and release into soil for absorption by plants. They secrete organic acids and lower the pH to dissolve bound phosphates in soil. The examples include- species of *Bacillus*, *Pseudomonas*, *Penicillium*, *Aspergillus* etc.

Bacillus: *Bacillus thuringiensis* is a spore-forming Gram-positive bacterium found in soil. It is a powerful phosphate-solubilizing bacterium and produces diverse compounds useful for crop production. It also exhibit ability for checking insect-pest populations with an equal role in controlling plant diseases.

Pseudomonas: *Pseudomonas* improves the soil properties by its phosphate-solubilizing activity, improving soil permeability and oxygen availability to the roots. The biofertilizer containing *Pseudomonas* species is efficient in controlling rice blight in paddy crops.

Phosphorus Mobilizing Biofertilizers: These biofertilizers contain mycorrhizal fungi which form a bridge between soil and roots by establishing symbiotic relationship. The mycorrhizal fungi absorb phosphorus from the soil and transfer to the root.

Mycorrhizae: The symbiotic association between roots and fungi are called mycorrhizae. Mycorrhizal fungi form symbiotic relationships with plant roots, extending the root system and improving nutrient and water uptake. This association often leads to healthier and more robust plants. These symbiotic arrangements have been found in about 90% of all land plants. Plant roots are hospitable sites for the fungi to anchor and produce their threads (hyphae). The roots provide essential nutrients for the growth of the fungi. In return, the large mass of fungal hyphae acts as a virtual root system for the plants, increasing the amount of water and nutrients that the plant may obtain from the surrounding soil. They store the nutrients (especially phosphorus and micro nutrients) and improve the soil quality as well as the soil health. Mycorrhizae significantly improve plant nutrient uptake and provide resistance against several abiotic and biotic stresses. Mycorrhizae play a major role in the absorption of phosphorus and increases the availability of phosphorus from soil by 60-80%. They also increase the absorption of nitrogen from soil. The use of mycorrhizae reduces the dependence on chemical fertilizers and pesticides and increases the beneficial organisms in the soil.

Him Mrida Sanjeevani-1: Him Mrida Sanjeevani-1 mycorrhizal biofertilizer is soil and vermiculite carrier based formulation, which contain above 100 mycorrhizal propagules (*Funneliformis mosseae* syn. *Glomus mosseae*) per 1 gram of formulation. The formulation has been developed and the product got registered with Directorate of Agriculture, Himachal Pradesh for production and sale. The formulation contain above 100 viable propagules of arbuscular mycorrhizal fungi (AMF) per gram. The efficacy of formulation was evaluated for the cultivation of two temperate medicinal plants viz. *Angelica glauca* and *Valeriana jatamansi* under nursery and field conditions. This formulation can be used for the organic cultivation of medicinal plant, vegetables and broad leaved crops.



Multiplication of AMF




Formulation of Him Mrida Sanjeevani

b) Plant Growth Promoting Bio-Fertilizers

Plant growth-promoting bio-fertilizers are a group of microbes that inhabit the rhizosphere and rhizoplane of plants. These actively colonize the plant's roots, where they perform a variety of tasks that eventually promote plant growth and improved plant yield. Plant growth-promoting bio-fertilizers induces plant growth by a variety of mechanisms like nutrient solubilization (potassium, phosphate, and zinc-solubilizing bacteria); production of siderophores; which are low-molecular-weight proteins that chelates ferric ions from the environment, thus providing plants with iron when it is limiting in the environment, they increase nutrient availability by fixing them which reduces their leaching out. They produce biofilm which helps it to better colonize the plant roots and contributes to overall plant health. They also produce important plant hormones like IAA (both in the presence and absence of Tryptophan), GA, etc. that help in the growth of the plant. There are examples of



Release of Him Mrida Sanjeevani- AMF biofertilizer



these beneficial microbes which can degrade the residual chemical fertilizers, like urea by the production of agriculturally important enzyme Urease. Apart from that many agriculturally significant enzymes like catalase, phosphatase, sulfatases etc. have been reported to be synthesized by the rhizospheric microbes. Plant growth-promoting bio-fertilizers has been established as effective biocontrol agents in the recent years.

Rhizobacteria: Plant growth promoting rhizobacteria facilitate the plant growth directly by either assisting in resource acquisition (nitrogen, phosphorus and essential minerals) or modulating plant hormone levels, or indirectly by decreasing the inhibitory effects of various pathogens on plant growth and development in the forms of biocontrol agents. Various studies have documented the increased health and productivity of different plant species by the application of plant growth promoting rhizobacteria under both normal and stressed conditions.

The plant-beneficial rhizobacteria may decrease the global dependence on hazardous agricultural chemicals which destabilize the agro-ecosystems.

Methods Application

The application methods of biofertilizers depend on biofertilizers types and their active ingredients. Some of biofertilizers can be used for all crops, while some are crop specific. In addition, their application is highly correlated with crop grown and ecosystem conditions. The common methods of biofertilizers application are described as follows:

- i. **Seed treatment:** The seeds are inoculated with biofertilizers before sowing in field or nursery bed. It is commonly used for crops that planted with direct seed sowing.
- ii. **Seedling dipping:** This method is useful where the transplantation of seedlings are required. For this, a suspension of required amount of biofertilizers can be prepared, the roots of seedling are immersed for five minutes in suspension and transplanted as early as possible.
- iii. **Soil application:** The biofertilizers can be applied directly in field or nursery bed. Before application, about 1-2 kg of biofertilizer can be mixed with 10-20 kg of finely powdered compost or organic manure. It can be applied homogenously or spread on planting row or put in planting hole. The mycorrhizal inoculum can be applied as powder, pellet or others form containing propagule and spore. It can be applied on nursery beds or seedling trays or polythene bag at the appropriate rate.

How the biofertilizers work?

Biofertilizers fix atmospheric nitrogen in the soil and root nodules of legume crops and make it available to the plant.

They solubilise the insoluble forms of phosphates into soluble forms.

They scavenge phosphate from the soil layers.

They produce hormones and anti metabolites which promote root growth.

They decompose organic matter and help in mineralization in soil.

When applied to seed or soil, biofertilizers increases the availability of nutrients and improve the yield by 10-25% .

They improve soil texture and are non polluting.

Novel strains of potential beneficial microbes (mycorrhizal fungi, PGPRs, antagonistic fungi, etc.)

WORKSHOPS/SEMINARS/WEBINAR ORGANIZED

- ♦ Himalayan Forest Research Institute (HFRI), Shimla organized a One-day consultative workshop on “National Project on Forest Fire Management” on 13 January, 2023 . The workshop was the brain-child of the NDMA, Ministry of Home Affairs, GoI New Delhi, the apex body for disaster management in India. Dr. Vaneet Jishtu, Scientist-E was the Coordinator of this workshop.
- ♦ Science and Management Society, H.P. organized International conference on “Empowering individuals for a Better Future” in collaboration with ICFRE-HFRI from 12 to 14 May 2023 at Shimla, which was attended by the scientists and professionals(200 Nos.) from 20 Nos. countries physically and virtually. Dr. Pawan Kumar, Scientist-E from this institute was the Coordinator from this institute. During the Conference, following papers were presented by the scientists of the institute;

MONTHLY RESEARCH SEMINAR OF INSTITUTE

- ♦ Monthly Research Seminar on “Diversity, Distribution, Usage Pattern and Conservation Status of Wild Edible Plants of Kinnaur District of Himachal Pradesh in Conference Hall of Institute on 30 January 2023, wherein, Sh. Pitamber Singh Negi, Scientist-D , Professor Bhupinder Dutt, UHF, Nauni Solan delivered a talk and also shared his experience in the field. Total 75 participants including Scientists, Technical staff, Research staff attended the seminar.
- ♦ Monthly Research Seminar on “Potential of Silvipastoral Systems in livelihood, productivity enhancement and restoration of waste/degraded lands in North Western Himalaya: Challenges and Opportunities” under the theme “Managing forests and forests products for livelihood support and economic growth” was organized by HFRI, Shimla during the month of February 2023 in Conference Hall on 28 February 2023. Dr. Swaran Lata Scientist-D made a presentation on the said topic. During the seminar, Dr. Sanjeev Chauhan, Director Research, UHF, Nauni Solan online attended the seminar and also made a presentation. 69 participants including Scientists, Technical staff, Research staff attended the seminar (through Online and Offline mode).
- ♦ Monthly Research Seminar on “Habitat Modelling – A Tool for Predicting Ecological Habitat Suitability” was organized by HFRI, Shimla in Conference Hall on 28 March, 2023. Sh. Jawala Prasad, Senior Technical Officer, SFM Division made a presentation on the said topic and Dr. Sharad Tiwari, Scientist-G, IFP Ranchi also made a presentation. 72 participants including Scientists, Technical staff, Research staff attended the seminar.
- ♦ Monthly Research Seminar on “Microbial, Biopesticides: Opportunities and Challenges” under the theme “Managing forests and forests products for livelihood support and economic growth” was organized by HFRI, Shimla during the month of April, 2023 in Conference Hall on 27 April 2023. Sh. Akhil Kumar, Chief Technical Officer, FPD Division made a presentation on the said topic. During the seminar, Dr. R.S. Minhas, Director, HIMORD online attended the seminar and also made a presentation. Dr. Rajesh Kaushik, Director Agriculture, Himachal Pradesh also participated as Special Invitee on this occasion and nicely concluded the monthly seminar by sharing his vast experience in this field.

