साधर्म्य भाष्यम्

SĀDHARMYA BHĀṢYAM

People - Culture - Places

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AGRARIAN TRADITIONS OF UTTARAKHAND

INDIGENOUS WISDOM, CULTURE, AND ECOLOGY

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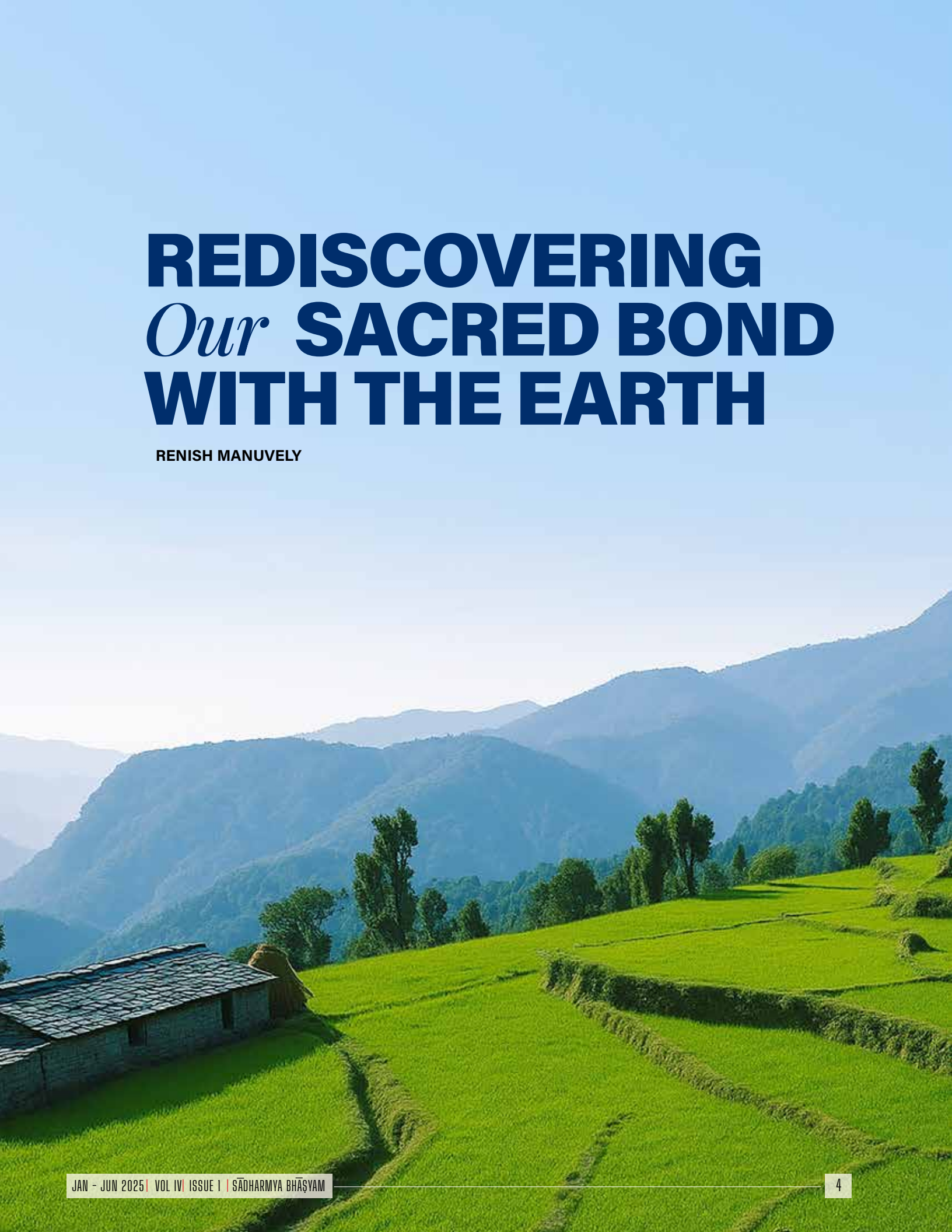
"The Lord God took
the man and put him in the
garden of Eden to cultivate it
and take care of it."
Genesis 2:15

C O N T E N T S

REDISCOVERING *Our* SACRED BOND WITH THE EARTH

RENISH MANUVELY



Editorial

Courtesy: Rithu

In the Book of Genesis, the Bible narrates a wonderful tale that reveals the origins of humanity's intimate bond with the earth. In Eden, the garden of divine grace, Adam and Eve, the first man and woman were given the privileges in abundance. All their needs were met. Everything surrounded them was engaged in providing the infinite happiness. It was a life untouched by labour, a gift of effortless joy.

But that privilege in paradise did not last long. With one fateful act of disobedience, the first humans broke the divine trust, and the gate of Eden was closed behind them. Cast out into a world unknown, their lives were no longer graced by privileges but burdened by responsibility. The daily bread was nomore free for them. It would be earned 'by the sweat of their brow.' Thus, began the long and sacred journey of tilling the earth.

Yet the curse was not without its hidden blessings.

As Adam and Eve worked with the soil, something remarkable began to unfold. The earth, once distant and aloof, responded with quiet generosity. Seeds grew, roots took hold, and food began to spring from the toil of their hands. In their sweat, there was not only hardship but a discovered dignity. By embracing the labour demanded of them, they kindled a silent harmony with nature. And nature, witnessing their resilience and humility, offered its secrets in return.

Thus, a profound bond was established between humankind and the earth. The wisdom of the earth, once veiled, began to flow through human hands and hearts. Agriculture was not merely born as a means of survival, but as a sacred dialogue between the human spirit and the natural world. The story of the Book of Genesis, then, is not only of the origin of agriculture but also of a deep communion that once existed between humanity and creation.

In those early days, humans did not try to conquer the earth rather they always listened to it. They studied its rhythms, observed its signs, and learned its ways. The indigenous practices that emerged were not inventions, but inheritances. They were the piece of wisdom drawn from generations of reverent interaction with the earth. This ancient knowledge enabled a peaceful coexistence, where both humanity and nature thrived under a silent pact of mutual respect.

Time has a way of eroding memory. When humans began to taste abundance, a dangerous illusion took root. It blinded them away from the reality. In ignorance, they believed that they are the master of all things. In their pride, they forgot the soil that sustained them, the labour that humbled them, and the grace that once guided them. They neglected the silent wisdom of the earth, choosing instead the noise of modernity.

And now, the humanity lives with the onsequences. The disasters we witness today—climate collapse, vanishing species, poisoned waters—are not mere accidents. They are echoes of our forgetfulness. They are the cries of a world once in harmony with us, now pushed to the brink.

Humanity today is searching for solutions to the collective forgetfulness and the illusions that cloud the clarity of vision. The ferocious face of nature has become unbearable. Yet, in the midst of this confusion, there have always been guiding lights, individuals unblemished by illusion, who call us back to what we have forgotten. These voices of wisdom warn society of its delusions and offer paths to remembrance. At the heart of their message lies one essential truth: the restoration of our lost bond with nature. They affirm that to regain true wisdom and balance, humanity must once again listen to the earth and align itself with its rhythms.

This message is particularly resonant in the context of India, a land deeply rooted in agricultural heritage. The identity of our nation has long been shaped by its intimate relationship with the soil. Sixty percent of its land is agricultural, and a great number of people in India depend solely on agriculture for their daily bread. As Mahatma Gandhi, the Father of the Nation, once said, "The soul of India lives in its villages." He recognized that the well-being of the nation depended not on

industrial growth alone, but on the self-reliance and sustainability of its rural heartlands.

Gandhi's vision of Village Swaraj was more than a political ideal. It was a blueprint for ecological harmony and human dignity. His emphasis on cooperation over competition, his advocacy for traditional grains like millets, and his concept of trusteeship reveal a profound understanding of humanity's existential need to be in harmony with the earth. He famously said, "Nature has enough for everyone's need, but not for everyone's greed." For Gandhi, indigenous village practices were not only practical but sacred, reflecting a worldview in which the land was not a resource to be exploited but a living presence to be respected.

This edition of Sadharmya Bhashyam celebrates the rich agricultural heritage of Uttarakhand, a land situated in the great Himalayas. A state with rugged mountain terrain, Uttarakhand poses unique challenges to farming. Yet, the people here have cultivated a profound wisdom by interacting with the earth. Through organic methods, terrace farming, and agroforestry, they have developed sustainable agricultural systems that align with the natural rhythm of the land. These practices are not just techniques, but they are expressions of a deep, respectful relationship with nature.

One remarkable aspect of Uttarakhand's agricultural culture is the central role of women. It is often through women that agricultural knowledge and traditions are preserved and passed on. Their contributions are vital to the sustainability of these indigenous practices.

Today, we witness a steady decline in these traditional methods. Vacant terraces and abandoned fields stand as silent witnesses to a fading legacy. Multiple factors contribute to this decline, but what is most urgent is the need to act now. We must awaken to the importance of preserving our agricultural heritage. We must reorient ourselves to the truth that the real meaning of life lies in our connection with the soil. Every village must be revitalized, and ancient agricultural practices must be reestablished.

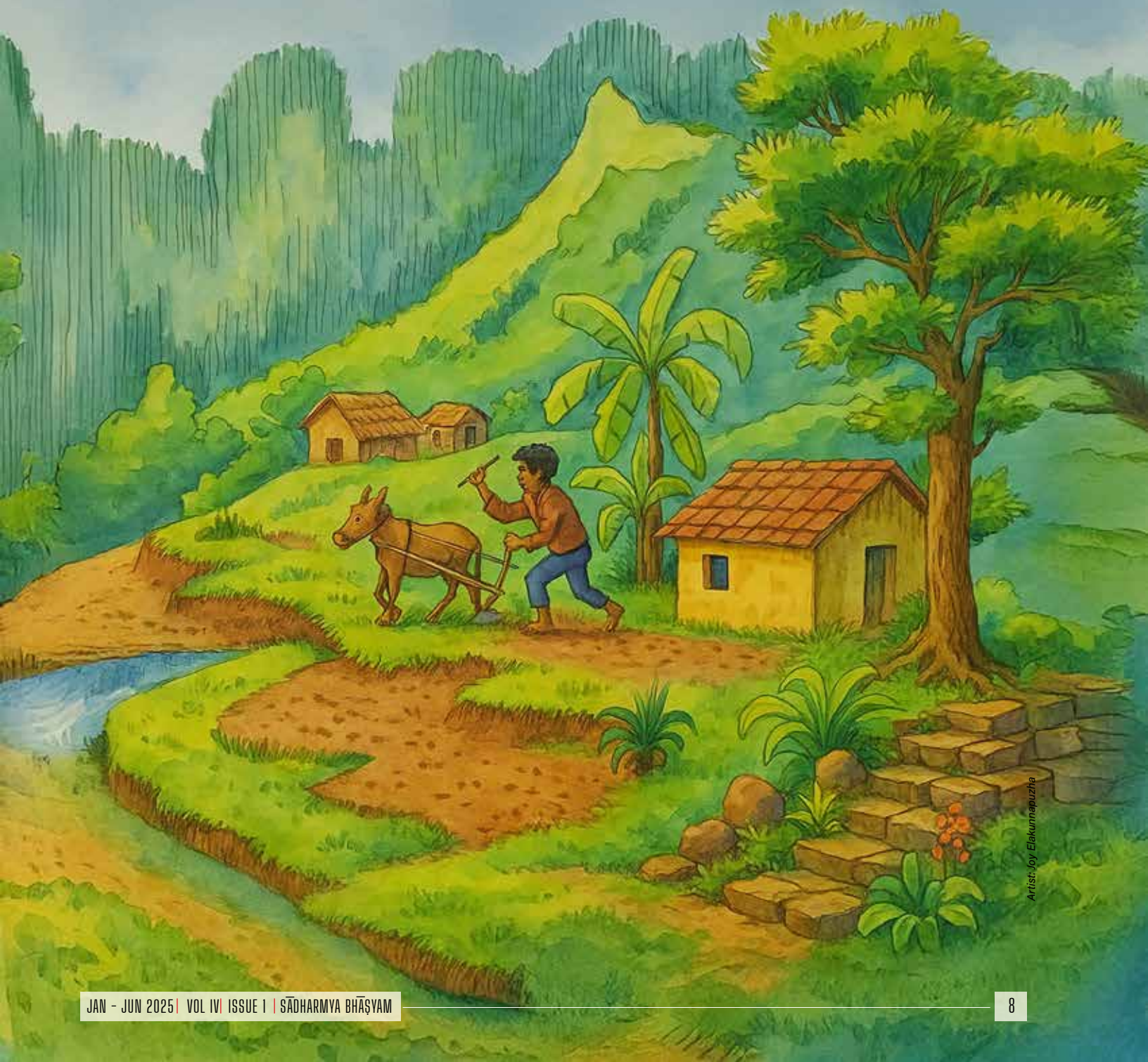
Uttarakhand has also been the birthplace of prophetic figures who have championed this cause. Leaders like Sunderlal Bahuguna of the Chipko Movement and Vijay Jardhari of the Seed Preservation Movement have inspired the nation. Their lives and actions serve as guiding lights for farmers across India. As Gandhians, they have shown us the path of integral development that honors both nature and humanity.

This edition of Sadharmya Bhashyam seeks to uncover and celebrate the agricultural treasures in Uttarakhand inherited through generations. By affirming and promoting these indigenous practices, we are not only preserving a legacy but also offering vital wisdom to the world that is desperately in need of it.

I express my heartfelt gratitude to Prof. Aravind Bijilwan and his team for their valuable collaboration on this project. Their support and scholarly contributions immensely helped in shaping this colourful edition, which is remarkably rich in content. ■

उत्तराखंड में खेती और उसकी प्रथायें

UMA GILDIYAL
Writer, Social Activist
Editor of Regional Reporter



Artist: Joy Elakunnapuzha

शिकार युग से कृषि के युग में प्रवेश मानव जाति के विकास और सभ्यता की प्रथम क्रांति है। कृषि का सभ्यता के विकास के साथ अटूट सम्बन्ध है। जब कृषि के लिये एक स्थान पर मानव ने ठहरना प्रारम्भ किया, तभी समाज की संरचना सम्भव हो पायी। इससे हम सामाजिक मूल्यों को समझ पाये और कृषि की एक ऐसी संस्कृति विकसित हुई, जिसने जीवन के दर्शन, सभ्यता और ठहराव की भावना को जन्म दिया। हिमालयी खेती एक विशिष्ट खेती है, जिसमें हमें जीवन की कठिनाइयाँ तो दिखती ही हैं, साथ ही दिखती है मानव की अदम्य जिजीविषा और कुदाल हाथों में ले पहाडों का सीना चीर कर खेती करने का अदम्य साहस।

पर्वतीय खेती में अत्यधिक श्रम और पर्यावरणीय दक्षता की आवश्यकता होती है। यहाँ कृषि सीढीदार खेतों में की जाती है। इन खेतों को पर्वतों को काट कर बनाया गया है। मिट्टी ढलान पर न बहे, इसलिये पत्थरों की दीवार बनायी जाती है। देखने में ये खेत बहुत खूबसूरत लगते हैं। इन खेतों में परिश्रम करते पहाड़ी किसान को देख कर कमिश्नर रामजे ने लिखा थाः ''पहाड़ी किसान की तुलना भारत के श्रेष्ठतम किसानों से की जा सकती है, क्योंकि ये सदियों से पर्यावरण के साथ समन्वय बनाये हुये हैं।''

पहाड़ का किसान आकाशीय वर्षा पर निर्भर रहता है। यहाँ बाढ़, सूखा आदि प्राकृतिक प्रकोप नहीं के बराबर हैं, परन्तु भूमिकटाव और भूस्खलन जैसी समस्यायें प्रायः उठती रहती हैं। सन् 1868 में जब अकाल पड़ा तो यह क्षेत्र इस अकाल से मुक्त रहा और मैदानी क्षेत्रों के लिये यहाँ से अनाज भेजा गया था।

Courtesy: YV

उत्तराखंड की खेती मनुस्मृति पर आधारित है। यहाँ भूमि पर लगातार खेती अर्थात् एक फसल के बाद तुरन्त दूसरी फसल नहीं बोई जाती है, वरन् उसे एक साल के लिये परती छोड़ दिया जाता है। इन खेतों पर इस समय पशु चरते हैं, खेतों में उनका गोबर और मूत्र गिर कर उन्हें उपजाऊ बना देता है। इसी उर्वरता के कारण इन खेतों में साल भर का अन्न उत्पन्न हो जाता था। खेतों में गोठ लगाने की परम्परा थी। यह गोठ जाडों के मौसम में और कभी बरसात के मौसम हमें खेतों में लगती थी। इसमें बाँस की लकड़ी से बड़े–बड़े घर बना कर पशुओं को रखा जाता था। घर का मुखिया इन्हीं गोठों में रहता था। कुछ समय बाद गोठ को दूसरे स्थान पर खिसका देते थे। पशुओं का मल–मूत्र खेतों में गिरता रहता था। इससे खेत बहुत अधिक उपजाऊ हो जाते थे। इन गोठों में कभी एक परिवार का मुखिया या दो–चार परिवार मिल कर अपने जानवरों को रखते थे।

भोटिया लोग अधिक ठंड में अपनी भेड़–बकरियों को लेकर हिमालयी उच्च स्थानों से चल कर निचले गर्म इलाकों में आ जाते हैं। गाँवों से होकर जब ये लोग गुजरते हैं तो कई गाँवों के लोग अपने परती पड़े खेतोः में इन्हें भेड़ों को रखने की जगह दे देते हैं। भेड़ों की मींगियों से खेत कई सालों के लिये उर्वरक हो जाते हैं। गाँवों के लोग यह मानते हैं कि एक बार खेतों में अच्छी प्रकार से डाला गया गोबर तीन वर्षों तक खेतों को उर्वर बनाये रखता है।

उत्तराखंड में हल और बैल से खेती करने की प्रथा है। यही कारण है कि उत्तराखंड के देवता भगवान शिव का वाहन भी बैल ही है, जो पहाडों पर आसानी से ऊपर–नीचे चढ़ जाता है। छोटे बड़े खेतों में यह आसानी से हल को खींच लेता है। बहुत छोटे खेतों में कुदाल से खोद कर खेती की जाती है। एक इंच भूमि को भी खाली नहीं छोड़ा जाता है।

इस प्रदेश में नीचे से ऊपर चढ़ते खेतों के समूह को 'सारी' कहा जाता है। प्रायः चारों ओर खेत और मध्य में गाँव। सारी को कई नामों से उल्लिखित किया जाता है। जैसे; वल्ली (नजदीक के खेत) सारी, पल्ली (दूर के खेत), मल्ली (ऊपर के खेत), तल्ली (नीचे के खेत) आदि संकेतों

और नामों से खेतों की पहचान होती है। हर खेत का कोई न कोई नाम अवश्य होता है। नाम उसके आकार–प्रकार, उसमें उगने वाले अन्न, पेड़, धारा, झाड़ी, दूरी आदि के कारण भी रखे जाते हैं।

उत्तराखंड में खेती दो प्रकार की होती है। पहली उखड़ खेती, जो आकाशीय वर्षा पर आधारित है। दूसरी सिंचित खेती, जिसके लिये सिंचाई के साधन उपलब्ध हैं। यह खेती गाड–गधेरों, बड़े सोतों और नदियों के किनारे हैं। इन्हें सेरा कहा जाता है। गढ़वाल मण्डल में मलेथा का सेरा बहुत प्रसिद्ध था किन्तु अब वह रेल की भेंट चढ़ चुका है। विकास ने अपने साथ विनाश को भी न्योता दिया है। कुछ घाटियाँ अपने सेरों के लिये बहुत प्रसिद्ध हैं। एटकिन्सन नामक अंग्रेज ने अपने सर्वे में कहा है कि सोमेश्वर और भीमताल की घाटियाँ एशिया में सबसे सुन्दर और सर्वाधिक उपजाऊ हैं। इस प्रदेश में 'बारहनाजा' की प्रथा है। इसका तात्पर्य है कि खेती में बारह अनाज बोये जाते हैं। इसके पीछे लोकमत है कि खेती में नुकसान न हो। ये बारह अनाज–धान, झँगोरा, कोदा या रागी, तोर, उड़द, गहथ, तिल, सूँटा (लोबिया), कौणी, भट्ट, रयांस, राजमा, ओंगल, चीणा, भंगजीरा, जख्या आदि हैं। इनमें कुछ कहीं होते हैं, कुछ कहीं। कुछ अनाज सभी जगह होते हैं। यह एक पारम्परिक मिश्रित फसल प्रणाली है। इसमें मिट्टी की उर्वरता बढ़ जाती है। खाद्य सुरक्षा सुनिश्चित होती है और पारिस्थितिक सन्तुलन बना रहता है। इसमें किसानों का पारम्परिक ज्ञान व अनुभव पीढ़ी दर पीढ़ी प्राप्त होता रहता है। खेती में किसान को नुकसान नहीं होता। क्योंकि एक अनाज न हो तो दूसरा हो जाता है। दलहन फसलें मिट्टी की उर्वरता को बढ़ाती हैं। बारहना. जा खेती जलवायु के प्रति संवेदनशील है। वर्षा न होने पर देखा गया है कि पौधे सिकुड़ जाते हैं और वर्षा होने पर खिल जाते हैं। एक साथ उगने पर खेतों की उत्पादकता भी बढ़ती है। लोगों को संतुलित आहार प्राप्त होता है। इस प्रकार खेती की यह प्रथा अत्यन्त महत्त्वपूर्ण है।