- ◆ Monthly Research Seminar on “Rhododendron diversity in North-Eastern Himalayas and their conservational issues” under the theme “Biodiversity Conservation and Ecological Security” was organized by HFRI, Shimla during the month of April, 2023 in Conference Hall on 29 May 2023. Dr. Vinod Kumar, Chief Technical Officer, Genetics and Tree Improvement Division made a presentation on the said topic. During the seminar, Dr. Jasbir Vazir, Professor (Retd.) Floriculture, UHF, Nauni, Solan, HP online attended the seminar and also shared his vast experiences.
- ◆ Monthly Research Seminar on “Dendroclimatological Analysis: Studying Effect of Climate Change on Growth of Tree Species” under the theme “Forest and Climate Change” was organized by HFRI, Shimla during the month of June, 2023 in Conference Hall on 28 June 2023. Sh. Kuldesk Kumar, Sr. Technical Officer, Silviculture and Forest Management Division made presentation on the said topic. Dr. Ezhumalai, Scientist-D from FRI, Dehradun also attended the seminar virtually and delivered a lecture on the subject.

हिन्दी कार्यशाला

- ◆ भा वा अ शि प -हिमालयन वन अनुसंधान संस्थान, शिमला में दिनांक 15.06.2023 को हिन्दी कार्यशाला का आयोजन



निदेशक (प्रभारी), डॉ. संदीप शर्मा की अध्यक्षता में किया गया, जिसमें सभी वैज्ञानिकों, विभागाध्यक्षों, कर्मचारीओं एवं शोधार्थियों ने भाग लिया।

निदेशक (प्रभारी), डॉ. संदीप शर्मा ने कार्यशाला के वक्ताओं डॉ. भवानी सिंह, सहायक आचार्य, हिन्दी भाषा विभाग, हिमाचल प्रदेश विश्वविद्यालय शिमला व डॉ. राजीव शर्मा, सहायक आचार्य, प्रदर्शन कला विभाग, हिमाचल प्रदेश विश्वविद्यालय शिमला का हिमाचली परंपरा से स्वागत किया तथा अपनी अध्यक्षीय

भाषण में हिन्दी के क्षेत्र में संस्थान द्वारा किए जा रहे कार्यों एवं उपलब्धियों से प्रतिभागियों को अवगत कराया। डॉ. भवानी सिंह ने “राजभाषा हिन्दी का विकास एवं उपयोगिता” विषय पर व्याख्यान प्रस्तुत करते हुए कार्यालयी काम काज में हिन्दी के प्रयोग के महत्व को उजागर किया। उन्होंने सरकारी रिपोर्ट एवं पत्रों को हिन्दी में जारी करने पर जोर दिया।



GLIMPSES OF WORKSHOPS ORGANIZED



WORKSHOPS/SEMINARS/WEBINARS ATTENDED

- ♦ Dr. Pravin Rawat, Scientist-B of this institute attended workshop on “National Workshop on Agroforestry and Farm Forestry for Sustainable Land and Ecosystem Management under Ecosystem Management Services Improvement Project” on 5 and 6 January, 2023.



- ♦ Dr. R.K. Verma, Scientist-G attended the online Workshop, which was organized by ICFRE for finalization of the Training Modules on Sustainable Land Management on 11 January 2023.

- ♦ Dr. Balkrishna Tiiwari, Scientist –B participated in 5-days Hands-on workshop on “Next generation sequencing data analysis organized by Department of Biotechnology and Bioinformatics, Jaypee University of Information Technology, Wagnaghat Solan, Himachal Pradesh from 20 to 24 March, 2023.
- ♦ Dr. Sandeep Sharma, Director Incharge and Sh. P. S. Negi, Scientist-D attended the three days International Workshop on “Enhancing Ecosystem Services by Improving Forest Quality and Productivity and SLEM Knowledge Dissemination” organized by ICFRE, Dehradun from 22 to 24 March, 2023 at ICFRE, Dehradun (Total Participants-200) and also presented the paper.
- ♦ Dr. R.K. Verma, Scientist-G, Sh. P. S. Negi, Scientist-D and Dr. Swaranlata, Scientist-D participated in National Conference on “Value Addition and Marketing of NTFPs/MAPs for Livelihood Security (NCVAM-2023)” organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) from 2 -3 May 2023 and following papers were presented by the Scientists of the institute during the conference.
- ♦ Dr. R.K. Verma, Scientist-G and Dr. Swaranlata, Scientist-D, participated in the webinar on “Health Care with Medicinal Plants” organized by Environmental Information, Awareness, Capacity Building and Livelihood Programme (EIACP) Programme Center Resource Partner on Wetland Ecosystem including Inland and Wetlands Salim Ali Center for Ornithology and Natural History, South Indian Center of Wildlife Institute of India, Anaikatty, Coimbatore-641 108, Tamil Nadu on dated 12 May 2023.

Meeting Attended

- ◆ Akhil Kumar, Chief Technical Officer, attended the meeting on “Stakeholder’s Consultation Meeting for Conservation and Wise-use of Gobind Sagar lake to Secure Habitats of Birds Migrating within the Central Asian Flyway” jointly organized by BNHS, Mumbai and WISA, New Delhi in the Conference Hall of Sagar View Hotel, Bilaspur on January 5, 2023.
- ◆ Dr. Sandeep Sharma, Coordinator, Dr. Ranjeet Kumar, Dr. Vaneet Jishtu, Sh. P. S. Negi and Dr. Balkrishan Tiwari, Pls of different component of FGR attended 5th six monthly review meeting of CAMPA funded project “*National Programme for Conservation and Development of Forest genetic Resources*” reviewed by Project Evaluation Group (PEG), ICFRE, Dehradun 10 January, 2023.
- ◆ Dr. Sandeep Sharma, Director Incharge, ICFRE-HFRI, Shimla attended the Director’s meeting through online mode on 13 January, 2023.
- ◆ Dr. Sandeep Sharma, Coordinator, Dr. Ranjeet Kumar, Dr. Vaneet Jishtu, Sh. P. S. Negi and Dr. Balkrishan Tiwari, Pls of different component of FGR attended quarterly progress review meeting of CAMPA funded project on “*National Programme for Conservation and Development of Forest genetic Resources*” reviewed by NPC, Dr. H. S. Ginwal, Scientist-G, FRI, Dehradun, on 16 Jan., 2023.
- ◆ Dr. R K Verma, Scientist-G, attended online meeting on Monitoring of Action Plan for Filling up of Vacancy under Mission Recruitment Mode and GIS held on 17 January 2023 under the Chairmanship on Shri Tanmay Kumar, Additional Secretary, MoEF&CC, New Delhi.
- ◆ Dr. Sandeep Sharma, Director, HFRI, Shimla attended the “10th Meeting of the Expert Committee/ Technical Group under Support for Statistical Strengthening (SSS) Scheme ”on 17 January 2023 held under the Chairmanship of the Economic Advisor in the Conference Hall of Economic and Statistics Department, SDA Complex, Kasumpti, Shimla.
- ◆ Dr. Vaneet Jishtu, Scientist-E and Monika Chauhan, JRF, ICFRE-HFRI, Shimla participated in the “Survey for a Review on long-term ecological monitoring in India”, being conducted by Nature Conservation Foundation (NCF), Bangalore.
- ◆ Dr. Ashwani Tapwal, Scientist- F, attended 88th meeting of Himachal Pradesh State level Expert Appraisal Committee in the Conference Hall of Department of Environment, Science & Technology, Paryawaran Bhawan near US Club Shimla on 19 and 20 January, 2023.
- ◆ Dr. Sandeep Sharma, Director, HFRI, Dr. Ashwani Tapwal, Scientist-F, Dr. Balkrishan Tiwari, Scientist-B and Dr. Pravin Rawat, Scientist-B attended a meeting COE CAMPA at HPSFD Talland, Shimla on 20 January, 2023 and presented three research proposals for funding.
- ◆ Dr. Ashwani Tapwal, Scientist-F attended the Review meeting of AICRP-11 and presented overall progress of the project on 23 January, 2023.