उत्तराखंड में खेती का कार्य करने के लिये मुहुर्त निकालने

की भी प्रथा है। इसका एक अच्छा उदाहरण जीतू बगड़्वाल का है, जिसके सेरे में हल लगाने के लिये जब मुहूर्त निकाला जाने लगा तो उसकी राशि पर मुहुर्त नहीं मिला। तब ब्राह्मण ने उसकी बहिन की राशि पर दिन निकाला। जीतू बहिन को लाने के लिये घर से निकला, परन्तु मार्ग में उसकी सुन्दरता से आकृष्ट होकर आँछरियों (परियों) ने उसका हरण कर लिया। आज हर परिवार अलग से दिन नहीं निकालता, वरन् सामुहिक रूप से किसी एक दिन हल लगाने का दिन निश्चित किया जाता है।

नया अनाज जब घर में लाया जाता है तो देवी–देवताओं को सर्वप्रथम नये अनाज का भोग लगाया जाता है। यह भोग रोट के रूप में लगता है। स्थानीय देवताओं में नागराजा, भैरव, नृसिंह, क्षेत्रपाल, भूदेवी आदि हैं। जिन्हें नया अनाज भोग लगाने के बाद ही अपने प्रयोग में लाने की प्रथा है। नया अनाज, विवाहित बेटी, शिक्षक, मन्दिर, दर्जी, लोहार, ढोलवादक आदि के लिये भी निकाला जाता था। घर में आये हुये मेहमान को भी अन्न सौगात के रूप में देने की आज भी प्रथा है। यह सौगात चावल, झंगोरा, मंडुआ, दालें आदि के रूप में दी जाती हैं।

फसल घर में लाने के बाद सबसे अच्छा अनाज बीज के रूप में रख दिया जाता है। कनस्तरों में बीज रख कर ऊपर से गोबर का लेप (दड़क) लगा दिया जाता है। आज यद्यपि परिष्कृत बीज सरकार की ओर से दिये जाते हैं, परन्तु वे जलवायु के अनुकूलन में पिछड़ जाते हैं। इसलिये परम्परागत बीजों को वरीयता देना आवश्ययक है। सेरों में और खेतों में रोपाई, गुड़ाई आदि के समय–ढोलवा. दक के साथ गीत गाते हुये काम करने की भी प्रथा है। संगीत की धुन पर काम करते हुये स्त्री–पुरुष प्रकृति का श्रृंगार करते हुये प्रतीत होते हैं। यह अपने आप में खेती को उत्सव के रूप में मनाने की प्रथा है। आज उत्तराखंड में निरन्तर पलायन हो रहा है। खेत बंजर हो रहे हैं और गाँव वीरान। शहरों पर निरन्तर जनसंख्या दबाव बढ़ता जा रहा है। हमें प्रयास करना चाहिये कि हम गाँवों की ओर लौट कर उन्हें जीवित करें और प्रकृति के साथ चलें। ■

MILLETS *in* UTTARAKHAND

A TRADITIONAL FOOD SYSTEM

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Uttarakhand, a Himalayan state in India, has a rich tradition of cultivating and consuming millets. These small-seeded grains have been a staple food for centuries, providing nutrition and sustenance to the people of the region. Millets such as *mandua* (finger millet), *jhangora* (barnyard millet), *cheena* (proso millet), and *kauni* (foxtail millet) are deeply embedded in the traditional food culture of Uttarakhand.

With growing awareness about their health benefits and environmental sustainability, there is a renewed interest in reviving millet cultivation in the state.

Millets are known for their resilience and historical significance. These ancient grain crops, also known as Famine Grain with long shelf life, have long been cultivated in many regions and served avital part of traditional agricultural practices and

Courtesy: Harshit Singh

heritage. In the past, millets were considered major crops in Asia, Africa, and other parts of the world, particularly in dry and drought-prone regions. In India, these are grown in diverse soils, varying rainfall regimes and in areas widely differing in thermo-and photoperiods. In Uttarakhand, they are mostly cultivated in hilly areas by traditional farming communities, and by indigenous groups, as they are highly adaptable to adverse environmental conditions.

TRADITIONAL IMPORTANCE OF MILLETS IN UTTARAKHAND

Millets have long been a part of Uttarakhand agrarian system, thriving in the state's hilly terrain and unpredictable climate. The local communities, particularly in the Kumaon and Garhwal regions, rely on millets as a primary source of food. In Uttarakhand, these crops have long been cultivated by poor, marginal and tribal farmers as a staple food since time immemorial.

Some local traditional dishes made from millets with ethno-medicinal values include: *mandua ki Roti* (Mandua flour is kneaded with water to make dough which is used to make chapattis)-highly nutritious, it contains a high quantity of calcium and other nutrients. Traditional healers recommend it to cure bone-related disorders, sinus, and severe cold. Jhangore ka bhaat (Jhangora is cooked in water like rice)-easily digestible and used as a substitute for rice in areas where rice does not grow. *Jhangore ki Kheer* (A sweet dish made from barnyard millet, cooked with milk and sugar)-easily digestible and alternative of sweet dish. *Chainsoo* (dry roast millet is used)–high in protein, supports digestion, strengthens bones. Chatna/Pinda (Jhangora is cooked in water like rice)- used to cure constipation in cattle.

Palyun (jhangora is cooked with water and buttermilk/sugar)- easily digestible and used as a stomach tonic. Pinda (kauni is cooked in water like rice)- considered highly nutritious and used to cure indigestion


Courtesy: Laxmi

badi (mandua is soaked overnight and grinded with water and spices to form button-shaped parts, which are sun-dried and fried)-cooked as a substitute of pulse in winter season. Badi (Mandua is grinded and cooked with sweet and ghee)-cooked as a warming food in winter season. These foods not only provide essential nutrients but also have medicinal properties that support digestion, diabetes control, and heart health.

NUTRITIONAL AND HEALTH BENEFITS OF MILLETS

Millets are packed with essential nutrients, making them an excellent alternative to refined grains. Some key health benefits include: rich in fiber – helps with digestion and prevents constipation.

In Uttarakhand, millets they are mostly cultivated in hilly areas by traditional farming communities, and by indigenous groups, as they are highly adaptable to adverse environmental conditions.

High in protein and amino acids – essential for muscle growth and repair. Gluten-free – suitable for individuals with gluten intolerance. Low glycemic index – helps in managing diabetes. Rich in antioxidants – boosts immunity and reduces inflammation.

Finger Millet (Mandua) *Proso Millet (Cheena)*

As a staple cereal, millets are promising source of nutrients that are known to enhance immunity, while there are many other sources as well. Millets, also referred to as nutricereals, are nutritionally superior to major cereals (wheat and rice) for carbohydrate and energy, and serve as a healthy and balanced diet with good source of protein, high in dietary fibre, vitamins, minerals in balanced proportion, antioxidants and micronutrients which helps to support and boost immune system, which may act as a vital shield against any disease.

MILLETS AND ENVIRONMENTAL SUSTAINABILITY

Millets are known for their ability to withstand harsh climatic conditions. They require less water compared to rice and wheat, making them ideal for rain-fed agriculture, minimal use of fertilizers and pesticides, reducing soil and water pollution., drought resistance, ensuring food security even in adverse conditions. Given these benefits, promoting millet farming in Uttarakhand can help in tackling climate change while ensuring a sustainable food system.

THE LIFELINE OF TRIBAL HERITAGE AND HEALING

In

Foxtail Millet (Kauni)

Uttarakhand, millets have been an integral part of the traditional livelihood of tribal communities, serving both as a staple food and a key ingredient in indigenous medicinal practices. Mandua and jhangora are not only valued for their high nutritional content but also for their role in Ayurvedic and folk remedies. Tribal healers use millet-based formulations to treat ailments like digestive disorders, joint pain, and respiratory issues. Beyond medicine, millets hold cultural and religious significance, being used in rituals, festive

The field of Barnyard Millet (Jhangora)

offerings, and brewing traditional fermented drinks.

Tribal communities residing in the states of the Indian Himalayan Region represent the ethnic group and are mainly concentrated in the rural areas. The resilience of millets to harsh mountain climates makes them a crucial part of food security and sustainable agriculture for these tribal communities, reinforcing their deep connection to nature and heritage. In some areas, millet paste is applied to minor wounds or boils as folk remedy to reduce inflammation.

Millets also feature in local rituals and festivals, where offerings made from them symbolize purity and a connection to the earth, reflecting deep cultural and spiritual value in tribal life. Tribal communities in Uttarakhand (Jaunsari Tribe, Bhotia Tribe, Tharu Tribe, Raji and Mahigir Tribes) use locally accessible materials and methods that have been passed down from their ancestors to make fermented alcoholic beverages. Sura/Sur is a millet-based fermented beverage prepared by these tribal communities from finger millet (Mandua).

CHALLENGES IN MILLET CULTIVATION

Despite their advantages, millet cultivation in Uttarakhand has declined over the years due to various factors like: 1) Shift to cash crops like wheat and rice due to government subsidies. 2) Lack of market demand and low profitability for farmers. 3) Changing food habits, with a preference for processed and refined grains. 4) Migration from rural areas, leading to a decline in traditional farming practices.

EFFORTS TO PROMOTE MILLETS

The Indian government, along with local organizations, has taken several initiatives to promote millet cultivation and consumption in Uttarakhand state:

- Subsidies and support programs to encourage millet farming.
- Various awareness campaigns were organized under the International Year of Millets 2023

Millets are known for their ability to withstand harsh climatic conditions. They require less water compared to rice and wheat, making them ideal for rain-fed agriculture.

Finger millet (Mandua)

(Courtesy: Farm)

tohighlight the importance and for promoting the health benefits of millets.

- Inclusion of Millets in mid-day meals in schools to improve nutrition among children.

- In February 2023, the Uttarakhand government approved the Uttarakhand Millet Mission to promote coarse grains. Under this scheme: One kg of manduwa was made available for one rupee on every ration card under the Antyodaya Yojana. Jhangora has been included in the mid-day meal program. Mandua was procured from farmers through cooperative societies at Rs 35.78 per kg.

- Private entrepreneurs, supported by government schemes, are producing value-added millet products such as biscuits, cakes, and momos.

- 430 organic millet outlets are being set up at key tourist and religious locations, railway stations, and airports.

- In December 2023, Uttarakhand received a record 18 Geographical Indication (GI) tags in one day especially including for jhangora and mandua.

In times of climate change, millets are often the last crop standing and, thus, are a good risk management strategy for resource-poor marginal farmers. If these nutri-cereals are promoted and concerted efforts are put in right directions by scientists, policy makers, government, and progressive millet growers, we might see millets return on large scale in days to come on farms and the revival of those millets, which have been displaced across Uttarakhand's hillsides.

CONCLUSION

Millets are an integral part of Uttarakhand's traditional food system, offering both health and envirmental benefits, reviving their cultivation can

Barnyard Millet -Variety PRJ 1

provide sustainable livelihoods to farmers while preserving the rich culinary heritage of the state. By encouraging millet-based diets and supporting local farmers, Uttarakhand can pave the way for a more resilient and sustainable food system. Despite all the benefits, these millets encounteres several production constraints. There is need to think as policy makers, and we really need to push the progressive farmers to go for these crops. The attention to millets has come down terribly including the production. It's time to recognize the importance of millets and see how they can be popularized. The role of government is very important and the farmers who are involved in producing these precious seed materials should be rewarded. The millet is not a mere crop but it is a symbol and hope for prosperity. There is a need for policy-driven support, research to improve productivity, and farmer incentives. Establishing Nutri-cereal Model Villages and Nutri-cereal Seed Villages can help improve both food security and economic conditions for hilly/tribal farmers in Uttarakhand.■

Finger Millet (Mandua)

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MOTHER EARTH *and* AGRICULTURE

The Vital Role of Soil in Uttarakhand Farming

VIJENDER PAL PANWAR AND VIVEK CHAUHAN
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Artist: Joy Elakunnapuzha

In Uttarakhand sacred landscapes that cradle the fertile valleys between the great Himalayan peaks, the earth is more than just a growing medium but is considered to be the very personification of Mother Earth. As the Atharva Veda affirms, "माता भूमिः पुत्रोऽहं पृथिव्याः।" "The Earth is my mother, and I am her son" (Atharva Veda 12.1.12). This is not merely a poetic heritage but a living philosophy for Uttarakhand's villages. For thousands of years, the region's inhabitants have farmed in profound synchrony with nature, honouring the earth with a reverence that knows no boundaries. Today, however, that relationship is under pressure from the strains of ecological crisis, income inequalities, and increasing hill out migration. Though agriculture continues to be the mainstay of livelihood for almost 70% of the state population, the sector is afflicted with geographical and economic disparities of a stark sort.

GEOGRAPHIC CONSTRAINTS AND LAND USE PATTERNS

The state has a total geographical area of 5.35 million ha, of which 4.6 million ha (86%) is mountainous and 0.74 million ha (14%) is plain. The state's terrain is mostly to blame for the fact that only 14% of the total area is arable. In comparison to the national average of 43.37%, the share of net sown area of Uttarakhand is only about 14%. The state has 0.8 million ha of cultivated area constituting 16% of the total geographical area. Over 55% of the cultivated area is rainfed with frequent moisture stress to crops (ICAR). The highest sown area is under the wheat crop (34.79%) followed by rice with 24.3%. Mandua, a traditional millet crop has 15.1% sown area, while the area under pulses is 4.61%. The rest of the area is under other millets including kauni, jhangora, jowar, bajara, maize, and oil seeds. The land holdings are small and scattered. Most of Uttarakhand's current production of food grains is from some plain districts like Udham Singh Nagar and Haridwar. These areas have the advantage of fertile alluvial soils, guaranteed irrigation, mechanization, and market linkages.

Hill districts suffer from daunting rainfed conditions, poor soil, declining land holdings, low mechanization, and rising conflict with wildlife. On comparing, the hilly districts that share nearly 86% of the state area find it difficult to sustain agriculture as the 11 hill districts together produce a mere 16-18% of the total wheat and rice produce of the state. These factors often lead to low income with chronic under-employment in these districts and result in large-scale out-migration to plains and urban areas such as Dehradun, Haldwani, or other nearby townships.

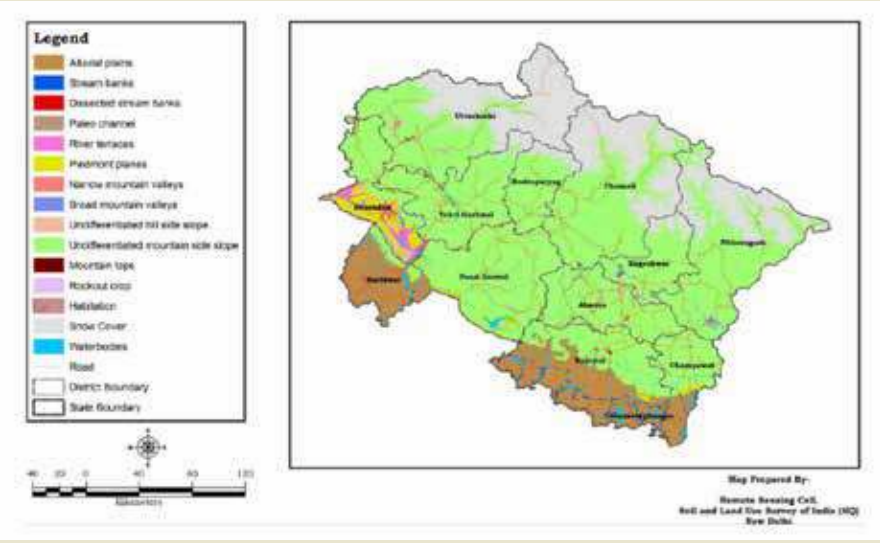


Figure 1 - Physiographic map of Uttarakhand. (Source: Soil and Land Use Survey of India, Compendium of Soil Resources for Sustainable Land Management of Uttarakhand)

THE ROLE OF SOIL IN AGRICULTURE AND ECOLOGY

Soil is the foundation of Uttarakhand's agricultural and ecological systems, serving not only as a resource but as a living entity that sustains rural livelihoods, cultural traditions, and environmental balance. The state's diverse terrain hosts four major soil types, they are Inceptisols, Entisols, Alfisols, and Mollisols. They play a unique role in agricultural productivity. The fertile Entisols and Mollisols of the Tarai region support intensive paddy-wheat cropping systems and high-value horticulture, benefiting from moisture retention and irrigation infrastructure. In contrast, the Inceptisols and Alfisols of the mid and high hills remain shallow, erosion-prone, and low in nutrients, making hill agriculture highly vulnerable to degradation. As nearly 70% of hill farming is rainfed, unpredictable monsoon patterns exacerbate soil erosion, nutrient loss, and declining fertility, creating challenges for sustainable agriculture.

Figure 2 - Soil types, characteristics, and locations in Uttarakhand.

The challenges posed by soil degradation extend beyond agriculture, significantly impacting rural demographics. As per the Uttarakhand Rural Development's Migration Commission Report (2019), more than 3.8 lakh people from 6,338 gram panchayats have migrated on a semi-permanent basis over the last decade, returning home occasionally but unable to sustain livelihoods in their villages. Census data further reveals that districts like Almora and Pauri Garhwal have recorded negative population growth rates, at 1.28% and 1.41%, respectively, underscoring how fragile soil health contributes to dwindling rural populations. The struggle of farmers in the state to maintain productive soils has led many to seek opportunities outside agriculture, exacerbating the rural-to-urban migration crisis.

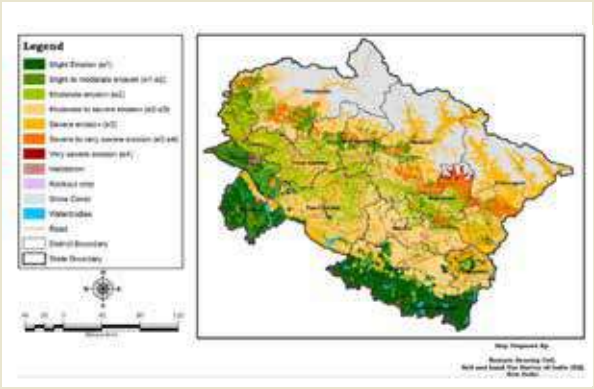


Figure 3 - Soil erosion map of Uttarakhand. (Source: Soil and Land Use Survey of India, Compendium of Soil Resources for Sustainable Land Management of Uttarakhand.)

Figure 4 - Weak geological formation leads to very severe soil erosion in Uttarakhand. (Photo by S.K. Mahapatra).

When soil begins to lose its vitality, it's not just the crops that suffer, the entire backbone of hill communities starts to give way. These regions, which have long depended on traditional farming systems, now face growing pressure from deforestation, overuse of the land, and stripping away the top layer - the once rich in life, nutrients, and everything that crops like finger millet, amaranth, and buckwheat need to grow. Out of the total geographical area, 12,489 ha (0.23%) and 2,23,065ha (4.17%) are under very severe and severe to very severe erosion respectively. Over time, when soil keeps getting drained and nothing's put back, yields fall in its fertility and productivity. Eventually, farming stops being worth the effort. The degradation of hill soils accelerates rural distress, increasing migration rates as younger generations seek alternative livelihoods outside their ancestral lands and occupation.

Figure 5 - Causes for soil degradation in the hill.

REVIVING SOIL HEALTH THROUGH SUSTAINABLE PRACTICES

Restoring soil health in Uttarakhand requires a multifaceted approach centered on conservation, regenerative agriculture, and climate-smart soil management. Organic amendments, including compost, vermiculture, and biofertilizers, replenish soil nutrients while reducing dependence on chemical inputs. Also, contour farming and terracing, traditional practices in hill regions like Barahnaja and Sari agriculture, prevent erosion and improve soil moisture or water retention. Agroforestry and cover cropping enhance soil structure and long-term productivity. Water management, including rainwater harvesting, micro-irrigation, and moisture conservation techniques such as green mulching, is crucial for mitigating monsoon uncertainty and supporting soil hydration.

Characteristic	Barahnaja	Sari System
Description	Diverse intercropping	Two-year rotational cropping
Location	Garhwal region	Terraced hill farms
Crops	Millets, pulses, oilseeds	Wheat, barley, rice
Season	Kharif (May–Oct)	Rabi, Kharif, Zaid
Benefits	Food security, soil enrichment	Soil fertility, crop resilience
Revival	Seed banks, organic certification	Seed banks, organic certification

Figure 6 - Traditional farming systems of Uttarakhand.

Reviving soil health also strengthens rural economies by fostering localized food systems and reducing reliance on migration. When soils are revitalized, they become more than just a medium for crops they transform into a source of security, dignity, and prosperity for farming communities. By integrating ecological restoration with sustainable soil practices, Uttarakhand can preserve its agricultural heritage while fostering resilience against climate change. Upholding the integrity of its

Figure 7 - Sustainable Agricultural Practices in Uttarakhand.

soils ensures that the promise of abundance, balance, and beauty endures for future generations, keeping Uttarakhand's agrarian legacy intact.

GOVERNMENT INITIATIVES

Recognizing the importance of soil health, both state and central governments launched initiatives to rehabilitate and sustain soils in Uttarakhand. The Soil Health Card Scheme, introduced in 2015, provides farmers with plot-based nutrient advisories, enabling them to track soil health over time and make informed decisions about fertilization and crop selection. The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is expanding micro-irrigation coverage in rainfed areas, improving water retention, and reducing vulnerability to erratic monsoon patterns. Additionally, the Integrated Model Agriculture Village (IMAV) program is fostering climate-resilient farming clusters that integrate soil, water, and biodiversity conservation.