- ♦ Dr. Jagdish Singh, Sh. P. S. Negi Scientist-D, Dr. Swaran Lata, Scientist-D and Dr Pravin Rawat, Scientist-B attended a virtual meeting organized by ADG (Media & Extension) ICFRE, Dehradun to discuss the framework for the preparation of booklet on agroforestry under the Chairmanship of Dr. Sudhir Kumar, DDG , Extension on 24 Jan., 2023.
- ♦ Sh. P. S. Negi, Scientist-D virtually attended the quarterly review meeting for the quarter ending Oct-Dec. 2022 of CAMPA funded project “Developing seed testing and seed storage protocols of selected forestry species from diverse forest types (AICRP-10)” reviewed by NPC, Dr. Manisha Thapliyal, Scientist-G, FRI, Dehradun on 2 Feb., 2023.
- ♦ Dr. Sandeep Sharma, Director, HFRI and Dr. Pawan Kumar, Scientist-E attended a meeting on State Focus Paper 2023-24 organized by NABARD Shimla at Hotel Holiday Home on 8 February 2023.
- ♦ Dr. Sandeep Sharma, Director and all scientists of the Institute virtually attended the **XXIII RPC meeting of ICFRE, Dehradun** on 13 and 14 February 2023 and following new project proposals were presented by the scientists/PIs of this institute before the Hon’ble Members RPC of ICFRE, Dehradun.
 1. Herbage production and carbon stock improvement of degraded grassland ecosystem through the introduction of grasses and fodder trees under different agro-climatic conditions of Himachal Pradesh.
 2. Evaluation of growth performance *Melia dubia* and *Neolamarckia cadamba* in Himachal Pradesh and Jammu & Kashmir UT.
 3. Population assessment and identification of superior genotype of *Quercus ilex* L. for improved fodder production and conservation in the dry temperate region of Himachal Pradesh.
 4. Insect-pests of Oaks of Jammu and Kashmir U. T. and their control.
 5. Evaluate green synthesized nanoparticles to develop ecofriendly management techniques against insect pests of Deodar nursery.
- ♦ Dr. Vaneet Jishtu, Scientist-D attended 1st Meeting on “Working Group on Integrated Management of the Great Himalayan National Park Landscape through an initiative of The Nature Conrvancy – India (TNC)”.
- ♦ Dr. Swaran Lata attended 22nd meeting of the Executive Committee of the National Authority virtually held in Krishna Conference hall, 4th floor, Jal Wing, MOEF & CC, New Delhi on 31st March, 2023.
- ♦ Dr. Vaneet Jishtu, Scientist-E, Forest Ecology and Climate Change Division participated in the 11th Meeting of the State Board for Wildlife at the HP Secretariat Conference Hall, chaired by the Chief Minister, HP on 14 February 2022.

- ♦ Dr. Ashwani Tapwal, Scientist- F, Forest Protection Division attended 89th meeting of Himachal Pradesh State level Expert Appraisal Committee in the Conference Hall of Department of Environment, Science & Technology, Paryawaran Bhawan near US Club Shimla on 16 February 2023.
- ♦ Dr. R.K. Verma, Scientist-G, Forest Ecology and Climate Change Division attended the meeting on Biodiversity and Eco Restoration by Capacity Building Commission under the Chairmanship on Capacity Building Commission to the Govt. of H.P. organized by Himachal Pradesh Secretariat on 24 February 2023 in the office Chamber of Principal Advisor (Trg. & FA) to the Govt. of H.P., Armsdale Building, H.P. Secretariat.
- ♦ Dr. Swarn Lata Scientist-D, Silviculture and Tree Improvement Division attended online meeting on 24 February 2023 under chairmanship of DDG Extension Dr. Sudhir Kumar for preparation of booklet on agroforestry.
- ♦ Dr. Sandeep Sharma, Director, HFRI alongwith his team of scientists and other research staff virtually attended a seminar organized by FOSA, FRI, Dehradun to celebrate National Science Day on 28 February 2023. Dr. H. C. Sharma (Retd. Scientist and Former V.C. of Dr. YSP UH and F, Nauni, Solan) delivered a lecture on “Global Warming and Climate Change: Biodiversity, Crop Production and Food Security”.
- ♦ Sh. Akhil Kumar, Chief Technical Officer, Forest Protection Division attended the meeting “State Level Stakeholder Meeting on Conservation and Wise Use of Select Wetlands in Himachal Pradesh to Secure Habitats of Birds, Migrating within the Central Asian Flyway” which was jointly organized by BNHS and Wetlands International at Hotel La Ri Sa, Kachi Ghati, Shimla, Himachal Pradesh. Dr. Sandeep Sharma, Director and Sh. P. S. Negi, Scientist-D attended the virtual meeting of the Standing Consultative Committee organized by the Jammu & Kashmir Forest Department for the finalization of Working Plans of Billawar and Jhelum Valley (JV) Forest Divisions on 06th March, 2023.
- ♦ Dr. Ashwani Tapwal, Scientist- F, attended 91th meeting of Himachal Pradesh State Level Expert Appraisal Committee in the Conference Hall of Department of Environment, Science & Technology, Paryawaran Bhawan near US Club Shimla on 3 and 4 March 2023.
- ♦ Dr. Sandeep Sharma, Director, HFRI alongwith Dr. Ashwani Tapwal, Scientist-F attended state level multi-stakeholder meeting on “Integrated management plans for Shree Renuka ji wetland and Pong Dam lake and their budgets” on 12 May 2023 at the Oberoi Clarks, Shimla, which was organized by HIMCOSTE, Shimla.
- ♦ Dr. Swarnlata, Scientist-D participated online in the meeting held on 16 May 2023 on ‘Forest Productivity and Livelihood’ chaired by Director General, ICFRE.

- ♦ Dr. Sandeep Sharma, Director, ICFRE-HFRI and scientists attended the Annual Progress Review meeting of ICFRE Plan projects held under the chairmanship of Dr. Sumit Chakrabarti, Assistant Director General, Monitoring and Evaluation, ICFRE (HQ), Dehradun on 17 May 2023 and progress of ICFRE plan funded projects was also presented by the PIs/ Scientists.
- ♦ Dr. Swarnlata, Scientist-D, participated in AICRP-29 “Sustainable management of NTFPs through conservation and value addition” progress review meeting taken by NPC on dated 18 May 2023.
- ♦ Dr. Sandeep Sharma, Director, HFRI, Shimla attended the Society Meeting of ICFRE-FRI Dehradun, organized by ICFRE. The meeting was chaired by Sh. Bhupinder Yadav, Hon’ble Minister of MoEF &CC, New Delhi.
- ♦ Dr. Swarnlata, Scientist-D participated online in one day seminar on “Biodegradable Food Packaging-As a Alternative to Single Use Plastic” organised by ICFRE-IWST Field Station, Kolkata on 25 May 2023.
- ♦ Dr. R.K. Verma, Scientist-G, HFRI, Shimla attended the online seminar on “Advances in water requirement estimation in forestry” on 25 May 2023 organized by Forest Ecology and Climate Change Division, Forest Research Institute, Dehradun
- ♦ Dr. Ashwani Tapwal, Scientist-F attended State Expert Appraisal Committee (SEAC) meeting at Shimla on 7 June 2023, organized by Department of Science and Technology, Distt. Shimla.
- ♦ Sh. P. S. Negi, Scientist-D attended the quarterly review meeting of CAMPA funded project “Developing seed testing and seed storage protocols of selected forestry species from diverse forest types (AICRP-10)” reviewed virtually by NPC, Dr. Manisha Thapliyal, Scientist-G, FRI, Dehradun on 7 June 2023.
- ♦ Dr. Swarn Lata Scientist- D, participated in online meeting of Standing Committee on Government e-Marketplace (SCoGEM) for all officers from the Ministry/Autonomous organizations/ Statutory bodies/Subordinate offices handling procurement and payments under the Chairmanship of AS&FA, MoEF&CC on dated 12 June 2023.
- ♦ Sh. P. S. Negi, Scientist-D attended One day National Workshop on the occasion of “*World Day to Combat Desertification and Drought*” organised virtually by Centre of Excellence on Sustainable Land Management, ICFRE Dehradun on 17 June 2023.
- ♦ Dr. R. K. Verma, Scientist-G attended the meeting on HP specific Research & Development Project Review on 17 June 2023 under the Chairmanship of the Joint Member Secretary, HIMCOSTE, Shimla (HP) at Hotel Holiday Home Shimla, Himachal Pradesh.
- ♦ Dr. R.K. Verma, Scientist-G attended 6th meeting of the State Level Project Steering Committee of GoI-UNDP-GEF SECURE Himalayan Project on 20 June 2023 under the Chairmanship of the Pr. Chief Conservator of Forests (Wildlife), Shimla (HP) at Armsdale Committee H.P. Secretariat Shimla

- ◆ Dr. Ashwani Tapwal, Drawing and Disbursing Officer and officials of Accounts Section attended the meeting on Public Financial Management System (PFMS) at Shimla on 26 June, 2023.
- ◆ Sh. P. S. Negi, Scientist-D attended the virtual meeting organized by FRI, Dehradun on 30 June 2023 under the Chairmanship of Dr. N.K. Upreti, GCR, FRI Dehradun for working out and fixing the testing charges for carrying out nursery trials of Green Mantra Compostable Nursery bags being executed by FRI, Dehradun, ICFRE-HFRI, Shimla and IFGTB, Coimbatore.
- ◆ Dr. Sandeep Sharma, Director, HFRI, Shimla alongwith Dr. R.K. Verma, HOO, Dr. Ashwani Tapwal, DDO, HFRI and staff of account section attended the Budget review meeting of AICRPs and FGR held under the chairmanship of Director General, ICFRE on 30 June 2023.
- ◆ Dr. Vaneet Jishtu, Scientist-E of this institute made a presentation on “High Altitude Transition Zones in Himachal Pradesh – Long Term Studies to Assess the Effect of Global Warming” before the Director General, ICFRE on 30 June, 2023.
- ◆ Dr. Sandeep Sharma, Director, HFRI, Shimla and Dr. Jagdish Singh, Scientist-F attended a meeting with Dr. Narender Singh Kaith, Head and Scientists of KVK, Rohru and agreed upon to establish demonstration plantations of important high value temperate medicinal plants in the farm land of KVK, Rohru. Both the parties also agreed to organize training program on cultivation of medicinal plants for augmentation of rural income. On this occasion an interactive session was also held with Pradhan and members of Tridev Aushdhiye Podh Utpadan Society Rohal, Chirgoan, Shimla.

MEETING ORGANIZED:

- ◆ Himalayan Forest Research Institute, Shimla organized a meeting of Implementation Team related to Variety Release of regional species of *Picrorhiza kurroa* Royle ex Benth., *Valeriana jatamansi* Jones and *Sinopodophyllum hexandrum* Royle on 30 January, 2023 under the Chairmanship of Dr. Sandeep Sharma, Director, HFRI, Shimla and other members of different offices and Institutes.
- ◆ Dr. R.K. Verma, Scientist-G, Nodal Officer, FRIDU, Shimla Centre organized Research Advisory Committee Meeting (RAC) on 15 February 2023.
- ◆ Himalayan Forest Research Institute, Shimla organized a meeting of Regional Variety Testing Committee (RVTC) for temperate medicinal plants species of *Picrorhiza kurroa* Royle ex Benth., *Valeriana jatamansi* Jones and *Sinopodophyllum hexandrum* Royle related to Variety Release of the same on 02 February, 2023 under the Chairmanship of Dr. Sandeep Sharma, Director, ICFRE-HFRI, Shimla.

TRAINING PROGRAMME ORGANIZED

- ♦ Under VVK activities, Extension Division of ICFRE - Himalayan Forest Research Institute, Shimla Organized a One day training program in collaboration with KVK Rohru and Tridev medicinal plant society Chirgaon at Taganu, Chirgaon, Rohru district, Shimla. 40 people including farmers, members of Mahila mandal, NGO from Tanganu, Diudi, Janglik panchayat of Chirgaon Rohru participated in the training programme.
- ♦ Dr. Vaneet Jishtu, Scientist-E, HFRI, Shimla organised three-days "Capacity Building Training Programme for frontline Staff of the Forest Department" from 16-18 March, 2023 at HFRI, Shimla, which was funded by the Himachal Pradesh State Forest Department (Research & Training). Under the project "*High Altitude Transition Zones in Himachal Pradesh: Long Term Studies to Assess the Effects of Global Warming*". The training was attended by 40 numbers of Frontline staff of SFD.
- ♦ Dr. Pawan Kumar, Scientist-E organized one day training program "Capacity Building on Promoting Practices for Conservation of Native Pollinators and their Food Plants through Community Based Approach" funded by NABARD at Choltu, Distt. Kinnaur on March 18, 2022. 85 participants including Farmers, Panchayat members and forest officials of Forest Range, Bhavanagar (Kinnaur) participated in training program.
- ♦ Dr. Vaneet Jishtu, Scientist-E two-days training workshop titled "Capacity Building of Forest Staff on Identification of Flora and Methodology of Plant Inventory/ Sampling for Baseline Data Collection", funded by the office of the Divisional Forest Office (Wildlife) Kullu from 24 and 25 March 2023 at Wildlife Information Centre, Manali, Kullu.
- ♦ Under Mission Life ICFRE-HFRI, Shimla organized Environmental Awareness cum One Day Training Programme on "Conservation and Propagation of Temperate Medicinal Plants" at Jagatsukh, Manali (HP). About 50 farmers from local nearby areas including students from Govt. Sr. Secondary School, Jagatsukh participated in the programme.
- ♦ ICFRE- HFRI organized one day training programme on "Nursery technique of Juniper (Shukpa) and Cultivation of temperate medicinal plants of temperate Zone" at Kaza, Lahaul & Spiti HP, wherein, lectures on various topics were delivered by the scientists of the institute. Sh. A.S. Rawat, IFS, Director General, ICFRE inaugurated the training programme at Kaza, Lahaul and Spiti, H.P. Dr. Sandeep Sharma, Director, HFRI, Shimla, Dr. Jagdish Singh, Dr. Pawan Kumar, Dr. Ranjeet Kumar and Dr. Balkrishan Tiwari participated as Resource Person in the training. Besides, Sh. Rajul Jain, IAS, ADC Kaza also participated in the training programme as Guest of Honour.
- ♦ On the request of villagers of demo village Badagaon training cum demonstration programme was organized on grafting on horticultural crops on 6 March, 2023. About 15 people were trained.
- ♦ ICFRED-HFRI, Shimla Hands on training cum awareness programme about forestry and environmental awareness, plantation techniques and vermi-compost making at Demonstration Nursery at Shivdwala, VVK Longani, Dharampur, Mandi on 9 June, 2023 in which 24 students of Govt. Sr. Sec. School. Longani Dharampur were present.

Glimpses of Meeting Organized



Glimpses of Training Organized



PARTICIPATION IN THE TRAINING PROGRAMMES

- ♦ Sh. Dushyant Kumar, Sr. Technical Officer, Forest Ecology and Climate Change Division attended training programmes on 'Application of GIS & Remote Sensing in Forestry' from this institute, which was organized by GIS Centre of FRI, Dehradun on 16-20 February, 2023.
- ♦ Sh. Manoj Kumar, Technician of this institute attended the training programme on Climate Change, Carbon Sequestration and Mitigation organized by IFP Ranchi from 13-17 March, 2023.
- ♦ Dr. Jagdish Singh, Scientist-F attended Advanced Training Programme on HPLC/LC-MS based drug discovery and de-replication strategies for natural product lead identification at CSIR-CDRI, Lucknow, UP from 6 to 10 February 2023.
- ♦ Dr. Ranjeet Kumar, Scientist-E, Forest Ecology and Climate Change Division, HFRI, Shimla attended the Training Program on Data Processing for Carbon Flux System-Eddy Covariance organized by Campbell Scientific India Pvt. Ltd, New Delhi at ICFRE Dehradun from 9 – 10 February 2023.
- ♦ Sh. Kuldesk Kumar, Technical Officer, SFM Division, HFRI, attended HRD Advanced Training Program on "Qualitative and quantitative analysis by UV-Vis, IR, HPLC/PDA and its data interpretation" for technical personnel from ICFRE at Sophisticated Analytical Instrument Facility & Research Division CSIR-Central Drug Research Institute, Lucknow from 20 to 24 February 2023.
- ♦ Dr. Vaneet Jishtu, Scientist-E, Forest Ecology and Climate Change Division attended online 5-days Training Programme organized by the Lal Bahadur Shastri National Academy of Administration, Mussoorie, Uttarakhand on "Climate Risk Management: Policy and Governance" funded by the Department of Science and Technology (DST), GoI from 30 January – 3 February 2023.



Memorandum of Understanding (MoU)

- ♦ To foster the forestry research and extension, under VVK Jagatsukh, Manali, a MoU has been signed for five years between ICFRE-HFRI and DFO Kullu, HP on 27th May, 2023 at DFO Office, Kullu.



EXTENSION ACTIVITIES

Activities under Azadi Ka Amrit Mahotsava

- ♦ Under Azadi Ka Amrit Mahotsav, ICFRE-HFRI Shimla organized International Day of Forest on theme “Forests and Health” on 21 March, 2023 in the conference hall of the Institute. **Sh. Nek Ram, Padmshree** was key speaker of the occasion. He shared his views on theme of the day and his experience about millets cultivation.
- ♦ Under Mission Life HFRI, Shimla organized a Scientific Exhibition cum Environmental Awareness program at Kendriya Vidhyalay, Jutogh Cantt. (Shimla) Himachal Pradesh. About 120 students from 9th to 12th class participated in the programme.
- ♦ ICFRE-Himalayan Forest Research Institute Shimla organized various environment related programs under World Environment Day – 2023 at Potter Hill, Shimla. The chief guest of the program Mr. VK Joshi, retired IAS officer said that plastic pollution is a big problem and people are using plastic bags indiscriminately, which is adversely affecting the environment.
- ♦ ICFRE-HFRI, Shimla celebrated “International Yoga Day” in the Campus of the institute 21 June 2023. Scientists, officers and staff of the institute were present. Sh. Suresh Chauhan and Ms. Savitri Chohan from Art of Living, Shimla demonstrated Yoga Asans to the participants.
- ♦ Under AKAM & Mission Life ICFRE-HFRI, Shimla celebrated International Bio-diversity day (IBD) on May 22, 2023 in the institute under the theme – From Agreement to Action: Build Biodiversity Back. Dr. Ranjit Kumar, Scientist-E delivered a lecture on the theme of this year on 22 May, 2023.