Beyond soil health monitoring, Uttarakhand's agricultural policies are facilitating market access and economic sustainability for farmers. Initiatives such as One District One Product (ODOP), Madhugram Scheme, Ganga Gaay Mahila Dairy Yojana, and the awarding of GI tags to 14 farm products are helping farmers secure premium pricing for traditional and high-value crops. Collective farming arrangements, including the 'Madho Singh Bhandari Cooperative Scheme' and 'Hilans', are strengthening farmer networks and improving market linkages.

Women who undertake most of the farm work in hilly areas need to be identified and enabled as the key agents of soil guardianship. Soil pits, check dams, and bio-fencing through

Figure 8 - Terrace farming in rural landscapes of Uttarakhand.
(Photos by: Ankit Chamoli and Vivek Chauhan)

people involvement and collective action need to be scaled up and GIS-based tools utilised to map soils, prevent landslides, and achieve nutrient budgeting. Green manuring, composting, and vermicomposting from farm and forest biomass need to be universally promoted. Tradition should be merged with innovation in the direction forward.

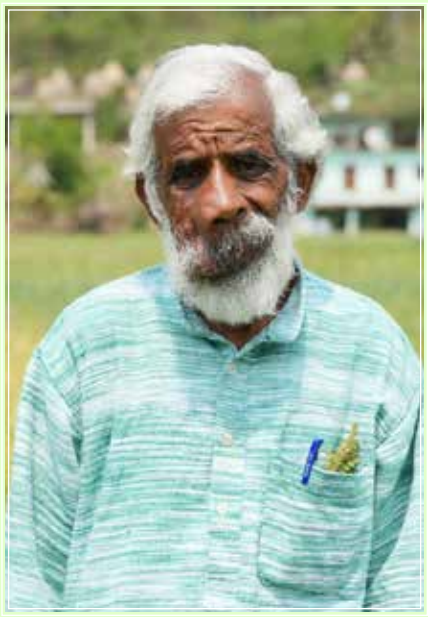
SOIL, IDENTITY, AND THE FUTURE OF UTTARAKHAND

Overall, soil is not only a natural resource that also a livelihood, a heritage, and a culture. In taking care of soils, we build healthy communities. Smart management of soils can close the hill-to-plain gap in income, deliver respectable livelihoods to hill youths, and end the reliance on emigration for survival. When we heal the soil, we not only restore food systems but also rebuild the lost dignity of the farmer, reduce distress migration, and stimulate a green rural economy rooted in place, culture, and ecology. And in doing so, we ensure that the promise of Uttarakhand of abundance, balance, and beauty is passed on intact to the next generation. As Girish Chandra Tiwari Girda beautifully envisioned:

''उत्तराखंड मेरी मातृभूमि
मातृभूमि, मेरी पितृभूमि,
ओ भूमि तेरी जै–जै कारा म्यार हिमाला।''

May these words echo in the valleys, urging us to cherish, protect, and rejuvenate the land that has nurtured generations.■

Courtesy: Alamy



THE GUARDIAN *of* INDIGENOUS GRAINS

Sri Vijay Jardhari Ji, founder of "Save Seed Movement" talks onTarditional Agriculture, Crop diversification, Environment and other vital issues with Arvind Bijalwan.

ARVIND BIJALWAN
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श्री विजय जड़धारी एक प्रसिद्ध पर्यावरणविद्, समाजसेवक और किसान हैं, जिन्होंने पारंपरिक खेती और जैव विविधता के संरक्षण हेतु अपना जीवन समर्पित किया है। वे 'बीज बचाओ आंदोलन' के संस्थापक हैं, जो स्थानीय बीजों को संरक्षित करने, खेती में बाहरी लागत की निर्भरता घटाने और सतत कृषि को बढ़ावा देने के उद्देश्य से शुरू हुआ। उन्होंने उत्तराखंड की परंपरागत 'बारहनाजा' पद्धति और मोटे अनाजों के महत्व को लोकप्रिय बनाया।

1953 में टिहरी गढ़वाल के जड़धार गांव में जन्मे श्री जड़धारी बचपन से ही पारंपरिक खेती से जुड़े रहे। 1980 के दशक में उन्होंने रासायनिक खेती और संकर बीजों के दुष्परिणामों पर चिंता व्यक्त की। उन्होंने देखा कि इससे मिट्टी की उर्वरता घट रही है, जल प्रदूषित हो रहा है और पारंपरिक फसलें व लाभकारी सूक्ष्म जीव नष्ट हो रहे हैं। इसी चेतना के तहत उन्होंने 'बीज बचाओ आंदोलन' की शुरुआत की, जो स्थानीय परिस्थितियों के अनुकूल बीजों को संरक्षित करने की पहल है। वे मानते हैं कि यदि किसान अपने बीज स्वयं तैयार करें तो खेती टिकाऊ और कम खर्चीली होगी।

उन्होंने 'पहाड़ी खेती', 'किसानों का परम्परागत विज्ञान', 'बारहनाजा', 'उत्तराखण्ड में खानपन की संस्कृति' जैसी अनेक पुस्तकें लिखी हैं। उनके उत्कृष्ट योगदान के लिए उन्हें कई सम्मान प्राप्त हुए हैं, जिनमें भारत सरकार द्वारा प्रदत्त 'इंदिरा गांधी पर्यावरण पुरस्कार' प्रमुख है। इस पृष्ठभूमि में प्रस्तुत है श्री जड़धारी जी से बातचीत।

श्री जड़धारी जी, आप उत्तराखंड में परम्परागत खेती एवं बीज बचाओ आंदोलन के प्रणेता के रूप में जाने जाते हैं। क्या आप हमें अपनी पृष्ठभूमि के बारे में बता सकते हैं और आपने इस आंदोलन की शुरुआत कैसे की?

मेरा सौभाग्य है कि मैं एक छोटा किसान होने के साथ–साथ चिपको आंदोलन का कार्यकर्ता भी रहा हूँ। जब अस्सी के दशक की शुरुआत में चिपको आंदोलन सफल हुआ और पर्यावरण संबंधी नीतियाँ बनने लगीं, तब हमें कुछ समय मिला और मैं अपने पिताजी के साथ खेती करने लगा। उस समय मैंने देखा कि हरित क्रांति के तहत जो नए बीज आ रहे थे, उनके साथ रासायनिक खाद भी आ रही थी। प्रारंभ में उत्पादन अधिक हुआ। जहाँ एक बोरा अनाज होता था, वहाँ दो बोरे होने लगे। लेकिन मुझे पहले से ही यह समझ थी कि जंगल, मिट्टी, पानी और हवा हमारे जीवन के आधार हैं। जब यह देखा कि ये बीज बिना रासायनिक खाद के नहीं हो सकते, तब मुझे मिट्टी की चिंता होने लगी। महसूस हुआ कि ये प्रक्रिया तो मिट्टी को 'नशे की लत' जैसी बना रही है। कुछ वर्षों बाद देखा कि जिन खेतों में उत्पादन बढ़ा था, वहीं उपज घटने लगी। साथ ही यह भी देखने में आया कि परम्परागत बीज लुप्त हो रहे थे, कुछ तो पूरी तरह खत्म भी हो चुके थे। तब हमने तय किया कि इन बीजों को ढूँढना और संरक्षित करना जरूरी

है। हमने उन इलाकों की यात्रा की जहाँ आधुनिक खेती नहीं पहुँची थी और वहाँ से बीजों को एकत्र किया। बाद में उन्हें बोकर फिर से तैयार किया और स्थानीय लोगों को बाँटना शुरू किया। यही 'बीज बचाओ आंदोलन' की शुरुआत थी।

आपको बीज बचाओ आंदोलन शुरू करने की प्रेरणा कहाँ से मिली और आपके शुरुआती लक्ष्य क्या थे?

शुरुआत में कोई स्पष्ट लक्ष्य या रूपरेखा नहीं थी। केवल एक ही बात मन में थी–कि रासायनिक खाद और संकर (हाइब्रिड) बीज हमारे खेतों, बीजों और मिट्टी के लिए खतरा हैं। यह अनुभव हुआ कि इन बीजों से उपजा अनाज स्वादहीन है, गुणवत्ता कमजोर है और सेहत के लिए भी हानिकारक है। उसी समय कुछ लोग कहने लगे कि मंडुआ, झंगोरा, कौणी, चीणा जैसे मोटे अनाज उगाना बंद कर दो और उसकी जगह सोयाबीन जैसी फसलें उगाओ, जिनका बाजार अच्छा है। किसानों ने जब सोयाबीन लगाना शुरू किया, तो शुरू में उपज अच्छी रही, लेकिन धीरे उत्पादन घटने लगा और मिट्टी में रासायनिक खाद की मांग बढ़ने लगी। साथ ही यह भी अनुभव हुआ कि सोयाबीन से पशुओं को चारा नहीं मिलता, जबकि हमारी पारंपरिक मिश्रित खेती से अनाज के साथ–साथ चारा भी मिलता है। पहाड़ी खेती में पशुपालन बहुत जरूरी है, क्योंकि उनका गोबर ही जैविक खाद का आधार होता है। इन्हीं अनुभवों से प्रेरित होकर मैंने तय किया कि हमें अपनी परम्परागत खेती, बीज और मिट्टी को बचाना होगा, और लोगों को इसके लिए जागरूक करना होगा। यही बीज बचाओ आंदोलन की प्रेरणा बनी।

क्या आप खेती के प्रति बचपन से ही प्रभावित थे?

हमारा परिवार पूरी तरह खेती–किसानी से जुड़ा था, इसलिए खेती बचपन से ही जीवन का हिस्सा थी। लेकिन जागरूकता धीरे–धीरे आई। एक बार मेरी माताजी मायके से कुछ रासायनिक खाद लेकर आईं और उसे टमाटर के पौधों में डाल दिया। शायद मात्रा ज्यादा हो गई या खाद का असर था कि पौधे सूख गए। तब महसूस हुआ कि गोबर की खाद भले ज्यादा भी डालो, पौधों पर असर नहीं पड़ता, लेकिन रासायनिक खाद नुकसान पहुँचा सकती है।बाद में समझ में आया कि यह खाद मिट्टी को खराब कर रही है और उसमें मौजूद जीवांश (सूक्ष्म जीव) खत्म हो रहे हैं। यह मिट्टी धीरे–धीरे निर्जीव होती जा रही है–जैसे रेत। बड़ी कंपनियाँ पहले बीज देती हैं, फिर खाद, फिर दवाई और धीरे–धीरे हमारी खेती को अपने ऊपर निर्भर बना देती हैं। ऐसा लगता है जैसे पहले खेतों को बीमार करो, फिर इलाज बेचो और किसान उनकी दुकानों के ग्राहक बन जाएँ। यही सोच आगे चलकर आंदोलन की बुनियाद बनी।

बीज बचाओ आंदोलन किसानों एवं जन–जन तक पहुँचे इस हेतु अपने कौन–कौन सी विधाएं अपनाईं तथा किन–किन समस्याओं का सामना करना पड़ा?

शुरुआत में, मैं अकेले ही गाँव–गाँव जाकर पारंपरिक बीज इकट्ठा करता था। बाद में श्री कुंवर प्रसून जी, श्री धूम सिंह जी जैसे साथियों से चर्चा हुई और सभी ने मिलकर संकर बीजों के खतरे को समझते हुए पारंपरिक बीजों के संरक्षण व संवर्धन की दिशा में कार्य शुरू किया। तभी से 'बीज बचाओ आंदोलन' ने गति पकड़ी और लोगों में यह विचार फैलने लगा कि हमें अपना बीज स्वयं बचाना है इस उद्देश्य से हम किसानों, महिलाओं और जनसमुदाय के साथ मिलकर विभिन्न गाँवों में कार्यक्रम, गोष्ठियाँ और जागरूकता यात्राएँ करने लगे। इनमें सबसे प्रमुख 'आराकोट से अस्कोट' जैसी लंबी पदयात्राएँ भी शामिल रहीं, जो 500 किलोमीटर से अधिक की थीं। इन यात्राओं का मुख्य उद्देश्य था–बीज बचाना, मिट्टी बचाना और रासायनिक खेती के खतरों के प्रति लोगों को जागरूक करना। हम बताते थे कि मंडुवा, झंगोरा, कौणी, चीणा जैसी पारंपरिक फसलें न केवल स्वास्थ्यवर्धक हैं, बल्कि पहाड़ की जलवायु और मिट्टी के लिए भी अनुकूल हैं। हमारी पदयात्राओं में हम यह संदेश देते थे कि पारंपरिक कृषि ज्ञान ही सबसे बड़ा धन है और सतत खेती की रीढ़ भी। हमारी कोशिश थी कि किसान आत्मनिर्भर बनें। बीज, खाद और खेती की दिशा में किसी बाहरी कंपनी या व्यवस्था पर निर्भर न रहें। कुल मिलाकर कृषि के बारे में जागरूकता प्रदान करना ही हमारी यात्राओं का मुख्य उद्देश्य था। हां, जहाँ तक कठिनाइयों की बात है, तो

शुरुआती दौर में लोगों को यह बात पूर्णतः समझाना कठिन था। गाँव के किसान तो धीरे–धीरे समझने लगे, लेकिन वैज्ञानिकों और शिक्षित वर्ग ने हमें 'विकासविरोधी' कहा और आरोप लगाया कि हम देश को पीछे ले जाना चाहते हैं। जब हम मंडुवा, झंगोरा, कौणी जैसी फसलों की बात करते थे, तो उन्हें 'गौण' और कमजोर समझा जाता था। हालाँकि, ग्रामीण महिलाओं ने जल्दी समझ लिया कि रासायनिक खेती में एक बार खाद डालने की आदत पड़ जाए तो उसकी मात्रा बढ़ती जाती है, लागत भी बढ़ती है, और मिट्टी की सेहत बिगड़ती है। उन्होंने बड़ी सहजता से यह बात कही–''अपना आलू बाजार बेचा, विराण आलून थोबड़ा थेचा।'' अर्थात अपने अच्छे आलू बेचकर बाजार से खराब आलू बीज के लिए खरीदना, यह हास्यास्पद है। इससे यह समझ आने लगा कि पहले हम अपना बीज रखते थे, और अब हम दूसरों पर निर्भर हो गए हैं। बाद में, जब उत्तराखंड राज्य बना और देश में किसानों के लिए हरित क्रांति के जनक डॉ. एम.एस. स्वामिनाथन की अध्यक्षता में राष्ट्रीय किसान आयोग बना, तब हमने वहाँ भी अपनी बात रखी। हमने माँग की कि कृषि नीति ऐसी हो जहाँ बीज, खेती और निर्णय का अधिकार किसानों के हाथ में हो। ऐसा नहीं हो सकता कि बीज, खाद, दवाइयाँ सब कंपनियों के पास हों, मेहनत किसान की हो और मुनाफा किसी और का। सौभाग्य से उत्तराखंड सरकार ने वर्ष 2003 में 'उत्तराखंड जैविक उत्पाद बोर्ड' की स्थापना की, जो जैविक खेती की दिशा में एक महत्वपूर्ण पहल थी।

जड़धारी जी, कृपया बारहनाजा पद्धति के बारे में जानकारी दें तथा वर्तमान परिदृश्य में इसकी सार्थकता बताएं।

देखिए, बारहनाजा का अर्थ है–मिश्रित खेती की एक पारंपरिक पद्धति, जिसमें एक ही खेत में एक साथ कई प्रकार की फसलें उगाई जाती हैं। इसकी मूल अवधारणा जंगल से ली गई है। जैसे जंगलों में अनेक प्रकार के पेड़, झाड़ियाँ, बेलें और जड़ी–बूटियाँ एक साथ रहते हुए एक–दूसरे को सहारा देते हैं और पारिस्थिति की तंत्र को संतुलित रखते हैं, वैसे ही बारहनाजा पद्धति में अनेक फसलें एक साथ उगाई जाती हैं, जो एक–दूसरे की पूरक होती हैं, न कि प्रतिद्वंद्वी। उत्तराखंड के गढ़वाल क्षेत्र में यह परंपरा रही है कि किसान एक ही खेत में मंडुआ (कोदा), मक्का, झंगोरा, रामदाना (चौलाई), कुट्टू, राजमा, गहत, तिल और कई तरह की बेलदार दालें जैसे बीन आदि एक साथ बोते हैं। इसमें बेलें अन्य पौधों का सहारा लेकर चढ़ती हैं, जिससे खेत में जगह का समुचित उपयोग होता है और प्रतिस्पर्धा कम होती है। मिट्टी की उर्वरता बनी रहती है और एक ही खेत से अन्न, दालें, तिलहन आदि अनेक प्रकार की उपज प्राप्त होती है।इस पद्धति का एक और बड़ा लाभ यह है कि यदि किसी एक फसल पर रोग या आपदा का असर होता है, तब भी बाकी फसलें सुरक्षित रहती हैं और किसान को पूर्ण नुकसान नहीं उठाना पड़ता। साथ ही, इन फसलों का पोषण मूल्य भी अत्यधिक होता है। पहले के पहाड़ी लोग – जिन्हें 'भड़' कहा जाता था, वे यही अन्न खाते थे और हृष्ट–पुष्ट रहते थे। श्री घनश्याम रतूड़ी 'शैलानी' की कविता में भी गढ़वाल की पारंपरिक खेती और भोजन की महिमा का वर्णन है।

> 'हरचि कख गढ़वाल कू, वो कोदो–कंडाली।
> गोल गफ्फा बण्यां रंदा था जैन गढ़वाली।।
> मोल था भमोर पंक्यां, डाला झकझोर झुक्यां।
> कन दिन था तबारी, कुछ नि थै दुख बिमारी।।
> काफल किनगोड़ खाई, लोण रालि–रालि।
> हरचि कख गढ़वाल कू, वो कोदो–कंडाली।।

इसका भाव यही है कि गढ़वाल के लोगों की ताकत और सेहत का राज उनकी पारंपरिक खेती और भोजन में छिपा था, जो पूरी तरह से पोषक और पर्यावरण के अनुकूल था। आज के परिप्रेक्ष्य में, जब रासायनिक खेती ने मिट्टी को बंजर, बीजों को निर्भर और किसान को कर्जदार बना दिया है, ऐसे समय में बारहनाजा जैसी जैविक और आत्मनिर्भर कृषि पद्धति अत्यंत प्रासंगिक और आवश्यक हो गई है। यह न केवल स्वास्थ्य के लिए लाभदायक है, बल्कि जलवायु परिवर्तन और खाद्य संकट से निपटने का भी एक प्रभावी समाधान है।

'मिलेट्स' (जैसे मंडुआ, झंगोरा, चीणा, कौणी आदि), जिन्हें मोटा अनाज भी कहा जाता है–इनकी क्या महत्ता है और वर्तमान में ये कितने प्रासंगिक हैं?

देखिए, 'मिलेट्स' जिन्हें 'मोटा अनाज' भी कहते थे, आज

करते हैं, बल्कि खेत की मिट्टी में जीवांश बनाए रखते हैं, नमी को सुरक्षित रखते हैं और फसल को तेज धूप, पाले व हवाओं से संरक्षण भी देते हैं। इनसे तापमान संतुलित रहता है, परागण में सहायक कीटों को आवास मिलता है और मिट्टी का क्षरण भी रुकता है। आज जब कार्बन क्रेडिट की बात हो रही है, तो पेड़ कार्बन अवशोषण के माध्यम से जलवायु को संतुलित करते हैं और किसानों को आर्थिक लाभ का एक नया मार्ग भी देते हैं। साथ ही पेड़ों की उपस्थिति जलस्रोतों को पुनर्जीवित रखती है। इसलिए खेतों में पेड़ केवल लकड़ी या फल देने वाले स्रोत नहीं हैं, बल्कि पारिस्थितिकीय संतुलन, आर्थिकी, पोषण और जल–संरक्षण का आधार हैं। आवश्यकता इस बात की है कि इनके संरक्षण, संवर्धन और विपणन की उचित व्यवस्था की जाए, ताकि पहाड़ का किसान और अधिक सशक्त हो सके।

जलवायु परिवर्तन के दौर में परंपरागत खेती कितनी प्रासंगिक और सशक्त है?

जलवायु परिवर्तन अब एक सच्चाई बन चुका है। पहले हमारे गाँवों में तीन फुट तक बर्फ पड़ती थी जिसे 'गोरसिंग्या बर्फ' कहते थे, लेकिन अब वर्षों से बर्फबारी लगभग समाप्त हो चुकी है। अगर बर्फ गिरती भी है तो वह टिकती नहीं, जिससे शीतोष्ण फलों जैसे सेब की उपज प्रभावित हो रही है क्योंकि उन्हें चिलिंग आवर्स की आवश्यकता होती है। साथ ही, बुरांश और फ्योंली जैसे मौसमीचिह्न फूल भी अब समय से पहले खिलने लगे हैं, जो जलवायु असंतुलन का संकेत है।

इस परिपेक्ष्य में परंपरागत खेती की प्रासंगिकता और बढ़ जाती है। खासकर मंडुआ, झंगोरा, कौणी जैसे मिलेट्स जलवायु परिवर्तन के प्रति अधिक सहनशील हैं। ये फसलें कम पानी, अधिक तापमान या प्रतिकूल परिस्थितियों में भी टिकाऊ उत्पादन देती हैं। पारंपरिक खेती प्रकृति के साथ तालमेल में होती है, जिसमें न तो रासायनिक खादों का अत्यधिक प्रयोग होता है और न ही जल की बर्बादी।

इसके विपरीत आधुनिक जीवनशैली, वाहनों की बढ़ती संख्या, संसाधनों का अत्यधिक दोहन, जलवायु संकट को और गंभीर बना रही है। इस संकट से उबरने के लिए अब यह आवश्यक है कि हम अपने पूर्वजों के ज्ञान और पारंपरिक कृषि पद्धतियों को आधुनिक संदर्भों में पुनः अपनाएँ। पारंपरिक खेती टिकाऊ, पोषणयुक्त और पर्यावरण–संरक्षक मार्ग प्रदान करती है, जो आज की सबसे बड़ी आवश्यकता है।

वर्तमान समय में 'मानव–वन्यजीव संघर्ष' एक गंभीर समस्या है। इस विषय में आपका अनुभव क्या है?