GLIMPSES OF ACTIVITIES UNDER AKAM



Activities under Van Vigyan Kendras

About 60 different awareness and demonstration programmes/ activities under Mission LIFE were organized by Himalayan Forest Research Institute, Shimla during the month of May 2023

Prakriti Programme

- ♦ HFRI, Shimla organized a Programme on Various methods of vegetative propagation of different forestry species under Prakriti Programme on 18 January, 2023 in which 80 students participated in this program, Kendriya Vidyalaya, Miran Sahib, Jammu were participated.
- ♦ HFRI, Shimla organized a Programme on Importance of the tree planting for conservation of natural resources and sustainable development under Prakriti Programme on 13 January, 2023.
- ♦ HFRI, Shimla organized a Programme on Basic forestry on 2 February, 2023 in which 41 students along with four faculty members of Government Senior Secondary School, Patta Mehlog, District Solan, H.P. were present.
- ♦ HFRI, Shimla organized a Programme on Rain water harvesting: infrastructure in home/schools/offices on 6 February, 2023 in which 80 students of Kendriya Vidyalaya, Ghumarwin, Bilaspur, H.P. participated.
- ♦ HFRI, Shimla organized a Programme on Single Use Plastic Reduced on 15 February, 2023 in which 80 students of Jawahar Navodaya Vidyalaya, Kothipura, Bilaspur, HP were present.
- ♦ HFRI, Shimla organized a Programme on Hands on Training on Scientific instruments under the Prakriti programme on 11 May, 2023 in which 120 Nos. of students from Kendriya Vidyalaya, Jutogh Cantt Shimla were present.
- ♦ ICFRE-HFRI, Shimla organized a Programme on Forestry and Environmental Conservation on 19 May, 2023 in which 28 students of B.Sc Forestry from Dr. Y.S. Parmar UHF, Nauni, Solan were present.



Glimpses of Prakriti Programme



Awareness and Demonstration Programmes:

- ♦ HFRI established demonstration plot of ten poplar clones in farmer fields in collaboration with KVK RS Pura Jammu at Arnia Jammu on 19 January, 2023.
- ♦ Under Mission Life HFRI, Shimla organized an awareness program on “Adopting Sustainable Food System” at Dadhol Panchayat, District Bilaspur (HP) on 6 March, 2023. About 60 people participated in the programme. They were apprised about millets, kitchen gardening and organic farming.
- ♦ Interaction with School Children on issues like Environment, Mission LiFE, International Year of Millets and general discussions on Biodiversity Conservation. Schools visited included Government Middle School, Kurda Dhar on 30 May 2023; Government Middle School, Lagga; GSSS, Kiri on 31 May 2023 in Sahoo Valley of Chamba District of HP. in which 60, 50, 100 students and staff were present, respectively.

Glimpses of Awareness and Demonstration Programmes:



Celebrations of Special Days

- ♦ Himalayan Forest Research Institute (HFRI) celebrated 74th Republic Day on 26 January 2023 at HFRI Campus, Panthaghati, Shimla. About 65 participants including Scientists, Officers, staff, project staff and other staff was present during the occasion. Dr. Sandeep Sharma, Director of the Institute unfurled the National Flag.
- ♦ हिमालयन वन अनुसंधान संस्थान, शिमला द्वारा दिनांक 27 जनवरी 2023 व 24 फरवरी 2023 को स्वच्छता अभियान का आयोजन किया गया व संस्थान के स्टाफ द्वारा कार्यालय के केम्पस के आसपास की साफ-सफाई की गई ।
- ♦ ICFRE- Himalayan Forest Research Institute, Shimla celebrated International Women Day. On this occasion different competitions like painting, essay and poetry recitation were organized for women and winners were awarded with prizes. Ms. Savita Banyal delivered a talk on empowerment of women on 8 March, 2023.
- ♦ ICFRE-HFRI, Shimla participated in Exhibition on NTFPs, organized by department of Forest, Ecology, & Environment, Govt. of J&K, UT at Convention Centre, Jammu on the occasion of International Day of Forests. Different R&D activities of the institute were displayed in the exhibition. Sh Manoj Sinha Lt. Governor of J&K UT, Sh. Neeraj Gupta, Forest Secretary, Govt. of J&K, Sh Mohit Gera, PCCF &HoFF, J&K, other forest officers, members of different departments, research institutions NGO's, farmers, etc. visited HFRI stall. They were apprised about different displayed activities of the institute on 21 March, 2023.
- ♦ LiFE mission- Organized awareness and demonstration programmes under various themes of the mission LiFE. About 290 awareness and demonstration activities have been organized during the month of May by HFRI in the month of May, 2023 in which Villagers, students, Mahila Mandals, Anganwadi workers, Vendors, Shopkeepers, Researchers, Teachers, etc. of the area were present.
- ♦ Under Mission Life ICFRE-HFRI, Shimla organized a Scientific Exhibition cum Environmental Awareness program at Kendriya Vidhyalay, Jutogh Cantt. (Shimla) Himachal Pradesh. About 120 students from 9th to 12th class participated in the programme on 11 May, 2023.
- ♦ Dr. Vaneet Jishtu, Scientist-E as Coordinator conducted the joint programme on the Awareness Activities & Celebration of International Day for Biological Diversity - 2023 under Mission LiFE at the Western Himalayan Temperate Arboretum on **19 May 2023**. Over 150 participated in this awareness program which included school children, teachers, along with officials and researchers from HFRI and HIMCOSTE.
- ♦ HFRI, Shimla organized Environmental Awareness cum One Day Training Programme on "Conservation and Propagation of Temperate Medicinal Plants" at Jagatsukh, Manali (HP). About 50 farmers from local nearby areas including students from Govt. Sr. Secondary School, Jagatsukh participated in the programme on 27 May, 2023.
- ♦ HFRI, Shimla organized an Environmental Awareness Program on E-Waste Reduced in collaboration a Non Govt. Organization i.e. "KARO SAMBHAV" who provided useful information about Cloud Storage and the proper and scientific management /disposal of E-Waste on 29 May, 2023.

- ♦ 75 Range Forest Officer trainees from Uttarakhand Forest Academy, Haldwani visited ICFRE-HFRI Shimla. They were apprised about R&D activities of the Institute on 31 May, 2023.
- ♦ Under Mission LiFE Program ICFRE-HFRI, Shimla organized an event on Mission LiFE theme "Water Saved" at GSSS Tungh, Dharmshala, District Kangra, (HP) on 1st June, 2023. Conducted awareness programme for the students about ways and practices to save water and 'Solid Waste Management' event on Mission LiFE theme "Water Saved" at Aadhunik Public School Sidhwari, Dharamshala, District Kangra (HP) on 1 June 2023. Dr. Vinod , CTO also apprised about judicious use of water and ways and practices to save water.
- ♦ HFRI, Shimla organized an event on Mission LiFE theme "Waste Reduced" at GSSS Matiana, District Shimla, (HP) on 26 June, 2023. Conducted awareness programme for the students about ways and practices to segregate dry and wet waste at their homes. Sh. Akhil Kumar apprised the students about the benefits of segregation of waste.
- ♦ Dr. Vaneet Jishtu, Scientist HFRI Shimla interacted with the faculty and students of HPU, education department on environmental issues and mission life activities during the a cleanliness drive near the Western Himalayan Temperate Arboretum Potter Hill Shimla organized by Education department of HPU, Shimla 3 June, 2023.
- ♦ Dr. Vaneet Jishtu, Scientist-E, ICFRE-HFRI Shimla conducted a nature walk with 50 students and members of Rotary Club Shimla in the Potter Hill forest. Provided information on native biodiversity and plant identification in the field on 4 June, 2023.
- ♦ Forest Guard trainees (36) from forest training Academy Haldwani, Uttarakhand visited HFRI, Shimla and they were apprised about different research and extension activities of the institute on 4 June, 2023.
- ♦ Second batch of Forest Guard trainees (42) from forest training Academy Haldwani, Uttarakhand visited HFRI, Shimla and Dr. Vaneet Jishtu, Scientist-E presented the Institutes activities and achievements to the visiting Trainee Forest Guards.
- ♦ A batch of 54 B.Sc. Forestry IVth year students along with two faculty members from TNAU-FCRI, Mettupalayam visited ICFRE-HFRI Shimla on 23 February, 2023.
- ♦ Forty one students of forestry from College of Forestry Odisha University of Agriculture and Technology, Bhubneshwar visited ICFRE-HFRI Shimla on 8 May, 2023. . They were apprised about R&D activities of the Institute.



Under Mission LiFE Program ICFRE-HFRI, Shimla organized an event on Mission LiFE theme "Waste Reduced" at Shillaru, District Shimla (HP) on 26 June 2023. Sh. Akhil Kumar apprised about use of agricultural residues and animal waste for composting, feeding the unused and uncooked food/leftover food to the cattle.