पहले जंगली जानवर जंगलों में ही रहते थे क्योंकि वहां उन्हें भरपूर भोजन मिलता था। पर अब हालात बदल गए हैं, विशेषकर बंदरों के व्यवहार में बदलाव आया है। वे अब इंसानी भोजन के आदी हो गए हैं और मेलों, बाजारों, शादियों में पहुंचने लगे हैं। खेतों और फल–सब्जियों को नुकसान पहुँचा रहे हैं। जंगली सूअर भी खेत उजाड़ रहे हैं। यह संघर्ष खेती–किसानी के लिए गंभीर चुनौती बन चुका है।

समाधान के लिए पारंपरिक रखवाले ('जगवाले') और बंदर भगाने वाले ('बंदरवाल') की व्यवस्था को फिर से शुरू करना चाहिए। ऐसी फसलों का चुनाव करना चाहिए जिनसे बंदरों को नुकसान न हो। बंदरों की बढ़ती संख्या को नियंत्रित करने के लिए नसबंदी जैसे उपाय कारगर हो सकते हैं। साथ ही कचरे का प्रबंधन ऐसा होना चाहिए कि वह जानवरों की पहुंच में न आए। पारंपरिक उपायों और आधुनिक तकनीकों का समन्वय ही इस समस्या से निपटने का टिकाऊ समाधान है।

वनाग्नि हिमालयी क्षेत्रों की एक बड़ी समस्या है। आपके विचार?

वनाग्नि आज एक गंभीर समस्या है। इसका मुख्य कारण मानवीय लापरवाही है–जैसे झाड़ियों में लगाई गई आग, बीड़ी–सिगरेट फेंकना या जानबूझकर लगाई गई नियंत्रित आग का फैल जाना। पहले ग्रामीण आग जलाने के समय

सावधानी बरतते थे–सुबह या शाम जब हवा न हो, और वे तब तक लौटते नहीं थे, जब तक आग पूरी तरह बुझ न जाए। आज पेड़ तो लगाए जा रहे हैं, लेकिन उनकी देखभाल नहीं हो रही। कहावत है–'डालू अर बालू', यानी जैसे नवजात शिशु की देखभाल करनी पड़ती है, वैसे ही पौधों की भी। उत्तराखंड में चीड़ के जंगलों से गिरने वाली पत्तियाँ (पिरूल) आग को फैलाने में मदद करती हैं। यदि चीड़ के जंगलों को मिश्रित वन में बदला जाए और पौधों की देखभाल की जाए तो स्थिति सुधर सकती है। केवल सरकारी प्रयास काफी नहीं हैं। वन संरक्षण में जनभागीदारी जरूरी है। जड़धार गांव में ग्रामीणों की मेहनत से मिश्रित वन विकसित हुआ है, जहाँ अब आग नहीं लगती। यह मॉडल दूसरों के लिए उदाहरण बन गया है। वन संरक्षण के लिए सामूहिक उत्तरदायित्व, पारंपरिक समझ और जनसहभागिता आवश्यक है।

पलायन पर्वतीय क्षेत्रों की एक विकट समस्या है। आप इसे कैसे देखते हैं?

पलायन की जड़ हमारी शिक्षा और व्यवस्था में छिपी है। लोग अपने स्थानीय संसाधनों की सही पहचान नहीं कर पा रहे हैं। शिक्षा केवल नौकरी तक सीमित रह गई है। जरूरत है कि पढ़ाई को स्थानीय रोजगार से जोड़ा जाए–जैसे कृषि, बागवानी, वानिकी आदि। इससे बच्चों को शुरू से ही इन क्षेत्रों में रुचि होगी। यदि जंगली जानवर फसलें नष्ट कर रहे हैं, तो वही घास मवेशियों के लिए उपयोगी हो सकती है। डेयरी, दूध, घी, पनीर जैसे उत्पाद बनाकर भी आमदनी हो सकती है। पहाड़ों में आज भी मैदानों से दूध मंगाया जाता है, जबकि स्थानीय उत्पादन संभव है। इसके अलावा पर्यटन, वानिकी और उद्यानिकी जैसे क्षेत्रों में भी रोजगार की संभावनाएं हैं।

जब तक शिक्षा, नीति और सोच को स्थानीय जरूरतों से नहीं जोड़ा जाएगा, पलायन नहीं रुकेगा। लेकिन यदि यह काम ईमानदारी से किया जाए, तो पलायन को कम किया जा सकता है।

बीज बचाओ आंदोलन और पारंपरिक खेती की क्या उपलब्धियाँ रही हैं?

उत्तराखंड जैव विविधता की दृष्टि से बेहद समृद्ध है। परंपरागत कृषि ज्ञान गहरा और वैज्ञानिक है, जिसे पुनर्जीवित करने की आवश्यकता है। बीज बचाओ आंदोलन इसी सोच से शुरू हुआ कि पारंपरिक बीजों को संरक्षित किया जाए क्योंकि यही हमारी विरासत हैं। आज तक धान की लगभग 340–350, गेहूं की 30–32, राजमा की 220 और नौरंगी (एक दाल) की 25–30 किस्में संरक्षित की गई हैं। इसके अलावा भट्ट (एक प्रकार की सोयाबीन), सुन्टा (लोबिया), और पारंपरिक साग–सब्जियों की भी अनेक किस्में सुरक्षित रखी गई हैं। यह काम अकेले का नहीं था। लोगों ने इसे अपनाया और इसका लाभ देखा। बीज बचाओ आंदोलन ने पारंपरिक ज्ञान को फिर से लोगों तक पहुँचाया। इस कार्य को राष्ट्रीय और अंतरराष्ट्रीय स्तर पर सराहा गया, जैसे दक्षिण अफ्रीका, बेल्जियम, जर्मनी और मलेशिया में हुए कार्यक्रमों में इस कार्य की प्रशंसा हुई। भारत में भी लोग समझने लगे हैं कि अपनी मिट्टी, बीज और परंपराएं ही असली ताकत हैं। इस योगदान के लिए कई पुरस्कार मिले, जिनमें 'इंदिरा गांधी पर्यावरण पुरस्कार' भी शामिल है। कुल मिलाकर बीज बचाओ आंदोलन ने यह सिद्ध किया है कि पारंपरिक ज्ञान पर भरोसा करके हम न केवल खेती को बल्कि संस्कृति और आत्मनिर्भरता को भी सहेज सकते हैं।

जड़धारी जी भविष्य की क्या कार्ययोजना है तथा आप क्या संदेश देना चाहते हैं?

देखिए, मैं बहुत आशावादी व्यक्ति हूं और मुझे संतोष है कि आज पूरी दुनिया उन्हीं बातों की ओर लौट रही है जिन्हें हम वर्षों से कहते आ रहे हैं 'स्वदेशी बीज, परंपरागत खेती और शुद्ध खान–पान'। मेरी कार्ययोजना का केंद्र है– परंपरागत ज्ञान को जन–जन तक पहुंचाना, स्थानीय बीजों की अधिक से अधिक प्रजातियों का संरक्षण, और ऐसी खेती को बढ़ावा देना जो मनुष्य को रोगमुक्त रखे। मेरा संदेश यही है कि हमारी खेती और भोजन हमें स्वस्थ रखें, न कि बीमार करें। यह तभी संभव है जब हम शुद्ध, जैविक और अपनी जमीन से जुड़ी खेती करें। यही बीज बचाओ आंदोलन की सच्ची सफलता होगी। ■

WILD EDIBLES *of* UTTARAKHAND

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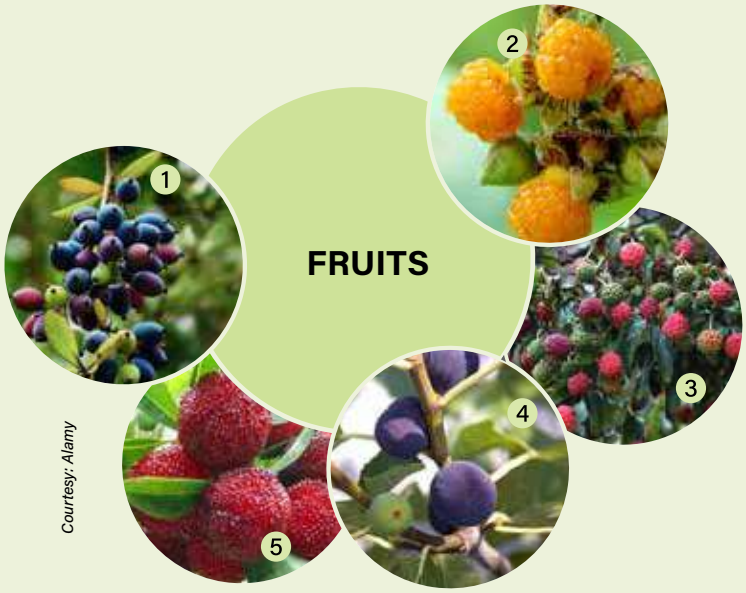
The International Day of Forests 2025 embraces the theme 'Forests and Food,' emphasizing the crucial role of forests in sustaining food security, nutrition, and livelihoods. Forests not only provide essential resources for people but also support wildlife by offering food and habitat.
Uttarakhand is home to a plethora of wild edible plants including fruits, flower, leaves, delicate stems, roots/tubers, ferns and mushrooms that holds significant socio-cultural, spiritual, and traditional value, making these resources integral to the region's heritage and sustainability. Wild edibles serve as vital sources of nutrition, medicine, and income for indigenous tribes and ethnic communities. These naturally occurring plant-based foods thrive in natural ecosystems, contributing to biodiversity and ecological balance. The traditional consumption of these wild edibles is deeply embedded in the daily lives of communities living in the remote and hilly regions of Uttarakhand. Common wild fruits include kafal, hinsar, bedu, kingora, awnla, bel, bhamora, while notable wildflowers such as buransh, semul, and guriyal also contribute to local diets. Some wild edibles are consumed as tubers, and various mushrooms play a significant role in the region's food culture. Recently, the research wing of the Uttarakhand Forest Department documented 14 edible mushroom species in the Sal forests of the Kumaon region. However the correct identification of edible and poisonous mushroom is not an easy task. The fern known as Lingura is a rich source of iron and is commonly used as a nutritious vegetable in local kitchens. Additionally, a wide variety of wild spices enhance the flavors of local cuisines. The extensive use of wild species by tribal communities reflects the rich diversity of vegetation of the region, which fulfills their diverse dietary and cultural needs.

Courtesy: Alamy

Fig 1-Coprinellus disseminatus (fairy inkcap),
Fig 2-Coprinus comatus (Shaggy Mane),
Fig 3-Lactarius deliciosus (Saffron Milk Cap),
Fig 4-Oyster Mushroom (Pleurotus ostreatus),
Fig 5-Porcini mushrooms, scientifically known as Boletus edulis.

Table 1 provides an overview of the wild edibles found in Uttarakhand, highlighting their diverse contributions to local diets from fruits to tubers, where nearly every part of the plant is utilized in some form. However, the identification, harvesting and consumption pattern of wild edibles need to be passed down to next generations.

Wild edibles serve as vital sources of nutrition, medicine, and income for indigenous tribes and ethnic communities. These naturally occurring plant-based foods thrive in natural ecosystems, contributing to biodiversity and ecological balance.



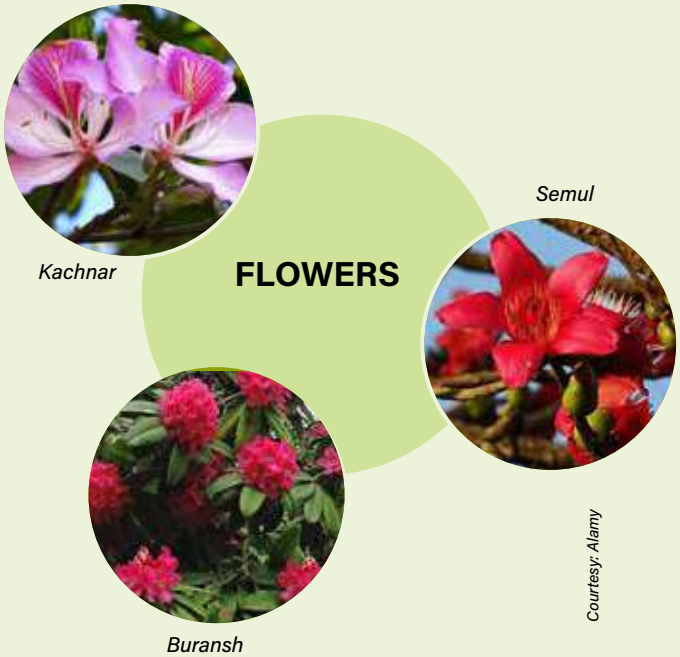
Courtesy: Alamy

Fig 1-Berberis asiatica D.C. (Kilmora)
Fig 2-Robus elliptica (Hinsar)
Fig 3-Cornus capitata (Himalayan strawberry)
Fig 4-Ficus auriculata Lour (Timla)
Fig 5-Myrica ensculata sny. (Kaifal)

SOCIO-CULTURAL SIGNIFICANCE

The conventional use of wild edible plants is habitual in the remote and hill regions of Uttarakhand, underscoring their cultural importance and their seasonal availability throughout the year confirm a constant source of nourishment and sustenance for local communities. These edibles are deeply embedded in the cultural fabric of Uttarakhand. Dishes like *Bichu Ghas* (nettle curry) and *Kandali ki Sabzi* (prepared from *Urtica dioica*) are traditional delicacies. Certain plants are not only consumed regularly but also play a significant role in festivals and celebrations, such as the use of 'Tarad' and 'Ber' during the festival of Shivratri. The importance of wild fruits in the lives of hill communities is also reflected in folk music, as seen in the famous folk song *Bedu Pako Bara Masa,* which celebrates the availability of *Bedu* (wild fig) throughout the year, and Kafal for month of April, highlighting its deep connection to the local culture.

Wild edibles serve as vital sources of nutrition, medicine, and income for indigenous tribes and ethnic communities. These naturally occurring plant-based foods thrive in natural ecosystems, contributing to biodiversity and ecological balance.



Courtesy: Alamy

NUTRITIONAL AND MEDICINAL VALUE

Wild edibles are nutritional powerhouses. They provide essential proteins, carbohydrates, fats, vitamins and minerals, enhancing dietary diversity of poor rural people in hilly areas of Uttarakhand. Ficus fruits are recognized as a nutritious food source, rich in crude fiber, ash, protein, carbohydrates and essential elements such as potassium (K), magnesium (Mg), calcium (Ca), iron (Fe), and sodium (Na). For example, Bedu is a valuable source of minerals, phosphorus, and a small amount of vitamin C. Ber is a good source of calcium. Timru has been traditionally used as spices and medicine since ancient times to treat toothache, cough, fever, itching, piles, and leucoderma.

Bauhinia variegata, known as *Kachnar* is used for traditional medicinal applications in Ayurveda, Unani, and Homoeopathy for conditions like diabetes, skin diseases, ulcers. Some possess therapeutic benefits, like *Myrica esculenta* is known for its anti- inflammatory properties. Similarly Kilmora acts as a natural laxative and is traditionally given to children for digestive relief.

ECONOMIC VALUE

Beyond their cultural significance, wild edibles play a crucial role in the local economy. Many rural communities gather and sell these seasonal delicacies in local markets, offering a vital source of supplementary income. For instance, Lingura (wild fern) is commonly available in vegetable markets during the rainy season, Tarad appears in February, and Kafal is a popular roadside offering in the summer months. The commercialization of these plants offers employment opportunities, especially for women and marginalized groups.

CONCLUSION

Wild edible plants in Uttarakhand are more than just food sources; they are integral to the region and cultural heritage, economic stability, and nutritional health. Despite their significance, these wild edibles are facing threats from habitat loss and overharvesting. Conservation efforts are crucial to ensure their availability for future generations. Promoting sustainable harvesting practices and integrating these plants into agroforestry systems can aid in their preservation. Additionally, raising awareness about their value can foster community-led conservation initiatives.

FRUITS

SL.NO.	SPECIES NAME	LOCAL NAME	EDIBLE FORM
1.	*Aegle marmelos*	Bel	Ripe fruits and juice
2.	*Berberis aristata*	Kingor	Ripe fruits
3.	*Berberis lycium*	Kingor/ Daiya	Ripe fruits
4.	*Callicarpa macrophylla*	Dhaiya	Ripe fruits
5.	*Carissa opaca*	Karaunda	Ripe fruits as pickle
6.	*Coccinia grandis*	Kundru	Green fruits as vegetable & Ripe fruits
7.	*Cornus capitata*	Bhamora	Ripe fruits
8.	*Cucumis melo*	Ban kakdi	Unripe fruits
9.	*Diospyros exsculpta*	Tendu	Ripe fruits
10.	*Embilica officinalis*	Awnla	Pickle, Candy and Fruits
11.	*Ficus auriculata*	Timla	Ripe fruits
12.	*Ficus palmata*	Bedu	Ripe fruits
13.	*Ficus racemosa*	Gular	Ripe fruits
14.	*Ficus semicordata*	Khaina	Ripe fruits
15.	*Hibiscus cannabinus*	L. Ban bhindi	Fruits as vegetable
16.	*Hippophae rhamnoides*	Sea buckthorn	Fruits
17.	*Mallotus philippensis*	Ruina	Fruits powder mixed in curry
18.	*Morus serrata*	Sahtoot	Ripe fruits
19.	*Madhuca longifolia*	Mahua	Ripe fruits &bark
20.	*Myrica esculenta*	Kaphal	Ripe fruits
21.	*Opuntia cochenillifera*	Nagfani	Fruits
22.	*Phoenix humilis*	Khajoor	Ripe fruits
23.	*Prunus armeniaca*	L. Chulu/Khumani	Ripe fruits
24.	*Punica granatum*	L. Dalimu/ Darim	Ripe fruits
25.	*Pyrus pashia*	Mole	Ripe fruits
26.	*Pyracantha crenulata*	Ghigharu	Ripe fruits
27.	*Rhus parviflora*	Tungla	Ripe fruits
28.	*Rubus ellipticus*	Hinsar/Hinsalu	Ripe fruits
29.	*Rubus paniculatus*	Kali Hinsar	Ripe fruits
30.	*Syzygium cumini*	Phalendu	Ripe fruits
31.	*Tamarindus indica*	Imli	Fruit pulp
32.	*Terminalia chibula*	Harad	Fruits, Seed pulp edible
33.	*Terminalia bellirica*	Baheda	Fruits & Seeds
34.	*Ziziphus glaberrima*	Ber	Ripe fruits

FLOWER

SL.NO.	SPECIES NAME	LOCAL NAME	EDIBLE FORM
1.	*Bombax ceiba*	Semul	Flower buds/green fruits as a vegetable
2.	*Bauhinia variegata*	Kachnar	Flower bud as vegetable, pickle and rayta
3.	*Cassia fistula*	Kirala	Flower bud as vegetable
4.	*Cordia dichotoma*	Lasoda	Green fruits as vegetable
5.	*Rhododendron arboreum*	Burans	Flowers as juice, sauce, jam, jellies refreshing drinks
6.	*Woodfordia fruticosa*	Dhaula	Flowers as a refreshing drink

LEAVES

7.	*Amaranthus spinosus*	Chualai	Young leafy stems as vegetable
8.	*Amaranthus tricolor*	Chualai	Young leafy stems as vegetable
9.	*Arenaria serpyllifolia*	-	Herb Leaves & Leafy twigs as vegetables
10.	*Bergera koenigii*	Gandela	Leaves for flavoring curries
11.	*Chenopodium album*	Baithu	Herb Leaves & Leafy twigs as vegetables
12.	*Commelina benghalensis*	Kanyaghas	Leaves as vegetable
13.	*Dysphania ambrosioides*	Jangli bathua	Leaves as vegetable
14.	*Euphorbia hirta*	Dudhi	Leaves as vegetable
15.	*Fagopyrum cymosum*	Kandya	Herb Leaves & Leafy twigs as vegetables
16.	*Fumaria indica*	Pit-Papra	Leaves as vegetable
17.	*Indigofera tinctoria*	Neel	Leaves & pods as Vegetables
18.	*Medicago polymorpha*	Sunara	Leaves as vegetable
19.	*Murraya koenigii*	Kadi Patta	Leaves used in curry
20.	*Moringa oleifera*	Sajana	Leaves as vegetable
21.	*Oxalis corniculata*	Chalmori	Fresh leaves orally and also as vegetable
22.	*Rubia manjith*	Manjith	Leaves as vegetable
23.	*Rumex nepalensis Jangli*	Palak	Leaves as vegetable
24.	*Solanum americanum*	Makoi	Ripe fruits edible & Fresh leaves as vegetable
25.	*Tribulus terrestris*	Gokhru	Leaves as vegetable
26.	*Trifolium repens*	Tipatiya	Leaves as vegetable
27.	*Trigonella emodi*	Ban-Methi	Leaves as vegetable
28.	*Urtica ardens*	Bichhughas	Leaves as vegetable
29.	*Urtica dioica*	Kandali	Young twigs & leaves as vegetable
30.	*Vicia sativa*	Kurphal	Leaves as vegetable

SEEDS			
SL.NO.	**SPECIES NAME**	**LOCAL NAME**	**EDIBLE FORM**
1.	*Cannabis sativa*	Bhang	Roasted seeds as condiments
2.	*Bauhinia vahlii*	Malu	Roasted seeds
3.	*Elsholtzia flava*	-	Mature seeds as raw & spice
4.	*Juglans regia*	Akhor	Seed inside shell
5.	*Pinus roxburghii*	Chir	Mature seeds
6.	*Senna tora*	Banad	Roasted seed powder as coffee
7.	*Zanthoxylum armatum*	Timru	Seed as spices
FERN			
1.	*Diplazium esculentum*	Lingra	Tender leaves with twigs as vegetable
ROOT/TUBER			
1.	*Amorphophallus campanulatus*	Jimikand	Vegetable & Pickle fromtuber
2.	*Asparagus racemosus*	Sataver	Fresh bud as vegetable.
			Root powder with milk.
3.	*Bambusa vulgaris*	Bans	Shoot bud as vegetable
4.	*Cheilocostus speciosus*	Kev Kand	Rhizome as vegetable & Soup
5.	*Dioscorea melanophyma*	Geith	Tuber as vegetable
6.	*Pueraria tuberosa (Willd.)*	Vidari Kand	Unripe tuber
7.	*Vigna vexillata*	Machali	Tuber as a vegetable
MUSHROOM			
1.	*Amanita hemibapha*	-	Mushroom
2.	*Cantharellus cibarius*	Peela Phool	Mushroom
3.	*Cantharellus minor*	-	Mushroom
4.	*Cordyceps*	Keeda Jari	Mushroom
5.	*Craterellus cornucopioides*	-	Mushroom
6.	*Grifola frondosa*	-	Mushroom
7.	*Ganoderma lucidum*	Lingzhi	Mushroom
8.	*Hydnum repandum*	Chhatri	Mushroom
9.	*Helvella crispa*	-	Mushroom
10.	*Lactarius deliciosus*	Sancha	Mushroom
11.	*Lactifluus hygrophoroides*	- Mushroom	
12.	*Lactarius subindigo*	-	Mushroom
13.	*Marasmius oreades*	-	Mushroom
14.	*Morchella esculenta*	-	Mushroom
15.	*Pleurotus ostreatus*	dhingri	Mushroom
16.	*Russula virescens*	-	Mushroom
17.	*Russula brevipes*	-	Mushroom
18.	*Tremella fuciformis*	-	Mushroom
19.	*Strobilomyces floccopus*	-	Mushroom
20.	*Schizophyllum commune*	Chiyaun	Mushroom

वींका सुळेटै संगात

MRS BEENA BENJWAL
Poet, Social Activist

वींकि गंज्याळि
कूटदि पाड़ै खैरि
वींकि थमाळि
काटदि बाटा काण्डा
वींकि कुटळि
खैंणदि दुखा जलड़ा
वींका घुंग्यासै जद से
भैर नि ह्वे सकदिन
झालों कि काखड़ि
वींका सुळेटै संगत
गवाळो ह्वे जांद
घासौ गर्रु से गर्रु बोझ

वींकि सोटगी सपाग
सुधारि देंदि
उज्याड़्या आदत
वींका अच्छाणा से
नि बचि सकदिन
क्वी आफत-बिपत
पाड़ सुखै डेळि
लीपण वाळा माटै
वींका पुंगड़ा मटखाण।

SACRED AND RITUALISTIC AGRICULTURE *in* UTTARAKHAND

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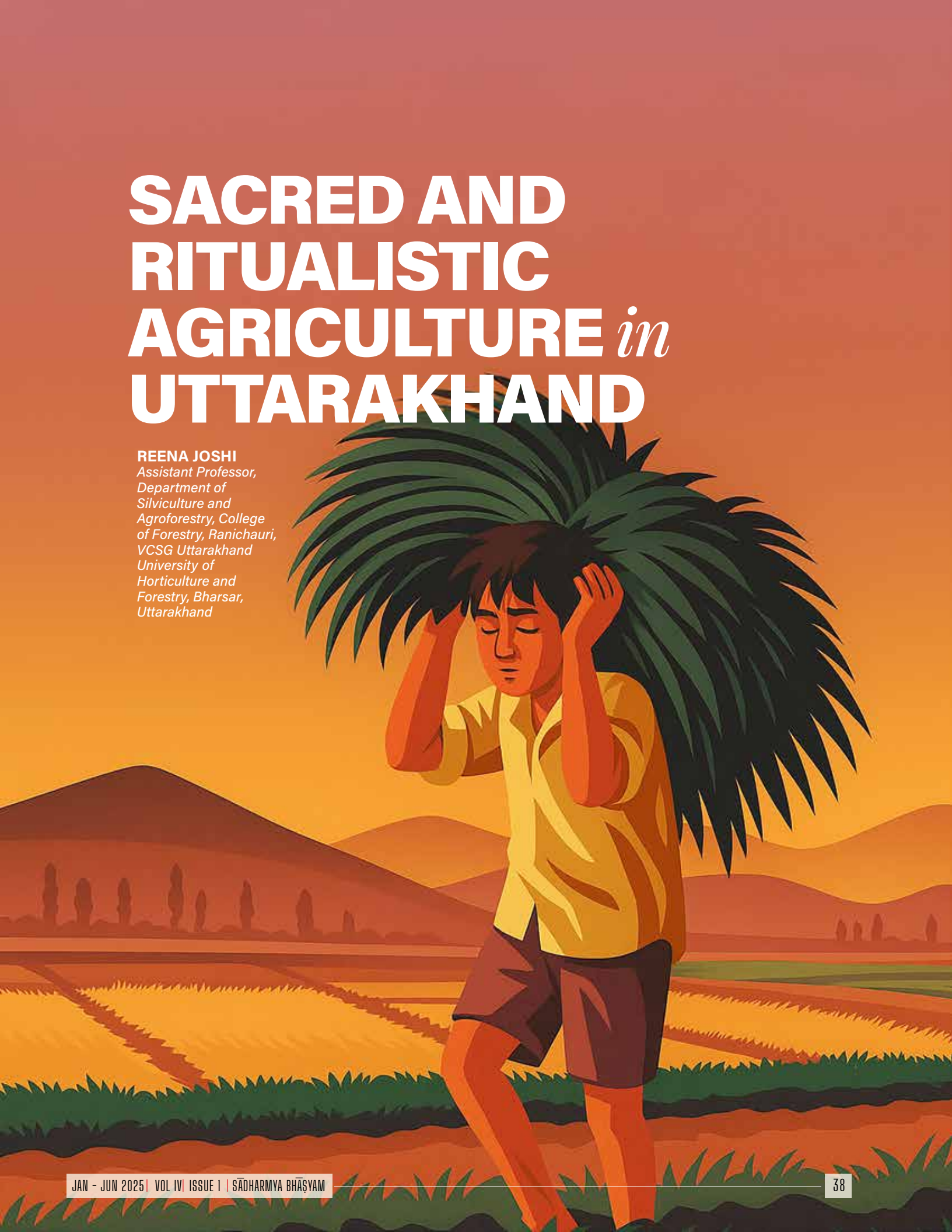

Uttarakhand is also called Dev Bhoomi or Land of Gods, situated in the middle Himalayas and Shivalik ranges, known for its lush green sceneries with snow clad mountains, divine customs, and traditional agricultural practices that are deeply entangled with pious and cultural rituals. Agriculture in this region is not only an economic activity but also a sacred practice, where nature and divine forces play a crucial role in the day to day lives of the people. The agricultural customs imitate the symbiotic relationship between nature and humans, ensuring ecological balance and sustainability.

HISTORICAL AND CULTURAL CONTEXT

The history of agriculture in Kumaon and Garhwal regions of Uttarakhand dates back centuries, with influences from Vedic traditions and local indigenous practices. The region is home to various indigenous communities, such as the Jaunsari, Tharu, Raji, Buksa, and Bhotia tribes, who follow unique agricultural rituals and have retained traditional ways of life. These practices are often linked to their religious beliefs, confirming that farming is done in harmony with nature.

In Vedas and Puranas, it is mentioned that agriculture and rituals are closely associated with each other. The practice of offering the first harvest of paddy and wheat to village deities, performing yajnas and hawan (offering prayers to God in front of fire) for a good yield, and keeping fast and offering prayers before sowing and harvesting are common practices in Uttarakhand specially in the hilly region.

SACRED AGRICULTURAL PRACTICES

1. Festival-Based Agricultural Rituals

Several festivals in Uttarakhand mark the agricultural cycle. These festivals serve as a means to invoke divine blessings for a prosperous harvest.

i. Makar Sankranti (Ghughutiya):
Makar Sankranti, known as Ghughutiya in Uttarakhand, celebrated in the month of January, marks the transition of the sun into capricorn and signifies the beginning of the agricultural season. In Kumaon, Makar Sankranti is celebrated as Uttarayani or Ghughutiya festival, whereas in Garhwal, as Makarani. Special dishes are prepared for the festival, which is called Ghughutiya. The ghughut made of wheat flour, jaggery and milk. Kneaded dough is given the shape of various toys, fried and then are strung together in a garland and small children wear garlands around their neck on the day of Makarsankranti and call the crows and invite them to eat ghughut. They sing the song:
"Kale Kawa Kale, Ghughuti Mala Kha Le. Le Kawa Bar, Maike Dija Sunak Ghar.Kale Kawa Kale, Ghughuti Mala Kha Le...

ii. Phool Dei: The festival is celebrated in the beginning of the month of Chaitra according to the Hindu calendar, which comes sometime in mid March. At this time the entire Uttarakhand is covered with a blanket of colourful flowers of buransh (rhododendron, the State flower of Uttarakhand), yellow pheonly flowers and flowers of peach, plum, apricot and cherry trees. It is mainly a festival of young girls, who go from house to house with plates full of rice, jaggery and flowers. These girls give their blessings and wishes for the prosperity of the house and are given gifts, jaggery, sweets, and money in return. Young girls sing the following local song:

"Phool Dei, Chhamma Dei
Daini Dwar, Bhar Bhakar
Ye Deli Par Barambar Namaskar".

iii. Harela Festival: Harela signifies the onset of the monsoon and the sowing of new crops. Women sow five or seven different types of grains like wheat, paddy, maize, barley, mustard in a basket full of soil. These grains then germinate

Ghughuti Mala for Makarsankrati (Ghughutiya) festival

Little girl doing phoodei

Harela Festival

and turn into yellow leaves known as Harela. These leaves are then cut on the very last day (the tenth day) and people place them behind their ears or on their head. It symbolizes prosperity, fertility, and harmony with nature. Harela highlights the agrarian essence of Uttarakhand and underscores the importance of agriculture in supporting local communities. It is a time for farmers to honour the fertility of the earth and celebrate the onset of the sowing season.

"Lagi Harawo, Lagi Dashe,
Lagi Bagwao Ji Raya Jagi Raya,
Ye Din Ye Baar Bhetene Raya
Dubaki Jas Jar, Pati Jas Pau
Himalaya Hyon Chan Jane,
Ganga Pani Chan Jane Ji Raya, Jagi Raya,
Ye Din Ye Baar Bhetene Raya"

iv. Ghee Sankranti: Ghee Sankranti, held in mid August corresponding to the first day of Bhado. It is a harvest festival where farmers honour their tools and livestock. It is a celebration of the abundance of crops, especially dairy products. The primary ritual involves the consumption of foods made with ghee, symbolising health and prosperity. Special dishes like beduwa roti (stuffed urd dal chapatis with ghee) and Kheer (rice pudding) are enjoyed.

2. Deity Worship in Agriculture

In Uttarakhand, deity worship is deeply entangled with agriculture and shows the connection between people, nature, and the harvest which often involve prayers for a bountiful yield and the well-being of the community. Farmers consider certain village deities as guardians of agriculture and their livestock. Bhumiya devta known as the deity of the land honoured and offerings and prayers are made before ploughing the fields. Nanda devi, the supreme goddess of Uttarakhand is worshipped for prosperity and good harvest. Mahasu devta, revered in the Jaunsar-Bhawar region is considered the protector of livestock and crops.

The practice of offering the first harvest of paddy and wheat to village deities, performing yajnas and hawan (offering prayers to God in front of fire) for a good yield, and keeping fast and offering prayers before sowing and harvesting are common practices in Uttarakhand specially in hilly region.

3. Traditional Agricultural Techniques with Rituals

i. Mixed Cropping and Organic Farming: Traditional mixed cropping methods, such as growing pulses with millets, are believed to bring balance to the land. Rituals like offering the first produce to the deities are commonly practised.

ii. Sowing and Harvesting Rituals: Before sowing seeds, farmers seek the blessings of the village priest or elder, who performs a small ritual with water and flowers. During harvesting, a portion of the first crop is offered in temples or sacred groves.

iii. Water Conservation Rituals: The construction and maintenance of water sources like naulas (traditional step wells) and dharas (natural springs) are accompanied by rituals, prayers, and community feasts.

4. Sacred Groves and Agricultural Sustainability

Sacred groves are those preserved forest patches or natural vegetation that are considered holy by local people and are often dedicated to local deities or spiritual beings. These groves are integral to the religious and cultural traditions of the communities that protect them, serving as places of worship, rituals, and making a spiritual connection to nature. Sacred groves preserve ecological balance, protect water sources, and conserve biodiversity playing an imperative role. Villagers avoid cutting trees in these areas and believe that doing so would invite divine wrath.

Sacred groves by preserving ecological balance, protecting water sources, and conserving biodiversity plays an imperative role. Villagers avoid cutting trees in these areas and have faith in that doing so would invite divine wrath.

CONCLUSION

In Uttarakhand, agricultural festivals and traditions are a vibrant reflection of the region's cultural heritage and its deep connection to the land. Sacred and ritualistic agriculture is a reflection of the region's deep-rooted cultural ethos, where farming is not just about food production but a spiritual activity. These traditions ensure sustainability, promote biodiversity, and strengthen the relationship between humans and nature. Although modernization poses challenges, conserving these age-old customs is crucial for maintaining the cultural heritage and ecological balance of the Himalayan region.■

Bhadrakali temple and cave as Sacred grove in Bageshwar district, Uttarakhand

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MEDICINAL PLANTS *of* UTTARAKHAND

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Uttarakhand is renowned not only for its scenic landscapes and spiritual significance but also for its remarkable diversity of medicinal plants. With approximately 1,800 species of medicinal and aromatic plants (MAPs), the state holds nearly one-fourth of India's total medicinal plant diversity. This abundance highlights the region as acritical biodiversity hotspot and an ecological sanctuary with immense cultural and scientific value.

GEOGRAPHICAL AND CLIMATIC FEATURES

Uttarakhand's exceptional diversity in medicinal plants is primarily due to its unique geographical and climatic features. The state lies in the central Himalayas, with altitudes ranging from 300 meters to over 7,800 meters, fostering a variety of ecological zones. These include the Terai-Bhabar lowlands, Shivalik hills, mid-Himalayas, and alpine regions, each home to distinct plant species. Over 60% of the state is covered by forests, providing a natural habitat conducive to medicinal plant growth. The climatic conditions are equally varied. From subtropical zones in the valleys to glacial climates at higher elevations, Uttarakhand experiences high rainfall, diverse temperatures, and snowfall in alpine areas. These variations support a broad spectrum of plant life. Furthermore, being part of the Western Himalayan Biodiversity Hotspot, the state houses some of the richest and most endangered flora in the world. Fertile valleys formed by the Ganga, Yamuna, and their tributaries further enhance plant diversity. Altitudinal variation, forest coverage, diverse climates, and abundant water resources collectively support the growth of over 1,800 species of medicinal and aromatic plants in Uttarakhand.

SARPAGANDHA (*RAUVOLFIA SERPENTINA*)

Medicinal uses: It is used to treat a wide variety of treatments, including snake and insect bites, febrile conditions, malaria, abdominal pain, and dysentery. It is also used as a uterine stimulant, febrifuge, and cure for insanity.

PASHANBHED (*BERGENIACILIATA*)

Medicinal uses: It is used for the treatment of various diseases like urinary stones, vesicular calculi, bladder diseases, excessive uterine haemorrhage, menorrhagia, heart diseases, splenic enlargement and dysentery.

BIODIVERSITY AND ECOLOGICAL SIGNIFICANCE

Uttarakhand hosts about 1,800 species of medicinal and aromatic plants, nearly one- fourth of India's total medicinal plant species. This reflects its status as a biodiversity hotspot. The variety in microclimates and ecosystems—ranging from tropical forests to alpine meadows—accounts for high species richness and ecological variety.

Many of these species are rare, endemic, or endangered, including *Nardostachys jatamansi* (Jatamansi), *Picrorhiza kurroa* (Kutki), *Aconitum*

KUTKI (*PICRORHIZA KURROA*)
Medicinal uses: Kutki, is used to treat a variety of conditions, including chronic fever, skin disorders, and diabetes, liver and upper respiratory conditions, as well as digestive issues like chronic diarrhea and jaundice.

heterophyllum (Atis), and *Saussurea obvallata* (Brahma Kamal). Indigenous knowledge systems like Ayurveda and local healing traditions heavily rely on this diversity. The high plant density underlines the ecological sensitivity of the region and the urgent need for conservation efforts amid threats like overharvesting and climate change.

NATURAL HABITATS AND HOTSPOT REGIONS

Uttarakhand's topography supports several medicinal plant-rich habitats. In the Terai and Bhabar region (300–1000 m), the climate is subtropical with fertile soils, supporting plants like Ashwagandha, Tulsi, and Aloe vera. The Shivalik hills and mid-Himalayas (1000–3000 m) offer temperate climates and oak-pine forests that shelter species like Berberis aristata and Rauvolfia serpentina. The subalpine and alpine zones (3000–5000+ m) are colder and home to high-value herbs like *Nardostachys jatamansi*, *Saussurea costus*, and *Picrorhiza kurroa.*

Key Hotspots

Valley of Flowers National Park in Chamoli district (3,200–6,675 m) is a UNESCO World Heritage Site known for over 500 flowering species, including rare herbs like Salampanja and Brahma Kamal. Its alpine meadows and minimal human interference make it a natural gene bank. Nanda Devi Biosphere Reserve, also a UNESCO site, spans 1,800–7,800 meters and contains multiple microclimates.

SALAM PANCHA (*DACTYLORHIZA HATAGIREA*)
Medicinal Uses: The juice extracted from tuber is used as a tonic and root paste is externally applied as a poultice on cuts and wounds and extract is given in intestinal disorders.

GILOY (*TINOSPORA CORDIFOLIA*)
Medicinal uses: Giloy is beneficial in fever, infections, low immunity, cancer, asthma, gout, rheumatoid arthritis, recurrent infections, recurrent common cold, chronic catarrh, chronic fever, chronic fatigue, etc.

Protected status, minimal anthropogenic pressure, and ecological isolation contribute to its role as a sanctuary for endemic medicinal plants like Kutki, Atis, and Swertia chirayita.

ROLE IN TRADITIONAL HEALTHCARE SYSTEMS

Medicinal plants are central to Ayurveda and local

KUSHTHA (*DOLOMIAEA COSTUS*)
Medicinal uses: It is used for Osteoarthritis, for strengthening digestion, cleanse the body of toxic accumulations, enhance fertility, and reduce pain. Its dried powder is the principal ingredient in an ointment for ulcers.

folk medicine in Uttarakhand. Ayurveda draws on local herbs like Ashwagandha, Giloy, and Brahmi for therapeutic formulations. Their potency is believed to be enhanced by the Himalayan environment.

In folk medicine, indigenous healers known as Vaidyas and Dais use herbal remedies to treat common ailments. This knowledge is passed orally through generations. Medicinal plants offer accessible and affordable healthcare in remote areas lacking modern facilities. Additionally, institutions like the Herbal Research and

Development Institute (HRDI) promote the sustainable use of traditional practices. The intersection of biodiversity, culture, and healthcare makes medicinal plants indispensable in the region.

HIMALAYAN YEW (*TAXUS WALLICHIANA*)
Medicinal uses: The extracts from various parts of the plant have significant activity against pain, inflammation, fever, fungal and bacterial infections, convulsions, and cancer.

PRESERVATION OF TRADITIONAL KNOWLEDGE

Traditional knowledge of medicinal plants is passed down through generations via oral traditions, apprenticeship, and cultural practices. Indigenous communities like the Bhotiya and Jaunsari play a pivotal role in this transmission. The Bhotiya, living in high-altitude regions, have mastered the use of alpine herbs for conditions like altitude sickness and digestive ailments, while the Jaunsari community blends Ayurvedic and animistic traditions in its healing practices. Women and elders are key custodians of this knowledge. Women, often the primary caregivers, maintain home gardens with medicinal herbs and transmit herbal wisdom to younger generations through daily practices. Elders serve as respected healers and mentors, preserving a deep, experience-based understanding of local flora and its therapeutic uses. Their roles are integral to ensuring both cultural continuity and ecological sustainability.

THREATS TO MEDICINAL PLANTS AND THEIR CONSERVATION STATUS

Medicinal plants are invaluable to both traditional and modern medicine, but they are increasingly threatened by various human and environmental pressures. These threats pose significant challenges to their survival and conservation.