Glimpses of Special Days Celebrated



Glimpses of Other Activities carried out by Institute





RESEARCH PAPERS

- Barman, T., Samant, S.S.; Tewari, L.M.; Kanwar, Nidhi; Singh, Amit; Paul, Shiv and Lata, S. (2023). Ecological assessment and suitability ranges of Ban Oak (*Quercus oblongata* D. Don) in Chamba district, Himalayas: implications for present and future conservation. *Brazilian Journal of Botany*. DOI: <https://doi.org/10.1007/s40415-023-00885-w>.
- Barman, T., Samant, S.S., Tewari, L.M., Kanwar, N., Singh, A., Paul, S. and Lata, S. (2023). Ecological assessment and suitability ranges of Ban oak (*Quercus oblongata* D. Don) in Chamba district, Himalayas: implications for present and future conservation. *Brazilian Journal of Botany*, 46: 477–497.
- Chauhan, P. and Tapwal, A. (2023). Green synthesis of nanoparticles using botanicals and their application in management of fungal phytopathogens - A review. *Archives of Microbiology*, 205:94. <https://doi.org/10.1007/s00203-023-03431-0>
- Devi, R. Kumar, P. and Mattu, V.K. 2023. An assessment of Diversity Pattern of Butterfly fauna (Lepidoptera: Papilionoidea) from subalpine zone of North-western Himalayas. *Oriental Insects*, DOI: 10.1080/00305316.2023.2186507.
- Devi, R., Abdulhaq, A., Verma, R., Sharma, K., Kumar, D., Kumar, A., Tapwal, A., Yadav, R., Mohan, S. (2023). Improvement in the phytochemical content and biological properties of *Stevia rebaudiana* (Bertoni) Bertoni plant using endophytic fungi *Fusarium fujikuroi*. *Plants*, 12: 1151.
- Jishtu, V. (2022): Moist Alpine Meadows of Temperate Himalaya, Pabbar Valley, Rohru (Shimla) Himachal Pradesh. *Indian Forester*, 148 (11): 1079 -1093, 2022.
- Kumar, P., Verma, Anchal, Anukriti and Sharma, Neha (2023). An outbreak of *Yponomeuta padella* (Linnaeus, 1758) on *Prunus cornuta* (Himalayan Bird Cherry) in Kullu district, Himachal Pradesh, *Uttar Pradesh Journal of Zoology*, 43(24): 616-621
- Kumar, R., Kumar, R., Singh, J., Lata, S. and Singh Joginder (2023). A Review on Ethnobotanical and Pharmacological Importance of *Vitex Negundo* L. *Asian Jr. of Microbiol. Biotech. Env. Sc.* 24 (4):794-801.
- Lata, S., Samant, S.S., Negi, P.S. and Varsha. 2023. Diversity and Distribution pattern of fuel Resource in Kinnaur district, Himachal Pradesh. *Trans and North-Western Himalaya. Indian Forester*, 149 (5): 513-525.
- Negi, P. S., Sharma, S. and Thakur, N. (2022). Response of Vermicompost on Seedling Growth and Quality Parameters of *Juniperus polycarpus* C. Koch under Nursery Condition. *Annals of Arid*

Zone, 61(3&4):181-186.

- Negi, P. S., Sharma, S. and Thakur, N. (2022). Effect of Irrigation Schedule on Growth and Quality Parameters of *Juniperus polycarpus* C. Koch Seedlings Under Nursery Condition. *Journal of Tree Sciences*, 41(1):1-8.
- Negi, P. S., Sharma, S., Kumar, R., Thakur, R. and Chauhan, P. (2022). Studies on Germination Behaviour of *Rubus ellipticus* Sm. seeds collected from different Seed Sources in Himachal Pradesh. *Journal of Non-Timber Forest Products*, 29(4):167-170.
- Paul, S. (2023). Diversity, distribution and conservation status of raw edible plant resources of the Madgram Watershed, Lahaul Valley, Himachal Pradesh, India. *Journal of Non-Timber Forest Products*. 28(4), 150-156.
- Paul, S. and Samant, S.S. (2023). Population biology, ecological niche modelling of endangered and endemic *Pitosporum eriocarpum* Royle in Western Himalaya, India. *Journal for Nature Conservation* 72 (2023) 126356. Pp-1-13.
- Paul, Shiv, Kanwal, Khilendra Singh, Sharma, Sheetal, Bhatt, Indra Dutt and Sundriyal, Rakesh Chandra (2023). Diversity, distribution, indigenous uses and conservation of medicinal and aromatic plants in Changthang landscape of Ladakh, Trans Himalaya. *Journal of Non-Timber Forest Products*. 28(4), 138-146.
- Paul, S., Lata, S. and Barman, T. (2023). Habitat distribution modeling of the *Pinus gerardiana* under projected climate change in the North-Western Himalaya, India. *Landscape and Ecological Engineering*, <https://doi.org/10.1007/s11355-023-00570-w>
- Paul, Shiv; Lata, Swaran and Barman, Tanay (2023). Habitat distribution modelling of the *Pinus gerardiana* under projected climate change in the North-Western Himalaya, India. *Landscape and Ecological Engineering*. <https://doi.org/10.107/s11355-023-00570-w>
- Sharma, N. and Tapwal, A. (2022). *Sparassis crispa*- An important wild edible mushroom with medicinal properties. *Himalayan News Letter*, 2(2): 12-14.
- Thakur, N., Kumar, P., Tapwal, A. and Jeet, K. (2023). Degradation of malachite green dye by capping polyvinylpyrrolidone and *Azadirachta indica* in hematite phase of Ni doped Fe₂O₃ nanoparticles via co-precipitation method. <https://doi.org/10.37819/Nanofab.008.304>
- Thakur, M. Chandel, M. Kumar, A. Kumari, S. Kumar, P. and Pathania, D. 2023. Development of carbohydrate polymers and protein-based biomaterials and their role in environmental health and hygiene: A review. *International Journal of Biological Macromolecules*, 242 (2):1-13.

Verma, R.K., Kumar R. and Chauhan, H. (2023). Status of Plant Diversity in Alpine Pasture of Chansel District Shimla, Himachal Pradesh. *Eco. Env. & Cons*, 29: S355-S363.

Verma, R.K., Verma, R. and Chauhan, H. (2023). Assessment of biomass and soil carbon stock in different forest land use systems of Lahaul Valley, Himachal Pradesh. *Indian Journal of Forestry*, 45(1), 14-19.

Verma, R.K. and Kumar R. (2022). Estimation of Biomass and soil Carbon Stock in Alpine Pastures of Lahaul Valley of District Lahaul & Spiti, Himachal Pradesh. *Environment and Ecology*, 40(4C): 2638-2641.

ABSTRACTS

Barman, T. and Lata. S. 2023. Ecological assessment of natural populations of *Myrica esculenta* Buch.-Ham. ex D. Don in the Indian North-Western Himalaya. p53-54. Abstract published in the proceedings of international conference on "Empowering Individuals for a better future" organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Chauhan, A., Jishtu, V., and Bano, H. (2023): Threatened ethnobotanical flora of cold arid trans-Himalayan landscape of Ladakh, India. International Conference on *Mountain Ecosystems: Biodiversity and Adaptations under Climate Change Scenarios* (MBCC-2023): March 22-24, 2023, Graphic Era Deemed to be University Dehradun, Page no 52-53.

Chauhan, V. and Lata. S. 2023. Transforming agricultural practices with modern automation techniques: A comprehensive survey and proposed framework. p52. Abstract published in the proceedings of international conference on "Empowering Individuals for a better future" organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Das, J., and Jishtu, V. (2023): An embrative review on the bio chemical characterization of genus *Rubus* L., with special reference to North-West Himalaya, India. International Conference on *Mountain Ecosystems: Biodiversity and Adaptations under Climate Change Scenarios* (MBCC-2023): March 22-24, 2023, Graphic Era Deemed to be University Dehradun, Page no 45.

Goonta, A., Nautiyal, I. and Lata. S. 2023. Effect on physical and mechanical properties of particle board of *Melia dubia* with addition of 3% zinc oxide nanoparticle in urea formaldehyde resin. p53. Abstract published in the proceedings of international conference on "Empowering Individuals for a better future" organised by ICFRE-Himalayan Forest Research Institute, Shimla.

Goonta. A and Lata. S. 2023. *Morchella esculenta* a comprehensive review of its biology, ecology, cultivation and medicinal uses. Poster presented by Aayush Goonta. p16. Abstract published in souvenir and compendium of abstract book of national conference on "Value Addition and Marketing of NTFPs/MAPs for Livelihood Security (NCVAM-2023)" organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) on dated 2 -3 May 2023.

Jishtu, V., Das, J., Minakshi and Chauhan, M. (2023). Comprehensive scrutiny on the Phytogeography of Genus *Rubus* L., with special reference to India. Page 10. Published in the Book of Abstracts of the International Symposium on Plant Taxonomy, Ethnobotany and Botanic Gardens; 13-14 February, 2023; organised by the Botanical Survey of India, Kolkata.

Jishtu, V., Goraya, G.S., Bhushan, B., and Chauhan, M. (2023) High Altitude Transition Zones in Himachal Pradesh: Long Term Studies to Assess the Effects of Global Warming. International Conference on *Mountain Ecosystems: Biodiversity and Adaptations under Climate Change Scenarios* (MBCC-2023): March22-24,2023, Graphic Era Deemed to be University Dehradun, Page no 7-8.

Jishtu, V., Minakshi, Singh, Y.D., Goraya, G.S., Bhushan, B., and Chauhan, M. (2023). Diversity and prioritization of Fodder species for Conservation in Nalagarh Forest Division Himachal Pradesh, NW India. International Conference on Mountain Ecosystems: *Biodiversity and Adaptations under Climate Change Scenarios* (MBCC-2023): March22-24,2023, Graphic Era Deemed to be University Dehradun, Page no 42-43.

Kohli, M., Lata. S. and Negi, P.S. 2023. Botany: Unveiling the wonders of plant life and unlocking the secrets of green world. p123-124.

Kumar, A. and Tapwal, A. (2023). Morpho-anatomical characterization of *Cedrus deodara* mycorrhizae. In: National Conference on Sustainable Himalayan Environment: Challenges and Opportunities, organized by Department of Environment Science, HP Univ. Shimla on 19-20 March, 2023. Abstract-OP-19. P-29.