1. Overharvesting

One of the most pressing threats is overharvesting. Due to the high demand for herbal medicines, cosmetics, and dietary supplements, many medicinal plants are collected unsustainably from the wild. This is particularly harmful to slow-growing or highly valued species like Taxus brevifolia and Prunus africana, leading to drastic population declines.

2. Habitat Loss and Degradation

Widespread deforestation, agricultural expansion, urbanization, mining, and infrastructure development have led to the destruction of natural habitats. Medicinal plants that thrive in biodiversity hotspots are especially vulnerable, as their

ecosystems are rapidly disappearing.

3. Climate Change

Climate change, characterized by rising

BANKAKRI (*PODOPHYLLACEAE*)
Medicinal uses: used for typhoid fever, jaundice, dysentery, chronic hepatitis, scrofula, rheumatism, skin diseases, tumorous growth, kidney & bladder problems.

BRHMA KAMAL (*SAUSSUREA OBVALLATA*)
Medicinal uses: it is used in the treatment of a wide range of problems and illnesses, including fevers, colds, flu, bronchitis, and asthma.

temperatures and shifting rainfall patterns,

impacts plant distribution and life cycles. Phenological changes such as altered

flowering and fruiting times can reduce the reproductive success and survival of

many species.

4. Invasive Species

The introduction of non-native plant species poses another threat. These invasives often outcompete native medicinal plants, reducing biodiversity and altering habitat dynamics.

5. Illegal Trade and Weak Regulation

Illegal collection and international smuggling of rare medicinal plants thrive due to poor enforcement of conservation laws. The high market value of some species fuels this unsustainable exploitation.

6. Loss of Indigenous Knowledge

Traditional knowledge about medicinal plant use and sustainable harvesting is rapidly declining due to cultural erosion and insufficient documentation. This loss undermines both conservation and healthcare practices based on these plants.

PRISHNIPARNI (URARIA)

Medicinal uses: the whole plant is used in diseases due to vitiated blood, gout, bleeding piles, blood dysentery, acute diarrhea, alcoholism, insanity, psychosis, cough, bronchitis and difficult breathing. The plant is used for treating fractures.

CONSERVATION AND SUSTAINABLE USE OF MEDICINAL PLANTS

The conservation of medicinal plants is a critical concern, as many species are threatened due to overharvesting and habitat loss. The IUCN has classified several important medicinal plants under various threat levels: Taxus wallichiana and Podophyllum hexandrum are endangered, Nardostachys jatamansi and Saussurea costus are critically endangered, while Prunus africana is vulnerable. In Uttarakhand, a biodiversity-rich Himalayan state, similarly threatened species include Aconitum heterophyllum, Picrorhiza kurroa, and Uraria picta.

Conservation efforts encompass in situ and ex situ strategies, sustainable harvesting, cultivation of high-demand species, legal protection under frameworks like CITES, and documentation of traditional knowledge. The State Medicinal Plants Board (SMPB) and the Herbal Research and Development Institute (HRDI) play key roles in Uttarakhand's conservation programs. Integration of medicinal plant conservation into forest management, along with adoption of international harvesting standards, strengthens sustainability.

NGOs like Navdanya, Grow Billion Trees Foundation, SOPHIA, and programs like COMDEKS support conservation through community engagement, training, and reforestation. Scientific institutions like CSIR-CIMAP contribute by developing improved plant varieties, while traditional farming methods such as Barahnaja aid agrobiodiversity conservation.

Medicinal plants also drive eco-tourism and the wellness industry. Herbal resorts and tourism centers in Rishikesh and Haridwar offer Ayurvedic therapies. Herbal trails, parks, and ethnobotanical workshops connect visitors with local traditions. Community-based tourism, herbal homestays, and the cultivation of plants like Aloe vera and Lemongrass generate sustainable livelihoods.

Branding Uttarakhand as the "Herbal State of India" enhances market value and promotes eco-friendly products. Institutions like HRDI and CIMAP ensure product quality and safety in collaboration with AYUSH and wellness centers. The integration of conservation with tourism and economic development brings environmental, economic, cultural, and tourism-related benefits. Recommendations include establishing medicinal eco-parks, training guides, certifying wellness centers, and supporting community-led tourism models ■

JATAMANSI (*NARDOSTACHYS*)

Medicinal uses: It has been traditionally used in the Ayurvedic system of medicine as a neuroprotective agent for the treatment of hysteria, epilepsy, insomnia.

THE ESSENCE *of* AGROFORESTRY
A Living Tradition

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In Uttarakhand, agroforestry is not just a farming practice; it is a way of life that has flourished for centuries, born out of the necessity to adapt to the rugged terrain and unpredictable weather patterns of the Himalayas. This unique land-use system integrates trees, crops, and livestock in a balanced, mutually beneficial relationship. The trees such as Grewia optiva (bhimal), Quercus leucotrichophora (banj oak), and Ficus spp. serve not only as fuelwood, fodder, and manure providers but also as guardians of the land, enriching the soil, preventing erosion, and improving water retention. Meanwhile, crops like finger millet, barnyard millet, and amaranth flourish beneath the protective canopy of these trees, ensuring both food security and economic stability.

This intricate relationship between the natural and the cultivated is the foundation of sustainable agriculture a dynamic equilibrium where every element, whether plant, animal, or soil, plays a role in maintaining the system's vitality. Traditional agroforestry in Uttarakhand is a living example of how nature and human ingenuity can coexist in harmony, creating resilient ecosystems that endure the test of time.

Agri-silvicultural Systems

TRADITIONAL AGROFORESTRY IN UTTARAKHAND

Agroforestry in Uttarakhand is a time-honored land-use practice born out of indigenous knowledge and ecological necessity, shaped by the region's mountainous terrain, unpredictable rainfall, and limited arable land. These systems are not merely farming techniques but holistic adaptations to local environmental and socioeconomic conditions, sustaining both biodiversity and rural livelihoods. Several traditional agroforestry systems have evolved over generations:

Agri-silvicultural Systems

The most prevalent form of agroforestry in the hills, agri-silvicultural systems integrate tree species such as Grewia optiva (bhimal), Quercus leucotrichophora (banj oak), and various Ficus species with rainfed staple crops like finger millet (Eleusine coracana), barnyard millet (Echinochloa frumentacea), and amaranth (Amaranthus spp.). These multipurpose trees play vital roles sproviding fuelwood, fodder, green manure through leaf litter, and stabilizing soil on steep slopes prone to erosion. Their canopy also moderates the microclimate, enhancing moisture retention and protecting crops from harsh climatic conditions.

Silvi-pastoral Systems

Livestock being integral to the hill economy, silvi-pastoral systems combine tree cultivation with pasture management. Forest patches or managed commons are enriched with fodder-yielding trees like Bauhinia variegata and Grewia optiva, whose leaves are a critical source of protein-rich fodder during lean, dry months. These systems ensure year-round forage availability, reduce pressure on natural forests, and maintain soil productivity through nutrient cycling facilitated by livestock dung and leaf litter.

Agri-horti-silvicultural Systems

In regions with slightly better climatic and soil conditions, complex systems integrating agriculture, horticulture, and forestry have developed. Fruit trees such as apple, apricot, walnut, and pear are cultivated alongside forest trees and seasonal crops. This multi-layered arrangement optimizes vertical and horizontal land use, supports pollinator populations, enhances biodiversity, and creates favorable microclimates for crop and tree productivity. Such systems also offer diversified income streams, reducing economic vulnerability.

Silvi-pastoral Systems

Home Gardens

Located near homesteads, traditional home gardens are dense, multifunctional spaces comprising vegetables, fruits, medicinal herbs, spices, and small trees. These gardens are managed primarily by women and serve as critical sources of household nutrition, herbal medicine, and supplementary income. Their structure reflects deep ecological understanding maximizing productivity in small spaces while recycling organic waste and conserving agrobiodiversity. They also

Agri-horti-silvicultural Systems

serve as repositories of local seed varieties and indigenous plant species. Together, these traditional agroforestry systems exemplify sustainable land management that balances ecological integrity with socioeconomic needs. They demonstrate how indigenous practices, when supported by appropriate policy and research, can contribute to food security, climate resilience, and the preservation of cultural landscapes in the fragile Himalayan environment.

ECOLOGICAL GUARDIANSHIP: AGROFORESTRY AS THE EARTH'S PROTECTOR

Agroforestry serves as a vital cornerstone in the stewardship of our planet's ecosystems, embodying a holistic approach to land management that harmonizes agriculture with environmental conservation. By integrating trees with crops and livestock, agroforestry acts as a powerful tool in safeguarding biodiversity, enhancing soil fertility, and combating deforestation. Trees in agroforestry systems act as carbon sinks, mitigating climate change by sequestering significant amounts of carbon dioxide from the atmosphere. Furthermore, agroforestry systems help to reduce soil erosion, preserve water quality, and maintain watershed health, acting as natural buffers against extreme weather events like floods and droughts. The biodiversity within these systems also provides habitats for wildlife, helping to protect endangered species and ensure the resilience of ecosystems. As ecological guardians, agroforestry systems not only increase sustainable agricultural productivity but also contribute to the restoration and preservation of vital natural resources, underscoring their indispensable role in protecting the Earth for future generations.

Home Garden

SOCIAL RESILIENCE: EMPOWERING COMMUNITIES THROUGH AGROFORESTRY

Agroforestry stands as a transformative practice that not only enhances environmental sustainability but also fosters profound social benefits, particularly in rural and marginalized communities. By integrating trees with crops and livestock, agroforestry provides a holistic approach to farming that improves food security, promotes income diversification, and enhances resilience to climate change. This practice empowers communities by creating new economic opportunities, such as through the sale of timber, fruits, and non-timber forest products, thereby reducing dependency on single-crop farming and increasing household income. Moreover, agroforestry supports local knowledge and traditional practices, encouraging community-driven decision-making and collective action. It also strengthens social ties, as communities engage in shared resource management, ensuring that the benefits are equitably distributed. Ultimately, agroforestry not only strengthens the socio-economic fabric of rural areas but also instills a sense of stewardship, as communities are actively involved in the sustainable management of their natural resources.

MODERN RELEVANCE AND INTEGRATION INTO POLICY

In the context of climate change, soil degradation, and agrarian distress, traditional agroforestry has gained renewed relevance as a resilient and adaptive land-use strategy. Recognizing its potential, India launched the National Agroforestry Policy (2014), the first of its kind globally to promote tree integration in farming and climate-smart agriculture. In Uttarakhand, local institutions like Van Panchayats and schemes such as MGNREGA have further enabled the institutionalization of agroforestry through community-based forest management and employment-linked conservation efforts. By blending traditional knowledge with scientific advancements such as improved yields, climate-resilient species, and better market access agroforestry now stands as a vital component of sustainable mountain development and rural livelihood enhancement.

CHALLENGES AND THE WAY FORWARD

Traditional agroforestry in Uttarakhand, despite its proven ecological and socioeconomic benefits, faces growing challenges that threaten its sustainability. Youth migration, labor shortages, land fragmentation, insecure tenure, and waning intergenerational knowledge transfer have weakened traditional practices, while limited policy coordination and inadequate extension support further hinder progress. Addressing these issues requires a holistic approach reviving indigenous knowledge, empowering women and youth through capacity-building, and fostering participatory research. Policy reforms that ensure land rights, offer financial incentives, and strengthen market access, alongside institutional support from bodies like Van Panchayats, are essential to mainstream agroforestry into climate-resilient rural development and ensure its continued relevance in modern mountain agriculture.

CONCLUSION

Traditional agroforestry practices in Uttarakhand embody a deep-rooted harmony between people and nature, offering invaluable lessons in resilience, sustainability, and

adaptive land management. These systems, developed through centuries of indigenous knowledge, continue to provide ecological stability, diversified livelihoods, and cultural continuity in the fragile Himalayan ecosystem. As modern agriculture grapples with the twin challenges of environmental degradation and climate change, the relevance of these age-old practices has never been greater. By integrating traditional wisdom with contemporary science and supportive policy frameworks, agroforestry can serve as a cornerstone for sustainable mountain development. The way forward lies in revitalizing these practices through education, community engagement, and institutional support, ensuring that they not only survive but thrive as models for ecological stewardship and rural prosperity in a changing world.■

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INDIGENOUS LIVESTOCK *and* TRADITIONAL DAIRY PRACTICES

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Courtesy: Alamy

In India, mixed crop–livestock farming systems dominate the agricultural landscape. Livestock plays a critical role by supporting farm incomes through employment generation, providing draught power, and producing manure. With extensive livestock resources, India's livestock sector significantly contributes to the national economy and enhances the socio-economic status of millions of rural households. Farmers across the Uttarakhand state practice mixed crop-livestock systems adapted to diverse agro-ecosystems, creating a miniature reflection of global livestock farming patterns. In rural areas, dairy farming has become an essential livelihood strategy for smallholders with limited land.

INDIGENOUS LIVESTOCK IN STATE'S ECONOMY

Buffaloes and cows are integral to the agrarian landscape of Uttarakhand, contributing significantly to the livelihood, nutrition, and agricultural sustainability of rural households. The state's hilly terrain often restricts the use of machinery, making these large ruminants essential for both milk production and draft purposes in ploughing fields and transporting goods. Dairy products such as ghee, curd, and paneer—produced from cow and buffalo milk—are staple components of the local diet and they serve as important sources of supplementary income, particularly for women and smallholder farmers. Buffaloes, in particular, are preferred for their higher milk yield and fat content, making them economically attractive for dairy development initiatives in the region. The small ruminants like goat and sheep are well-adapted to the region's steep, rugged terrain and sparse vegetation, making them ideal for resource-poor environments where large livestock may not be viable. Goats provide meat, milk, and


Courtesy: Alamy

manure, while sheep contribute wool and meat, helping fulfil both dietary needs and economic objectives for rural families. Their low maintenance requirements, rapid reproductive cycles, and resilience to harsh conditions make them particularly advantageous for landless individuals and traditional pastoralist groups. In areas like Chamoli, Pithoragarh, and Uttarkashi, sheep and goat rearing forms a significant component of transhuman pastoralism, a traditional system where herders migrate seasonally in search of grazing grounds. Due to the region's challenging topography and underdeveloped road infrastructure in remote areas, mules serve as an indispensable means of transportation for goods, agricultural produce, and construction materials, especially in high-altitude villages and pilgrimage routes such as Kedarnath and Hemkund Sahib. Mules provide a source of livelihood for many local families engaged in the traditional pack animal trade, contributing to income generation and rural employment. In addition to their economic contributions, mules are instrumental during emergencies, such as floods and landslides, when they are deployed to deliver relief materials to regions that are otherwise unreachable by conventional vehicles.

LIVESTOCK CENSUS TRENDS: CHANGING ANIMAL POPULATIONS

According to the 20th Livestock Census (2019), Uttarakhand accounts for 0.96% of India's cattle, 0.79% of buffaloes, 0.38% of sheep, 0.92% of goats, 0.20% of pigs, and 0.59% of poultry. Although there has been an increase in crossbred cattle due to breed improvement programs, the indigenous cattle population has declined. Similarly, buffalo and sheep numbers have fallen, while goat and poultry populations have risen sharply in response to consumer demand. In terms of livestock distribution, buffaloes and cattle are dominant up to 1000 meters elevation, cattle, sheep, and goats between 1000–2400 meters, and sheep and goats above 2400 meters (State Horticulture Mission, Government of Uttarakhand).

Livestock (buffalo and calf) rearing in hilly region of Garhwal Himalaya, Uttarakhand

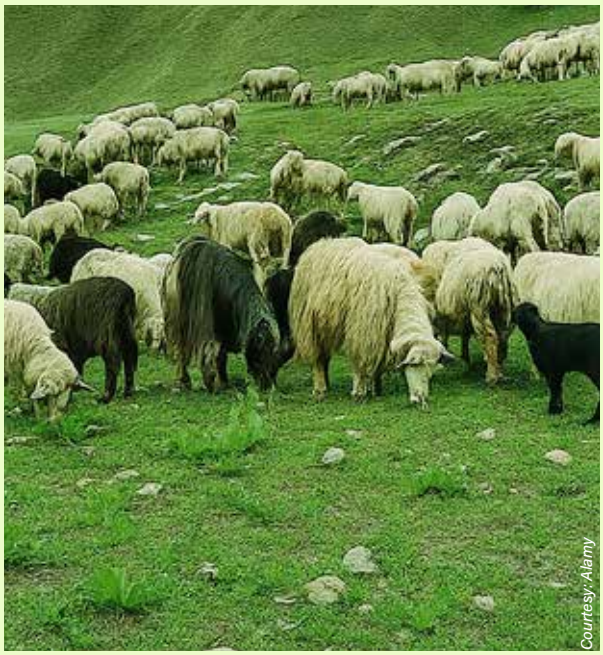

Courtesy: Alamy

DAIRY FARMING: A KEY DRIVER OF RURAL LIVELIHOOD

Dairy farming is widely recognized as a key driver of social and economic development. It offers valuable employment and additional income opportunities, especially for landless labourers and small and marginal farmers. More than 75 percent of farmers maintain 2–3 milch animals to sustain their livelihood. In the Himalayan region, integrated farming systems that combine cultivation, agroforestry, animal husbandry, and forestry have been practised for centuries.

THE GROWING IMPORTANCE OF DAIRY FARMING

In Uttarakhand, mixed crop–livestock farming is predominantly practiced by smallholder farmers. Two distinct livestock management systems—sedentary and migratory—are observed. In the sedentary system, livestock are kept in villages year-round, while migratory herders move their animals seasonally to highland pastures. Livestock, particularly dairy animals, are central to the region's agricultural economy. They provide manure for crops, generate income through milk, meat, and wool production, and offer draught power essential for farming. Many farmers engaged in dairy farming also maintain bullocks for ploughing, creating an integrated dairy–manure–draught cattle system. Cows, regarded as sacred, also hold significant economic value through their contribution of milk and manure, both essential to rural livelihood. Dairy farming is a major economic activity in Uttarakhand, deeply interwoven with the region's agricultural systems. Animal husbandry has traditionally played a crucial role, and milk production continues to rise steadily across all altitudes, signalling strong potential for further development. Growing urban centers such as Dehradun, Haridwar, Rishikesh, Haldwani-Kathgodam, Nainital, Rudrapur, Pantnagar, and Kashipur have led to increased demand for milk and dairy products. Institutions like the Uttarakhand Co-operative Dairy Federation Limited (UCDFL) and district milk unions, operating through numerous milk societies, are critical in meeting this demand.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AGROFORESTRY AND TRADITIONAL INTEGRATED FARMING SYSTEMS

Agroforestry systems, integrating trees, crops, and livestock, have long benefited rural communities through food, fruit, fodder, fuel, fertilizer, and fiber. In the Garhwal hills, these interrelationships between land use components are deeply rooted in traditional farming systems. Livestock feeding in the Himalayan hills largely depends on forest resources, with fodder trees, shrubs, and grasslands forming the primary nutritional base, supplemented by agricultural residues. In mid-hill zones, forests contribute between 30% to 50% of livestock feed requirements, while in lower hills, forests supply 26% to 43% of fodder needs. Sustainable forest management is therefore crucial to the future of livestock-based livelihood. Fodder trees are particularly critical during winter and summer when green forage is scarce. These species provide essential nutrition during lean periods, fulfilling approximately 40% of the annual fodder needs for ruminants in the hills (Malla, 2004). Important fodder trees in Uttarakhand's mid-hills include Grewia optiva (Bhimal), Quercus leucotrichophora (Banj), Ehretia laevis (Chamrod), Prunus cerasoides (Paiyaa), and various Bauhinia species, helping farmers bridge seasonal forage gaps.

Courtesy Dreamstime

FORESTS AND AGROFORESTRY AS A PILLAR OF LIVESTOCK FEEDING

Uttarakhand's agroecological richness supports a diverse range of fodder plants and grasses and sustains a significant livestock population. In temperate regions, oak leaves are an important fodder resource for milch animals. Pasturelands across subtropical, temperate, and alpine zones provide a strong foundation for dairy farming. Agroforestry practices, including the cultivation of fodder trees alongside crops, are common and critical during fodder shortages. In grazing-based systems, grasses dominate livestock diets, while in mixed systems, a wider variety of feed sources, including crop residues and fodder trees are utilized. In the Uttarakhand Himalaya, livestock feeding primarily revolves around grazing, supplemented occasionally by

cereal stovers and paddy straw.

CONSTRAINTS IN LIVESTOCK PRODUCTIVITY AND MARKET ACCESS

Despite the favourable climatic conditions and abundant grasslands and fodder trees, livestock farming remains economically unsustainable for many, with farmers often struggling due to poor market access and the lack of cold storage facilities. Despite its integral role, the livestock sector in the Himalayan hills remains underdeveloped, largely due to the low productivity of indigenous breeds and challenges in feed and health management. Limited availability of quality forage, particularly in winter, restricts livestock productivity.