Kumar, A., Tapwal, A., Sharma, S. and Thakur, N. (2023). Seasonal dynamics of arbuscular mycorrhizal fungi in the rhizosphere of *Valeriana jatamansi* Jones. In: National Conference on Sustainable Himalayan Environment: Challenges and Opportunities, organized by Department of Environment Science, HP Univ. Shimla on 19-20 March, 2023. Abstract No. -OP-20. p-30.

Kumar, P. and Sharma, N. (2023). Diversity study of insect pests of Oak forests of Himachal Pradesh. In: 2nd International conference on “Emerging scenario of science, Technology and innovation -2023” organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Kumar, P. Sharma, N. Verma, A. Thakur, T.S. and Deepika, 2023. Wild Insect species in India.

Kumar, P. and Verma, A. (2023). Distribution status of Microlepidoptera diversity of Deodar (*Cedrus deodara*) forests of Kinnaur District, Himachal Pradesh. In: 2nd International conference on “Emerging scenario of science, Technology and innovation -2023” organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Kumar, P., Anukriti and Sharma, N. (2023). Deodar Seed Oil: A promising Biopesticide to manage Insect pests of Forestry. In: 2nd International conference on “Emerging scenario of science, Tech-

nology and innovation -2023” organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Lata, S. (2023) in International Conference on 'Emerging Scenario of Science, Technology and Innovation' (ESSTI-2023)” organized by Carrier Point University, Hamirpur, Himachal Pradesh on 24th -25th February, 2023 and abstract entitled “Population assessment of the economically important and endangered plant *Cinnamomum tamala* (Tejpatta) in Himachal Pradesh, North western Himalaya published.

Lata, S. and Chauhan, V. (2023). Distribution of *Fritillaria cirrhosa* D. Don in Himachal Pradesh, North Western Himalaya, India in proceedings of national conference on Environmental Concerns in the Himalayan Region” organised by Government College Jukhala, Bilaspur, Himachal Pradesh on dated 20 May 2023. p38.

Lata. S. and Paul, S. 2023. Habitat Distribution Modelling of Threatened and Highly Demanding *Juniperus polycarpus* K.Koch in Lahaul valley of Himachal Pradesh under projected climate change. p13. Abstracts published in souvenir and compendium of abstract book of national conference on “Value Addition and Marketing of NTFPs/MAPs for Livelihood Security (NCVAM-2023)” organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) on dated 2 -3 May 2023.

Lata. S. and Paul, S. 2023. Plant Diversity, Threat Status and Indigenous Usage in Dodra Kwar, Himachal Pradesh, North Western Himalaya. p109. Abstracts published in souvenir and compendium of abstract book of national conference on “Value Addition and Marketing of NTFPs/MAPs for Livelihood Security (NCVAM-2023)” organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) on dated 2 -3 May 2023

Lata. S. and Varsha. 2023. Conservation and Sustainable management of *Pinus gerardiana* (Chilgoza) for sustaining livelihood of Kinnaura tribal communities of Himachal Pradesh, North Western Himalaya. p59. Abstract published in the proceedings of international conference on “Empowering Individuals for a better future” organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Naveen and Lata. S. 2023. Assessing the impact and drivers of biodiversity loss: A comprehensive review. p54. Abstract published in the proceedings of international conference on “Empowering Individuals for a better future” organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Naveen. and Lata. S. 2023. Non-timber forest products and their role in the livelihood of people of Himachal Pradesh: A review. Poster presented by Mukesh Kumar. p92. Abstract published in souvenir and compendium of abstract book of national conference on “Value Addition and Marketing of NTFPs/MAPs for Livelihood Security (NCVAM-2023)” organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) on dated 2 -3 May 2023.

Negi, P.S., Sharma, S., Kumar, R., Thakur, R. and Chauhan, P. (2023). Studies on Germination Behaviour of *Rubus ellipticus* Sm. seeds collected from different Seed Sources in Himachal Pradesh. Abstract: In 2nd International Conference on “Emerging Scenario of Science Technology and Innovation-2023” organized on 24th & 25th Feb., 2023 by Career Point University, Bhoranj, Hamirpur, Himachal Pradesh.

Paul, S., Samant, S.S.; Lata, S., Lal, M., Thakur, P. and Sharma, S. (2023). OP-3: Modelling the potential distribution of endemic and endangered *Pittosporum eriocarpum* in the Himalayan under Changing Climate Conditions.p-24

Paul, Shiv; Samant, S.S.; Lata, Swarn; Lal, Manohar; Thakur, Pawan Kumar and Sharma, Sandeep (2023). OP-3: Modelling the potential distribution of endemic and endangered *Pittosporum eriocarpum* in the Himalayan under Changing Climate Conditions.p-24. Abstract published in Abstract Book and presented during the National Conference on India's G20 Presidency & Green Growth Strategies for Sustaining Himalayan Societies under Changing Climate: Policy Pathway & Tools, organized from 27 to 28 June, 2023 by G.P. Pant National Institute of Himalayan Environment (NIHE) Kosi Katarimal, Almora, Uttarakhand and National Centre for Sustainable Coastal Management (NCSCM), Anna University Campus, Chennai, Tamil Nadu.

Paul. S., Samant, S.S. and Lata. S. 2023. Maxent Modeling for predicting the potential distribution of endangered and endemic *Pittosporum eriocarpin* in the Indian Himalayan Region. p51-52. Abstract published in the proceedings of international conference on "Empowering Individuals for a better future" organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Paul. S., Samant, S.S. and Lata. S. 2023. Maxent Modeling for predicting the potential distribution of endangered and endemic *Pittosporum eriocarpin* in the Indian Himalayan Region. p51-52.


Rishabh. S and Lata. S. 2023. *Bauhinia variegata*: A review of its traditional uses, bioactive compounds and potential application in Food and Pharmaceutical Industries. p21. Abstracts published in souvenir and compendium of abstract book of national conference on "Value Addition and Marketing of NTFPs/ MAPs for Livelihood Security (NCVAM-2023)" organised by ICFRE-Tropical Forest Research Institute, Jabalpur (M.P.) on dated 2 -3 May 2023.

Sharma, N., Tapwal, A. and Kumar, A. (2023) Mycorrhizal relationship in *Abies pindrow*: Diversity of mycobiont and morpho-anatomical characterization of roots. *In*: National Conference on Sustainable Himalayan Environment: Challenges and Opportunities, organized by Department of Environment Science, HP Univ. Shimla on 19-20 March, 2023. Abstract No. OP-22. p-32.

Sharma, N., Tapwal, A. and Kumar, V. (2023). Diversity and seasonal dynamics of arbuscular mycorrhizal fungi in Shimla Water Catchment Wildlife Sanctuary, Himachal Pradesh. *In*: National Conference on Sustainable Himalayan Environment: Challenges and Opportunities, organized by Department of Environment Science, HP Univ. Shimla on 19-20 March, 2023. Abstract No-OP-21. p-31.

Sharma, R. and Lata. S. 2023. Sacred Grooves: a unique traditional conservation approach against habitat degradation. p55-56. Abstract published in the proceedings of international conference on "Empowering Individuals for a better future" organised by ICFRE-Himalayan Forest Research Institute, Shimla, H.P. and Science and Management Society, Himachal Pradesh on dated 12 -14 May 2023.

Sharma, S. and Bidlan, I. (2023). Conservation of Himalayan Hornbeam (*Carpinus viminea*): A review study of its biology and threats". Paper presented in 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.



Sharma, S. and Gautam, S. (2023). *Corylus jacquemontii* Decne: A study on its taxonomy, distribution and cultivation practices". Paper presented in 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Sharma, S. and Nisha (2023). *Quercus semecarpifolia* Sm in the Himalayan Region: Ecology, importance, dependency, threats and conservation status". Poster presented in 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Sharma, S. and Thakuar, S. (2023). A review of Himalayan bird cherry: Medicinal uses and pharmacology". Paper presented in 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.


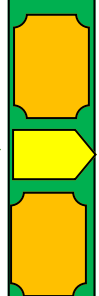

Tapwal, A., Kumari, A., Tiwari, B. Sharma, H. (2023). Evaluation of *Trichoderma* species for the antimycotic activity against *Ganoderma lucidum* causing root rot of *Dalbergia sissoo*. In: 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Thakur, P., Kumar, Kumar, R., Paul, S. and Sharma, S. (2023). PP-12: MaxEnt modelling to predict the spatiotemporal distribution of *Myrica esculenta* under climate change scenarios in Himachal Pradesh, North Western Himalaya. P-37

Thakur, Pawan Kumar; Kumar, Ranjeet; Paul, Shiv; and Sharma, Sandeep (2023). PP-12: MaxEnt modelling to predict the spatiotemporal distribution of *Myrica esculenta* under climate change scenarios in Himachal Pradesh, North Western Himalaya. P-37. Abstract published in Abstract Book and presented during the National Conference on India's G20 Presidency & Green Growth Strategies for Sustaining Himalayan Societies under Changing Climate: Policy Pathway & Tools, organized from 27 to 28 June, 2023 by G.P. Pant National Institute of Himalayan Environment (NIHE) Kosi Katarmal, Almora, Uttarakhand and National Centre for Sustainable Coastal Management (NCSCM), Anna University Campus, Chennai, Tamil Nadu.

Thakur, T. S., Kumar, P., Deepika and Sharma, N. (2023). Heavy insect pest incidences- A threat on high altitude vegetation. In: 2nd International conference on "Emerging scenario of science, Technology and innovation -2023" organized by Carrier Point University, Bhoranj, Hamirpur from 24-25 Feb. 2023.

Tiwari, B. (2023) gave oral presentation on "Utilization of organophosphate compound methyl parathion by the cyanobacterium *Scytonema* sp. BHUS-5 as a phosphate source" in National conference on Current Perspectives in Algal and Cyanobacterial Biology (CPACB-2023) organized by the Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi, India on 20 - 21 February, 2023



Tiwari, B., Sharma, S., Pant, D. and Jingta, N. (2023) "Distribution, Uses and genetic Diversity of Himalayan Species *Rhododendron arboretum* Smith : A Review" in 2nd international Conference on Emerging Scenario of Science Technology and innovation (ESSTI-2023), 24-25 February, 2023 organized by Career Point university, Hamirpur, Himachal Pradesh.

Tiwari, B., Tapwal, A., Mehta, D. and Sharma, H. "Genetic variability assessment of *Dalbergia sisoo* Roxb. Genotypes based on nursery growth performances" in 26th Punjab Science Congress- national conference on "Environment, Food security and Health with reference to climate change" Feb 7-9, 2023, organized by Sri Guru Granth Sahib World University, Fatehpur Sahib.

Tiwari, B., Tapwal, A., Mehta, D. and Sharma, H. (2023). Genetic variability assessment of *Dalbergia sissoo* roxb. genotypes based on nursery growth performance. *In*: National Conference on "Environment, Food Security and Health with Reference to Climate Change" organized by Sri Guru Granth Sahib World University, Fatehgarh Sahib from February 07-09, 2023.. Abstract No. DP21, p -180.

Book Chapter

Thapliyal, M., Namitha, N.K. **Rawat, Pravin.**, Dangwal, S., Rathore, K., Kumar, A. and Rana, A. 2022. FGR Seed and Germplasm Storage: In Conservation of Forest Genetic Resources: State Report Uttarakhand, Pilot Project, National Program for Conservation and Development of Forest Genetic Resources, edited by Ginwal, H.S., Mathur, P.K., Rawat, A. and Singh, S. Eds. Forest Research Institute, ICFRE, Dehradun of India. Pp 536-573.

Popular Article

Bhimta, S., Thakur, N. and Jishtu, V. (2022). लाठी बांस (डेंड्रोकलामस स्ट्रिक्टस) एक बहुउद्देशीय बांस. Van Sandesh - 2022. Himachal Pradesh Forest Department; Page 09. Jishtu, V. (2022). The Formidable Pin Pass Trek. <https://hillpost.in/2022/09/the-formidable-pin-pass-trek/118268/>.

Dushyant Kumar (2023). “Our Green Jewels: Nature’s Biggest Bounty”, an article published at <https://hillpost.in/2023/03/our-green-jewels-natures-biggest-bounty/119597/> (dated 04/01/23).

Dr. Vaneet Jishtu – “Shimla Chill Warmed by the Multi-Stakeholder Brainstorming on Forest Fire”. <https://hillpost.in/2023/01/shimla-chill-warmed-by-the-multi-stakeholder-brainstorming-on-forest-fire/119236/>.

Gupta A., Dutt B. and Sharma, S. (2023) “Analysis of chemical properties of thermally treated *Pinus roxburghii* Sargent wood”. *Bioresources* 18(3), 4598-4609

Kumar, P. and Jishtu, V. (2022). “भोजपत्र” हिमालय का एक अनूठा पेड़. Van Sandesh - 2022. Himachal Pradesh Forest Department; Page 11 – 12.

Meena, R. K., Dutt, B., Kumar, R., Kumar, A., Singh, S. L., Sihag, K., Sumthane, Y.Y. Singh, I. and Rawat, P. (2023). Effect of natural plant extracts on wood degradation and chemical constitute after decay test of *Pinus roxburghii* wood. *Agricultural Mechanization in Asia*. 54(1): 11421-11434.

Shweta Bhimta, Neerja Thakur & Vaneet Jishtu (2023) लाठी बांस (देन्द्रोकालामस स्ट्रिक्टस) एक बहुउद्देशीय बांस. वन सन्देश, 9, Pankaj Kumar & Vaneet Jishtu: “भोजपत्र” हिमालय का एक अनूठा पेड़. वन सन्देश, 11, 2023.

Vaneet Jishtu (2022). Rare and Revered – The Iconic Black – Necked Crane of Ladakh. Wildlife Week 2022 Souvenir. Himachal Pradesh Forest Department; Page 74 – 77.

Vaneet Jishtu (2023) Dhankar Lake –Stunning High-Altitude Wetland In The Trans Himalaya. <https://hillpost.in/2023/05/dhankar-lake-stunning-high-altitude-wetland-in-the-trans-himalaya/119757/>

Popularizing Forestry through All India Radio/ Doordarshan:

- ♦ Dr. Pawan Kumar, Scientist-E gave a detailed talk on “Importance of pollination in Himalayan Region” in the channel DD Shimla on 15 February, 2023.
- ♦ International Forestry day under *Azadi ka Amrit Mahotsav* in Doordarshan channel on 21 March, 2023.
- ♦ Manzil: Paryavaran Sanrakshan Mein Adhyayan Ke Sath Avasar in Doordarshan channel on 22 May, 2023.

VISITS OF DIGNITARIES AND SENIOR FUNCTIONARIES

Hon’ble Director General, ICFRE, Sh. Arun Singh Rawat, IFS visited ICFRE-HFRI, Shimla and Field Research Stations of the institute from 17 to 23 June 2023. During visit to the institute, DG, ICFRE interacted with the Scientists, Officers and officials of the institute. Director General, ICFRE formally released the products viz. HIM-MRIDA SANJEEVNI (AM- biofertilizer), HIM-ALBIWASH (Liquid formulation of pISSUMAR), HIM BOKIL-1 (Powder of pISSUMAR) and 04 technical brochures during his visit on 18 June 2023. On the same day, DG, ICFRE formally inaugurated **Technology Demonstration Centre (TDC)** established recently in the Campus of the institute. During field visit, DG, ICFRE inspected the Field Research Station, Tabo, L&S on 19 June 2023 and Van Vigyan Kendra, Jagatsukh, Manali, Distt. Kullu, Himachal Pradesh on 22 June 2023. He also met with ADC Kaza, Sh. Rahul Jain, IAS.



AWARDS

- ♦ Dr. Vaneet Jishtu, Scientist-D, Forest Ecology and Climate Change Division of this institute is nominated for the Rotary Shreyas Award for the year 2022-23 for exemplary work in the field of expertise.
- ♦ Sh. Badri Sen Negi, Assistant, Account Section, awarded “ICFRE Outstanding Employee-2022” Award for the year 2022 by the Director, HFRI, Shimla on Republic Day celebration on dated 26 January 2023.

STAFF NEWS

आई०सी०एफ०आर०ई०हिमालयन वन अनुसंधान संस्थान, शिमला की लेखा शाखा में अपनी 35 वर्ष की सेवाएं प्रदान करने के उपरान्त श्री उमाशंकर दिनांक 31 मार्च 2023 को सहायक के पद से सेवानिवृत्त हुए ।



ICFRE-Himalayan Forest Research Institute (HFRI) was initially established as High Altitude Conifer regeneration Centre in May 1977 and upgraded as Himalayan Forest Research Institute (HFRI) in 1998. The Institute has been declared as "Centre of Advanced Studies for Cold Desert Afforestation and Pasture Management" by ICFRE with the National mandate of eco-restoration of cold deserts. The mandate of the Institute is to undertake research on natural regeneration of coniferous and broad-leaved species; assess the populations of threatened, endemic and economically important species and develop Ecological Niche Model; standardize cost effective nursery techniques of various coniferous and broadleaved species; identify quality seed sources and planting material of various species and establish seed orchards; study ecological aspects of stress sites and cold deserts and work out models for their eco-rehabilitation; study diseases and insect pests of important tree species and suggest their control measures; study on mycorrhizal and other beneficial microbes, assess conservation status of important non-wood forest products in the region and standardize their cultivation techniques; develop suitable agro-forestry models for various zones of Himachal Pradesh state and J&K and Ladakh Union Territories; demonstrate the technologies in the Field Research Stations and educate the stakeholders; and build capacities of stakeholders and disseminate research findings to them.

The Institute has well developed infrastructure of laboratories, library, herbarium at its main campus and nurseries and experimental field areas of conducting research and training programmes in the state of Himachal Pradesh and Union Territories of Jammu & Kashmir and Ladakh. The faculty for imparting training by the institute consists of highly qualified, experienced, skilled professionals and researchers. The Institute has about 155 staff including Contractual and Research Staff at present, which is headed by a Director, who is assisted by a team of 12 Scientists having expertise in the field of Ecology, Biodiversity Conservation, Silviculture, Forest Genetics, Medicinal Plants, Forest Protection and Agro-forestry & Extension, and supported by the Technical Staff. Research Coordination Division, coordinates the research activities of these research divisions under the guidance of Director of the Institute. The Institute has four Van Vigyan Kendras, Six Field Research Stations and Two Demo villages.



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Azadi Ka
Amrit Mahotsav

HIMALAYAN NEWS LETTER



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