Nevertheless, dairy farming holds considerable potential across all altitudinal zones of the Uttarakhand Himalaya. Extensive forest cover (59.7%), grazing lands (3.4%), and ample water resources support this sector. The dominance of oak forests and diverse grasslands offers further opportunities for expanding dairy activities. Limited arable land (12.4%) has led to food insecurity and malnutrition, positioning livestock farming as a viable option to enhance food security and livelihoods. Indigenous breed of cattle, such as Badri breed of cow has shown promising future due to its adaptability especially for the hilly region of Uttarakhand as well as lower maintenance as compared to non-native breeds. With abundant indigenous knowledge, rich biodiversity, lower production costs, and a largely untapped domestic market, transitioning toward dairy farming presents a promising opportunity for both certified organic and traditional farmers in Uttarakhand.■

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TRADITIONAL AGRICULTURE *of* THE HILLS

A Model of Eco-friendly Approach

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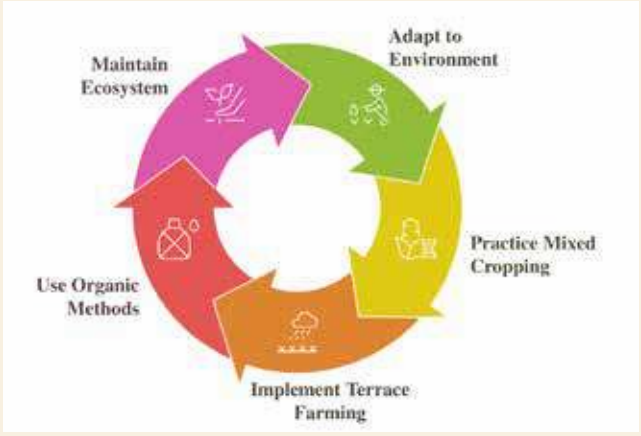
Uttarakhand is known for its breathtaking scenery, rich biodiversity and vibrant cultural heritage. Traditional farming methods, practised by the local people in harmony with nature, have flourished for centuries on the terraces that follow the contours of the Himalayan mountains despite the rough terrain and steep slopes. Traditional agriculture is an ancient way of farming, using a lot of indigenous knowledge to treat the land and plants with things that are probably poisonous and probably made artificially in a laboratory. The majority of people in Uttarakhand are employed in and around agriculture, with many farmers growing only for subsistence and practising subsistence farming. Traditionally, a wide range of cereals, millets, fruits, vegetables and pulses are grown on the slopes of the Himalayas in Uttarakhand, varying according to the growing season, topography, altitude, slope, orientation and climate. Apart from providing a means of subsistence, traditional agriculture in Uttarakhand's highlands is essential to preserving biodiversity, ecological balance, and the sustainability of this delicate mountain ecosystem.

Figures 1 Terrace farming system and field margin in the traditional agriculture of Uttarakhand

Cultivation of wheat under the bhemal-based traditional agroforestry system of Uttarakhand

A SYMBIOTIC RELATIONSHIP WITH NATURE

Traditional agriculture in Uttarakhand is characterized by practices that have evolved over generations, adapting to the unique topography, climate, and soil conditions of the Himalayan hills. Farmers rely on mixed cropping, terrace farming, and organic methods, eschewing the heavy use of chemical fertilizers and pesticides that dominate modern industrial agriculture. This symbiotic relationship with the environment ensures that the natural ecosystem remains intact. For instance, terrace farming—a hallmark of hill agriculture—prevents soil erosion on steep slopes, conserves water, and maintains soil fertility. By sculpting the landscape into stepped fields, farmers reduce runoff and allow rainwater to percolate into the soil, replenishing groundwater reserves in a region prone to water scarcity.



Importance of the traditional farming system of Uttarakhand.

Using cow dung as organic manure in traditional farming in the Garhwal Himalaya.

BIODIVERSITY CONSERVATION

One of the most significant ecological contributions of traditional agriculture in Uttarakhand is the preservation of agrobiodiversity. Farmers cultivate a diverse array of indigenous crops such as millets (mandua and jhangora), pulses (gahat and bhatt), traditional rice varieties like red rice, vegetables etc. These crops are well-suited to the local climate and resistant to pests and diseases, reducing the need for external inputs. Unlike monoculture practices, which deplete soil nutrients and disrupt ecosystems, the mixed cropping of Uttarakhand

supports a variety of plant species, fostering habitats for pollinators, birds, and beneficial insects. This diversity not only strengthens food security but also acts as a buffer against climate variability, a growing concern in the Himalayan region. Moreover, traditional farming incorporates agroforestry, where trees like oak, bhimal, khadik, timla and fruit-bearing species are integrated into agricultural landscapes. These trees stabilize soil, prevent landslides from the frequent hazard in the hills and sequester carbon, contributing to climate change mitigation. The practice of leaving field margins uncultivated further enhances biodiversity by providing space for wildflowers and small fauna.

sharply with chemical-intensive farming, which degrades soil health and pollutes water bodies. In Uttarakhand, the integration of livestock rearing with crop cultivation creates a closed-loop system where waste is recycled into resources, minimizing environmental harm. A significant portion of agriculture in Uttarakhand is rain-fed, highlighting the importance of water management (equally ingenious) and sustainable farming practices. Traditional irrigation systems, such as gulhs (small channels diverting water from streams), ensure equitable distribution of scarce water resources without overexploitation. These methods sustain agriculture while preserving the hydrological balance of the region, supporting downstream ecosystems and communities.

Growing Bhemal and Khadik in the traditional agroforestry system of Uttarakhand Himalaya.

Growing oak in the traditional agroforestry system of Uttarakhand Himalaya.

SOIL AND WATER MANAGEMENT

The ecological wisdom embedded in traditional agriculture extends to soil and water conservation, critical in a region where deforestation and modern development threaten natural resources. Farmers use organic manure from livestock, crop residues, and forest litter to enrich the soil, maintaining its structure and fertility over time. This contrasts

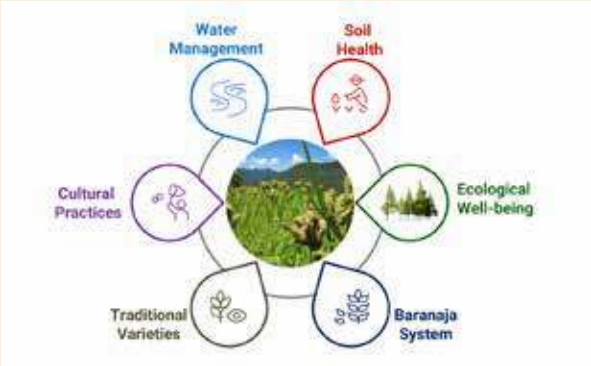
RESILIENCE AGAINST CLIMATE CHANGE

The Himalayan region is highly vulnerable to climate change, with rising temperatures, erratic rainfall, and extreme weather events posing significant challenges. Traditional agriculture in Uttarakhand offers a model of resilience. The use of hardy, drought-resistant crops and diversified

farming practices reduces dependence on a single harvest, mitigating risks from crop failure. Additionally, the knowledge passed down through generations, such as the timing of sowing and harvesting based on local weather patterns, equips farmers to adapt to changing conditions without disrupting the ecological equilibrium.

CULTURAL AND ECOLOGICAL SYNERGY

Beyond its ecological benefits, traditional agriculture in Uttarakhand is deeply intertwined with the cultural fabric of the region. Festivals, rituals, and community practices revolve around the agricultural calendar, reinforcing a collective stewardship of the land. This cultural-ecological synergy fosters a sense of responsibility toward the environment, ensuring that farming remains sustainable rather than extractive.



Benefits of traditional agriculture system of Uttarakhand.

CHALLENGES AND THE WAY FORWARD

Despite its ecological importance, traditional agriculture in Uttarakhand faces threats from modernization, outmigration, and the encroachment of commercial farming. Younger generations are increasingly abandoning

farming for urban livelihood, while government policies often prioritize high-yield varieties over indigenous crops. In addition, climate change and global warming pose a further challenge to traditional agriculture due to erratic weather patterns and frequent and heavy rainfall in short periods. To preserve this vital agricultural system, there is a need for greater recognition of its economic, social and ecological value. Promoting organic certification, supporting local seed banks, and integrating traditional knowledge into modern agricultural frameworks can help sustain these practices while improving livelihood.

CONCLUSION

The traditional agriculture of the Uttarakhand Himalaya is more than a livelihood it is a cornerstone of ecological stability in one of the world's most fragile ecosystems. By conserving biodiversity, managing soil and water resources, and building resilience against climate change, it offers lessons in sustainability that extend far beyond the hills. In an era of environmental crises, the wisdom of Uttarakhand's farmers serves as a reminder that living in harmony with nature is not just possible but essential for the planet's future. This essay highlights the ecological significance of traditional agriculture in Uttarakhand while emphasizing its relevance in the contemporary context. ■

यथा वाटिका, तथा संस्कृति

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हिमालय की धरती, श्रमी संस्कृति
देवभूमि की आभा, फूलों की घाटी।
अलकनंदा वसुंधरा जीवन प्रवाहिनी
नाचती मुदित प्रभा किरण सुहावनी।।

वृक्ष-लताओं फल-फूल धनी धरती
आँचल विशाल विविधता की कसौटी।
पर्वत मृदुल वनस्पति उर्वरक माटी
भंग न करना सभ्यता सहज सुकृति।।

देवदार-साल से गिरीश्रृंग की अलंकृति
चीड़ों से हो गढ़वाल वनमाला अकृति।
शाहबलूत से हो हमारी भूमि बलवती
ऊँचाईयों पर पेड़-वृक्षों की हो खेती।।

गढ़वाल फल-फूल से है लहलहलाती
सेब, माल्टा, आलबुख्खारा, नाशपाती।
आडू, आलू, बुरास, अखरोट गुणवती
प्रकृति की संपत्ति कृषि की हो प्रगति।।

दर्शन की यह धरती जीवधारा की भूमि
खेती-बाड़ी से सुशोभित हो यह धरित्री।
मौसम के अनुरूप फल-फूल की हो वृद्धि
जानो वृक्ष की संपत्ति जीवन की समृद्धि।।

वनस्पतियों का संरक्षण और वृक्षारोपण
यत्र-तत्र वृक्षों का वर्गीकरण और रोपण।
पर्वतीय परिस्थिति सहकारी बीजारोपण
वृक्ष-फलों से सुन्दर समृद्ध गढ़ पर्यावरण।।

WOMEN *as* THE INVISIBLE PILLARS OF AGRICULTURE

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Courtesy: Alamy

Uttarakhand is a famous mountainous state of India and recognized all over the word for its nature's beauty and divinity. The state located in North West part of Himalaya is rich with varied topography, with snow covered peaks to lake to plain area. The total geographical area of the state is 5.35 million hectare. Among the total geographical area, approximately 14 % is under agriculture, with

Courtesy: Mamta

a significant portion ie., 86 % being hilly and 14 % plain. After the tourism sector, agriculture sector plays a predominant role in uplifting the economy of the state. It acts as a primary source of livelihood for a large population and significantly contributes towards the Gross State Domestic Product (GSDP). Whenever, someone talks about traditional agriculture, the image that comes to mind is of a man leading the hal (plow) not a woman. It might be due to the male dominated society, whose perception is deeply rooted in historical, cultural and social norms. But this is only the half-truth. Woman always has been the flag bearer in context to traditional agriculture. This can be understood with a simple example a scooter or bike can't run on single wheel. For smooth running, both the wheels are needed.

Since ancient time, women have played a crucial role in traditional agriculture, a contribution that now needs to be recognized and appreciated. One of the best examples of the role of women in traditional agriculture in Uttarakhand was the Chipko Movement. The movement was led by the women of Laata village (Chamoli district of Uttarakhnad) under the leadership of Goura Devi. The primary purpose of this movement was to protect the forest from deforestation. The famous slogan of the movement was "What do the forests give us? Soil, water and air." This reflects a divine love of women for Mother Nature and also signifies their vision for wellbeing of humanity.

ACTIVE PARTICIPATION IN CROP CULTIVATION

Since the historic period, women were involved in crop cultivation and their management. The traditional agriculture crops of Uttarakhand are finger millets, barnyard millets, rice, maize, wheat, urad, gram, pea, masoor, rajma, mustard, soyabean and vegetables. The women were involved in various field activities, i.e., from sowing, transplanting, weeding, hoeing, irrigation, manuring, harvesting to storage. Even today, village men are migrating towards the cities

One of the best examples of the role of women in traditional agriculture in Uttarakhand was Chipko Movement. The movement was led by women of Laata village (Chamoli district of Uttarakhnad) under the leadership of Goura Devi.

or metropolitan area for work, leaving behind women, who are solely responsible for crop cultivation and sustaining the livelihood. Women are acquainted with the knowledge regarding crop rotation and mixed cropping system. They participated in farming from ancient time so they are sole custodians of traditional/indigenous seed varieties. The preservation of these seed varieties leads to biodiversity, conservation and further a huge scope of development of new high yielding varieties.


Courtesy: Mamta

LIVESTOCK MANAGEMENT AND TRADITIONAL KNOWLEDGE

In traditional agriculture, livestock management has always been an integral part of farming in Uttarakhnad. When it comes to livestock management either dairy, poultry, sheep and goat women are the primary caretakers. They perform various operations like rearing, milking to fodder collection, and healthcare of animals. In addition, they also engaged in preparation of manure obtained from the excreta of animal. The women also have the traditional knowledge of medicinal plants, which is found in the forest areas and used for preparation of various formulations for medicinal uses. They are involved in plantation of traditional crops integrating with forest trees. In addition to this, women participate in rain water harvesting, construction of terraces and contour farming. They play an important role in controlling the soil erosion, maintain the soil fertility and cut down the cost of chemicals in crop cultivation.

INSPIRATIONAL WOMEN FARMERS OF UTTARAKHAND

There are many women who have made significant contribution in the field of farming in Uttarakhnd. Priyanka belongs Kante, a village in district of Pithoragarh who received an award in North Zone All India Farmers Fair-2019 as a progressive farmer of the district Pithoragarh. She was also nominated to become a member of Scientific Advisory Committee of KVK, Pithoragarh. Divya Rawat, famous as the Mushroom Lady, whose innovative approach to mushroom farming transformed the Uttarakhnad villages by providing sustainable employment option through mushrooming. Sita Devi, well known as Kiwi Queen from Tehri District, successfully did the Kiwi farming and showed to the world that diversification is the need of agriculture. Khasti Devi Koranga, a woman famer of Bageshwar


Courtesy: Mamta

district was honoured with the award of the best farmer at the International Conference on System of Crop Intensification for Climate Smart Livelihood and Nutritional Security. She has also set up a network of 2500 women farmers from across 15 village in Bageshwar district, Uttarakhand. A young innovative student Ruchin Negi, alumni of College of Horticulture, VCSG, UUHF, Bharsar, chosen to be an entrepreneur as a way earning. She started her own startup in the name Garden Galaxy. She was awarded by the Governor of Uttarakhand, Honourable Lt. Gen. (Retd.) Gurmit Singh, under the category of Terrariums during Vasantotsav, Dehradun-2023.

THE NEED FOR RECOGNITION AND EMPOWERMENT

As mentioned above, women in Uttarakhand always worked shoulder to shoulder with men, but still their contribution is not recognized. So, it is high time that their role and strength the women's power in agriculture are acknowledged. For this everybody has to come forward to create an image of the feminin goddess ploughing the land by using modern equipments. To bring these changes, one needs to create awareness among the women farmers regarding the latest information/techniques, tools/equipments/machineries, crop resilient agriculture etc to make agriculture less labour intensive and more attractive in terms of productivity and income. For this purpose, frequent trainings/ workshops should be organized/conducted by state agriculture universities/institutes/Krishi Vigyan Kendra for them. Thus, they can be updated and acquaint with scientific information which save their time as well as labour intensive work. In addition to that policy should be made that joint ownership of land, so that women will feel more secure as well as empowered. The Government has to launch more and more subsidies for the upliftment of the female farmers. The promotion among female farmers to join Mahila Kisan Sashaktikaran Pariyojana, Self-Help Groups (SHGs) and Women-Led Cooperatives is need of hours. In village especially the focus should be given to provide best quality of education to the female child. Last but not least, we all need to recognize that farming is a respectable profession. In today's era of technology, the youth prefer uploading reels on Instagram, YouTube, and other social media platforms for earnings instead of engaging in farming. So it is our duty to uphold the privilege of our culture and make our ancestors proud. Life is all about the healthy environment, farming and protecting the Mother Nature. India is an agricultural country, and farming remains the backbone of our economy. Women play a crucial role in food security, biodiversity conservation and livelihood. If women farmers got appreciation, recognition and empowerment in the state, the economy will be improved in double rate and it will also address the problem of migration.


Courtesy: Mamta


Courtesy: Mamta

EMPOWERING THE FEMININE FORCE

Uttarakhand is a divine state known for the abode of deity or land of gods. The state is enriched in cultural and spiritual heritage where goddesses are deeply admired. But if one wants to extend one's gratitude towards this feminine power in real world, empower the female farmers who are the backbone of rural Uttarakhand. We need to uplift and support the female farmers and create a movement where these women prove that sky is not the limit.■

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CHALLENGES FACED *by* TRADITIONAL AGRICULTURE IN UTTARAKHAND

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College of Forestry Ranichauri, Tehri Garhwal

Courtesy: Alamy

Uttarakhand has four different agroclimatic zones that make it suitable for growing a range of crops like rice, wheat, sugarcane, maize, soybeans, pulses, oilseeds, and various fruits and vegetables. Despite the climatic and geographic support, there are certain factors that are limiting the potential of agriculture in the state of Uttarakhand. Farmers face numerous challenges such as human-wildlife conflict, small landholdings, poor irrigation, soil degradation, and climate change. Limited access to markets, modern tools, and technical knowledge further hampers progress. This study explores the various challenges faced in the field of agriculture in Uttarakhand.

HUMAN-WILDLIFE CONFLICT

The forests of the Garhwal Himalayas are recognized for their rich biodiversity, including habitats for rare and endangered fauna such as Panthera tigris (tiger), Elephas maximus (Asian elephant), and Panthera pardus (leopard). In Uttarakhand, crop raiding is one of the most widespread forms of human-wildlife conflict. It significantly affects the livelihood of people, especially in the hilly regions, and often leads to migration towards the plains.
Major crop-damaging species include wild boars, porcupines, monkeys, and elephants. The increasing population of monkeys and their frequent entry into villages have become a serious challenge for farmers. The table below highlights some key wild animals involved in human-wildlife conflict in Uttarakhand, along with their IUCN conservation status:

S.No.	Common Name	Scientific name	IUCN status
1.	Leopard	*Panthera pardus*	*Rare*
2	Tiger	*Panthera tigris*	Endangered
3	Himalayan black bear	*Ursus thibetanus*	Vulnerable
4	Wild boar	*Sus scrofa*	Least concern
5	Nilgai	*Boselaphus tragocamelus*	Least concern

(Source: Meena et.al. 2021)

DIFFICULT FARMING CONDITIONS DUE TO SMALL, SCATTERED TERRACES

Over 90% of farmers in Uttarakhand are smallholders, and the limited size of their farms makes large-scale cultivation unfeasible. The hilly districts of both the Kumaon and Garhwal divisions face the challenge of small, fragmented terrace fields. These uneven and scattered plots hinder the adoption of modern agricultural practices, especially mechanized sowing and harvesting, resulting in lower productivity. Approximately 70% of land holdings are marginal, and 18% are small. Given the predominance of small and marginal farmers, agricultural output in these regions tends to remain low.

INADEQUATE TECHNOLOGICAL RESOURCES

Poor farmers in Uttarakhand often lack access to modern machinery and farming equipment due to their weak economic condition. Limited financial resources, inadequate agricultural input, and a lack of technical knowledge lead to vast areas of cultivable land remaining uncultivated. Despite the region's fertile mountainous terrain, financial instability continues to hinder agricultural progress. Modern tools and technologies have yet to reach many remote villages, where there is significant untapped potential for productive and income-generating farming.

GEO-HYDROLOGICAL DISASTERS

Geo-hydrological disasters, such as landslides, flash floods, cloudbursts, debris flows, rock falls, extreme weather, and land submergence, are quite common in the Uttarakhand. These disasters, which are particularly active and frequent and mostly happen during the monsoon season, also raise direct and indirect challenges to agriculture.

CONVENTIONAL CROPPING SEQUENCE

Modern agriculture comprises of improved farming techniques and using irrigation as well as high yield grains resulting in increased production. Modern agriculture systems had been developed with two related goals in mind. Firstly to obtain highest yield possible and secondly, to get highest economic benefit possible. However, farmers in Uttarakhand largely follow conventional farming practices, focusing mainly on fulfilling their household food needs. Any surplus produce is sold, but often without a clear understanding of its economic potential. There is a pressing need to cultivate a mindset that recognizes farming as a viable source of income, not just subsistence.

NUTRIENT-DEPLETED SOIL

Land degradation, competition for non-agricultural land use, and population growth are all contributing to the decline of arable land. Over time, the soil's inherent capacity to supply nutrients, including micronutrients, is diminishing due to increased food grain production and unbalanced nutrient use. The Bhabhar region of Uttarakhand experienced more severenutrient deficiencies than the hilly areas because of heavy cultivation.

IRRIGATION CHALLENGES

In Uttarakhand, farmers do irrigated and rainfed farming, but water availability is limited due to slope terraces, uneven land, and distant water sources. Efficient irrigation is essential in

Courtesy: Alamy

rainfed areas, yet drip irrigation adoption remains low compared to other states. Even when implemented, it is often abandoned due to poor maintenance, lack of technical knowledge, training, and spare parts. Technical challenges outweigh financial ones in these hilly regions.

MARKETING RESTRICTIONS

Fruit growers in the hilly regions face significant challenges in marketing and transporting their produce. Middlemen often exploit the situation, leaving farmers with only a small share of the final consumer price. The continued reliance on unorganized marketing systems further increases marketing costs, reduces profit margins, and widens the price gap—ultimately diminishing the economic value of the crops. This discourages farmers from investing in better input or adopting modern technologies. Moreover, development in these areas is hindered by inaccessibility and geographical marginality, all of which contribute to physical isolation and high transportation costs.

SHIFTING CLIMATE PATTERNS

Climate change severely impacts agriculture in the Himalayan region, threatening food security for 70% of the population reliant on weather-based farming. Rising temperatures and erratic rainfall alter growing seasons, reduce soil moisture, and increase droughts, floods, and soil erosion. Crop yields—especially wheat, soybean, mustard, peanut, and potato—may decline by 3–7% per °C rise. Climate change also affects pests, diseases, and photosynthesis, further reducing productivity and crop duration.

FOREST FIRE

Crops in Uttarakhand are being destroyed by forest fires that are spreading to rural farms.
The Terai region's farmers said that their standing wheat crop, which covered roughly 30 acres of land, was destroyed by forest fires in the villages of Bhudakisani and Daah Dhaki in Khatima town in Udham Singh Nagar. As a result, they lost more than Rs 12 lakh.
District-wise Forest fire frequency recorded during 01-February to 24-April, 2023 & 2024 by IIRS is depicted in table below:

DISTRICT	2023	2024
ALMORA	443	965
BAGESHWAR	118	238
CHAMOLI	220	361
CHAMPAWAT	145	1135
DEHRADUN	76	94
HARIDWAR	101	54
NAINITAL	316	1715
PAURI GARHWAL	459	723
PITHORAGARH	314	697
RUDRAPRAYAG	48	171
TEHRI GARHWAL	169	431
UDHAM SINGH NAGAR	224	417
UTTARKASHI	81	121
TOTAL FIRE COUNT	2714	7122

(Source: Roy A. 2024)

MIGRATION

A further obstacle to agricultural development is the migration of people from the hills to the plains, which leaves many farmlands uncultivated and without any crops. More than 10% of the population

Courtesy: Alamy

in three districts—Pauri, Tehri, and Almora—migrated after 2011, with the majority of these migrations occurring inside the districts themselves,from mountain districts to urban areas. In Uttarakhand's rural districts, unemployment is the main issue, and 50% of migration is carried out only for work.

GOVERNMENT POLICIES TO ENSURE AGRICULTURAL PROSPERITY

The UN's IFAD and the Indian government signed a $105 million agreement to boost rural income in Uttarakhand by supporting small holder farmers and promoting climate-resilient agriculture. The Kisan Credit Card (KCC) scheme now includes Animal Husbandry and Fisheries, with interest subvention for loans up to 2 lakh. NABARD coordinates outreach to PM-KISAN beneficiaries. The Uttarakhand Livelihoods Improvement Project (ULIPH) and the Integrated Livelihood Support Project (ILSP), funded by IFAD, have improved food security, market access, and livelihood across several hilly districts through skill development, producer support, and rural tourism initiatives.

RECOMMENDATIONS FOR ADDRESSING AGRICULTURAL CHALLENGES

Despite the various anthropogenic and geographical challenges hindering the advancement of agriculture in Uttarakhand, these issues can be effectively addressed by integrating modern technologies with traditional farming practices. To overcome these challenges, several key recommendations should be considered:

- Educating farmers is a critical necessity, particularly in the hilly regions of Uttarakhand. They should be informed about government policies and the practices that could be integrated with agriculture.

- Transport and market facilities should be made readily accessible to farmers.
- It is necessary to monitor the practices of middlemen to ensure that the deserving farmers receive the full benefits.
- Agroforestry practices should be taken into account for improved and sustainable outcomes.
- Farmers should receive both moral and financial support to adopt practices like apiculture, horticulture, and others to maximize their farm's benefits.
- It is essential to monitor and maintain a balance with the wildlife that is approaching residents, including monkeys, wild pigs, and elephants.
- Farmers should be encouraged to continue cultivating traditional crops while also being introduced to more profitable crop options. ■

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Courtesy: Alamy

ANCIENT HORTICULTURE *in* THE HILLS

The Legacy of Uttarakhand's Agricultural Ingenuity

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Uttarakhand is known for its mountains, diverse plant and animal life, and long history of farming. While it is famous for its beautiful scenery and holy places, the state also has a long tradition of gardening and growing crops in ways that show a strong respect for nature and sustainable living. These practices, refined through generations, reveal the ingenuity of hill communities in cultivating diverse crops in one of the world's most challenging environments. What makes Uttarakhand's horticultural past especially fascinating is the intricate integration of horticulture with culture, spirituality, and social customs. Traditional knowledge systems emphasized seasonal planting aligned with lunar cycles, indigenous seed preservation, and polyculture — growing multiple crops such as amaranth, buckwheat, millets, pulses, and fruit trees like apricot and walnut within a single plot. These systems not only enhanced food security but also enriched the nutritional diversity of local diets. Ancient horticultural practices in India, particularly in the Himalayan region of Uttarakhand, reflect a deep understanding of ecological balance

Phyllanthus emblica (Amla)

Zanthoxylum armatum (Timur)

and sustainable agriculture. One notable example is the cultivation of Zanthoxylum armatum, commonly known as timur or toothache tree, which has been used for centuries both as a spice and a medicinal plant. Rich in bioactive compounds such as alkaloids and flavonoids, Z. armatum was traditionally grown in home gardens and forest margins, contributing to biodiversity and soil conservation. Its antimicrobial and anti-inflammatory properties were well recognized in traditional Ayurvedic and folk medicine systems. Another example is *Phyllanthus emblica*, commonly known as amla or Indian gooseberry, which stands

Traditional knowledge systems emphasized seasonal planting aligned with lunar cycles, indigenous seed preservation, and polyculture – growing multiple crops such as amaranth, buckwheat, millets, pulses, and fruit trees like apricot and walnut within a single plot. These systems not only enhanced food security but also enriched the nutritional diversity of local diets.

out as one of South Asia's most enduring ancient horticultural products. Cultivated since Vedic times in the foothills of the Himalaya (including Uttarakhand) and referenced in classical texts such as the Charaka and Sushruta Samhitas, amla trees thrive on welldrained, slightly acidic loamy soils at elevations between 600 and 2,100 m. The spherical, palegreen drupes are exceptionally rich in ascorbic acid—often exceeding 600 mg per 100 g of fresh fruit—alongside potent polyphenolic antioxidants (emblicanins A and B, gallic acid, and ellagic acid) that confer both nutritional and therapeutic benefits. Traditional agroforestry systems intercropped amla with legumes and grasses to improve soil fertility through nitrogen fixation, while low input pruning and organic mulching maintained tree vigor. This synergy of ancient cultivation practices and the fruit's unique phytochemical profile illustrates why amla remains a scientifically validated, sustainable crop in modern horticulture. Moreover, sacred groves and forest gardens, often protected for their spiritual significance, contributed to biodiversity conservation, long before formal ecological science recognized their value.

GEOGRAPHICAL AND CLIMATIC CONTEXT

Uttarakhand's terrain ranges from subtropical foothills to alpine elevations, producing a wide range of microclimates that have historically influenced agricultural practices (Sharma & Verma, 2019). Faced with steep slopes and erratic rainfall, early settlers developed terrace farming to conserve soil and water. These terraces, reinforced with stone bunds and organic mulch, enabled the cultivation of crops on otherwise unarable land. The adaptive strategies of these communities laid the foundation for sustainable horticulture, long before the termgained modern relevance.

HISTORICAL AND ARCHAEOLOGICAL EVIDENCE

Archaeological findings and historical records suggest that horticulture in Uttarakhand dates back to the early Iron Age (Kumar, 2015). Ancient texts and folklore describe methods for cultivating fruits, vegetables, and herbs on hill slopes, often guided by lunar cycles and indigenous ecological wisdom. Terracing was the cornerstone of these systems, simultaneously serving as an erosion control method and a technique to create diverse microenvironments (Mishra & Shukla, 2012).

INNOVATIONS IN ANCIENT HORTICULTURE

Terrace Farming and Soil Conservation: Perhaps the most iconic feature of Uttarakhand's ancient agriculture, terrace farming converted steep terrain into productive farmland. These structures improved water retention and prevented runoff during

monsoons, ensuring long-term soil fertility (Singh et al., 2018).

Traditional Irrigation Techniques: Water scarcity during dry spells led to the development of gravity-fed irrigation systems. Channels carved into hillsides diverted spring and rainwater to terraced fields. Small check dams and ponds stored water during the monsoon for later use, an approach modern hydrologists recognize as both efficient and environmentally sound (Joshi & Rana, 2020).

Crop Diversity and Polyculture: Farmers in ancient Uttarakhand practiced polyculture, growing cereals like millets and buckwheat alongside pulses, tubers, and fruit trees. This diversity increased nutritional security and acted as a buffer against crop failure (Gupta &Rao, 2017). The strategic use of native varieties also fostered genetic resilience to local pests and climatic fluctuations.

Organic Soil Management: Soil fertility was maintained through composted animal manure, crop rotation, and green manures. These organic methods not only enriched the soil but promoted microbial activity essential for plant health (Bhatia, 2016). Unlike modern chemical farming, these practices preserved ecosystem stability.

CULTURAL SIGNIFICANCE AND GENDER ROLES

The development of horticultural practices in the hills of Uttarakhand was not merely an agricultural innovation; it was deeply intertwined with the cultural and social fabric of the region. Agriculture was more than a means of sustenance—it was an expression of identity, tradition, and spiritual connection to the land. Festivals, rituals, and community gatherings often revolved around agricultural milestones such as sowing, harvesting, and celebrating thebounty of the earth (Sinha, 2018).

Local knowledge, passed down through generations, was often encoded in folklore and oral histories. These narratives provided insights into the symbiotic relationship between humans and nature. Rituals invoking blessings from local deities were performed to ensure a bountiful harvest, reflecting a belief system where nature was revered and treated with respect. This cultural framework not only enhanced community cohesion but also fostered practices that were inherently sustainable.

SCIENTIFIC ANALYSIS OF ANCIENT PRACTICES

Recent studies have confirmed the scientific validity of these traditional systems. Joshi and Rana (2020) used hydrological modeling to show that terraced

Farmers in ancient Uttarakhand practiced polyculture, growing cereals like millets and buckwheat alongside pulses, tubers, and fruit trees. This diversity increased nutritional security and acted as a buffer against crop failure.

fields could retain up to 70% of rainwater runoff. Similarly, research into organic soil amendments highlights their positive impact on microbial diversity and long-term soil structure (Bhatia, 2016). Polyculture is now gaining renewed interest for its role in enhancing crop resilience under changing climate conditions (Gupta & Rao, 2017).

INTEGRATION WITH MODERN AGRICULTURE

In recent decades, there has been a push to revive ancient horticultural techniques in response to soil degradation and climate instability. The terraces of Kumaon and Garhwal are being restored through community initiatives, often supported by NGOs and agricultural universities (Singh et al., 2018). Organic farming movements in districts like Almora and Pithoragarh have reintroduced composting and intercropping practices. These efforts are proving successful in improving yield stability and conserving biodiversity. Government-supported programs are also documenting traditional knowledge and training younger generations in sustainable techniques. Initiatives like school gardens and farmer field schools help preserve this agricultural heritage while integrating it with modern innovations such as biofertilizers and climate-resilient seed varieties (Joshi & Rana, 2020).

CHALLENGES TO CONTINUITY

Despite these efforts, traditional horticulture faces significant threats. Urbanization, climate change, and market-driven monoculture are eroding agrobiodiversity and displacing indigenous practices. Younger generations often prefer modern farming methods or urban employment, leading to a gradual loss of knowledge that was once passed down orally (Sinha, 2018). The absence of formal documentation and scientific validation of many traditional techniques has also hindered their broader adoption. This makes it imperative to bridge the gap between tradition and technology through research, policy, and education.

CASE STUDIES IN REVIVAL

Kumaon Terracing Project: In the Kumaon region, a collaborative project between local NGOs and agricultural universities has successfully restored traditional terrace farming techniques. Farmers have reported improved water retention and reduced soil erosion, which have led to more consistent crop yields even during erratic rainfall periods (Singh et al., 2018).

Almora's Organic Movement: Almora, another district in Uttarakhand, has witnessed a resurgence of organic farming practices that closely mirror ancient techniques. Farmers here have re-adopted the use of organic compost and crop rotation, leading to healthier soils and a noticeable increase in the diversity of cultivated crops (Bhatia, 2016).

Community-led Irrigation Restoration Projects: Several communities in the hilly regions of Uttarakhand have banded together to restore ancient irrigation channels and check dams. These

Apple Tree

Local knowledge, passed down through generations, was often encoded in folklore and oral histories. These narratives provided insights into the symbiotic relationship between humans and nature.

Wallnut tree

projects, often supported by local governments and international environmental agencies, serve as living laboratories for demonstrating how traditional water management practices can enhance modern agricultural productivity (Joshi &Rana, 2020). These examples show that traditional horticulture can be successfully integrated into modern sustainable agriculture with the right institutional support.

CONCLUSION

The ancient horticultural practices of Uttarakhand stand as a testament to human ingenuity and the capacity to adapt to challenging environments. Through the careful management of terraced landscapes, innovative irrigation techniques, and a deep understanding of ecological balance, early agriculturists in this region developed systems that ensured food security and preserved natural resources. Their legacy is not only embedded in the physical terraces that dot the hillsides but also in the cultural narratives and sustainable practices passed down through generations. As modern agriculture grapples with the twin challenges of climate change and environmental degradation, there is much to learn from these ancient techniques. Revitalization of traditional horticulture, supported by modern scientific research and sound policy measures, offers a promising path towards sustainable development. In embracing the wisdom of the past, we may well find the keys to a resilient and ecologically balanced future. ■

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TRADITIONAL METHODS OF WATER CONSERVATION *for* AGRICULTURE IN UTTARAKHAND

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Courtesy: H Gupta

The increasing gap between the demand for and supply of natural resources has promoted the importance of sustainability. India is confronted with severe water scarcity challenges, especially in the Himalayan Region. Rapid urbanization in this fragile ecosystem has further worsened the challenges of water scarcity. Uttarakhand, located in the western Himalayas, is rich in water resources, with over 12,000 glaciers and 8 major river catchments. The region has ample water resources, receiving an average rainfall of 100 to 200 cm during the monsoon season. However, the uneven distribution of these resources, combined with the rising demand for various uses such as drinking water, domestic use, irrigation, hydroelectric power, and industrial needs, continues to pose significant challenges. The limited availability of water is inadequate to support agricultural production and effectively address rural poverty in the region. The neglect of traditional knowledge and ineffective water management hinder the full utilization

Courtesy: H Gupta

of natural resources and obstruct the holistic development of Uttarakhand economic sectors.

Local water springs are essential for meeting the daily water needs of villages. However, in recent decades, there has been a significant decline in the availability of water from these springs and other sources. It is crucial to set a new balance that promotes the responsible use of water by integrating traditional and modern techniques while considering local culture and geo-environmental conditions (Bandooni et al., 2017).

TRADITIONAL WATER CONSERVATION STRUCTURES

The state benefits from ample water resources and a variety of conventional irrigation systems, including *Naula* (small stepwells), *Gadheras* (small river tributaries), *Gul* (traditional irrigation canals), *Dhara* (perennial springs), and *Chaal-Khal* (artificial ponds on hilltops). *Naula* and *Dhara* are significant water reservoirs that continue to be the main sources of drinking water in many hilly areas of Uttarakhand from centauries, particularly in the Kumaon division. Communities rely on water from these sources not only for drinking and domestic purposes but also for agriculture and the operation of traditional watermills.

Naula and *Dhara* are ancient water harvesting systems worshipped in Uttarakhand's tradition and culture. *Naulas* constructed during the Katyuri and Chand dynasties in Kumaon continue to serve communities even today. Notable examples include the millennium-old *Naula* at Suryakot in Almora; the 700-year-old structure near the Haat Kalika temple in Gangolihat (Pithoragarh), built by Raja Ramchandra Dev, the Garhsher Naula in Bageshwar, dating back to the 7th century and the Baleshwar Naula, established by Raja Thorchand in 1272. Other prominent examples include the Ranidhara Naula in Almora, Pattiani Naula and Tularameshwar Naula in Shealgaon (Almora) and Pahadpani Naula in Nainital. Several Naulas also feature intricate stone carvings, with the Ek Hathiya Naula in Dhakana village of Champawat district standing out as a particularly remarkable example.

Trenches in the forests of Gharwal region

Arvind Kumar (2023) conducted a Participatory Rural Appraisal and found that the Dewal Block in the Chamoli district is rich in natural resources that can meet the basic needs of its residents. The major crops grown in the region include mandua, wheat, rice, and chaulai, along with a variety of vegetables and fruits such as potatoes, malta oranges, lemons, and peaches. During the monsoon season, most surface water is sourced from heavy rainfall. However, steep slopes, difficult geographical conditions, and inadequate management techniques cause much of this water to flow into the valleys due to gravity. These challenges are adversely affecting the socio-economic conditions of the region. To address these challenges, the local community use traditional methods including chal-khal system, pit technology, gullies, farm ponds or tanks (locally known as talabs) along with the plantation of broad-leaved trees and oak forests.

A reasonable cropping pattern can be adopted without sacrificing farmers income. Water conservation practices can be implemented to strengthen supply-side management. The construction of establishments such as check dams, farm ponds, nala bunds, trenches and baudi plays a significant role in conserving and enhancing groundwater resources. These traditional water sources have provided fresh water supplies for centuries. These sources are often surrounded by a variety of vegetation, including *Ficus benghalensis, Mangifera indica,* and *Ficus religiosa,* which help to create a moist and cool environment.

LOCAL METHODS FOR WATER CONSERVATION

In Uttarakhand, methods for water conservation are used to ensure a reliable water supply. This is crucial for achieving food security, enhancing agricultural activities through improved irrigation, and creating more livelihood opportunities for the local community. To accomplish this, scientific methods must be integrated with traditional knowledge. This approach enhances productivity, drives economic growth, creates livelihood opportunities, and improves the socio-economic needs of local

communities, ultimately contributing to the overall development of the state economy. Chandi Prasad (2019) reported various types of traditional water systems in Kedarnath Valley which are used for daily water needs. The names of these structures may vary in different parts of Uttarakhand. The construction of *dhara*, *naula*, *chaal-khal*, *simar* and *dhaab* is one of the most common conventional water conservation devices used by the villages.

Chaal-khal (Tal)

The Chaal-khal system is one of the traditional and most widely used methods of water conservation by local communities in Uttarakhand. These ponds, typically rectangular or oval in shape, are constructed along mountain ridges, often situated in the saddles between two crests. Their construction requires minimal effort and technical expertise. Chaal-khals serve multiple purposes, including regenerative agriculture, domestic water needs and providing water for wildlife. Wild animals often visit these reservoirs or Chaal-khal systems, to access drinking water. Additionally, local communities create small ponds surrounded by various grasses and trees to enhance soil moisture retention, thereby promoting the healthy growth of surrounding vegetation.

Chaal-khal in Alomra district of Uttarakhand

Kul/Guls

To irrigate terraced fields, small channels known as Guls or Kuls, commonly found in the Kedarnath Valley, are structured by diverting water from rivers or gadheras using gravity. The management and maintenance of these irrigation channels are handled by the community, reflecting a strong tradition

of cooperative water governance. Scientific techniques are used to define the optimal slope and water volume for diversion. Temporary check dams are built along the river to channel water into the kuls for irrigation purposes. There are two types of kuls: Kachi kuls and Pakki kul.

Check dam to channel water in Kuls

The chaal-khal system is one of the traditional and most widely used methods of water conservation by local communities in Uttarakhand. These ponds, typically rectangular or oval in shape, are constructed along mountain ridges, often situated in the saddles between two crests.

Pakki kul in Tehri district of Uttarakhand

Kachi kuls are built using sand, soil, and stone and are conventionally constructed by local people. Pakki kuls are permanent diversion establishments made of cement, constructed by the state government. Although kuls are primarily used for irrigation, they are also used for grinding wheat through gharats (water mills), as well as supplying water for drinking, domestic use, and for livestock.

Dhara

Dhara is a common source of drinking water in the Garhwal Mandal, also known as panjera in the Kedarnath Valley. It primarily serves as a drinking water source, where water from springs or underground sources is directed through carved outlets. These outlets are designed in various shapes, including simple channels as well as intricate figures resembling cow, elephant, ox, and lion face masks.

Dhara for drinking water

The design of these outlets ensures that water can be easily accessed and consumed, even under low water pressure. These structures greatly contribute to the promotion of eco-tourism in Uttarakhand by providing tourists with free, natural drinking water from the dhara.

Dhaab

The dhaab is a traditional water harvesting structure found in both the Garhwal and Kumaon regions. It plays a vital role as a source of drinking water for both humans and animals, and it also provides water for tasks such as washing clothes and utensils. Dhaabs are basic structures commonly found in high-altitude areas. They collect and store water from springs, known as 'dhaara' or from water that seeps naturally from the ground, referred to as 'chhuyan' In the Chamoli district, these structures also serve as crucial water sources for birds and wildlife. In Himachal Pradesh, similar traditional water harvesting structures are known as 'Baudi'

These structures are not only vital for water storage and conservation but are also revered by local communities. In many parts of the state, baudis are considered a divine gift from Lord Shiva and are worshipped as sacred.

Pit Technology

Pit technology for water harvesting involves digging small pits in the ground to capture and

store rainwater. These pits are typically located in areas with significant rainwater runoff. The collected water can be used for various purposes, such as irrigation, watering livestock, and, depending on its quality and maintenance, even for drinking. This technology is a small part of the watershed development in the hilly areas. Sometimes, the vegetation around these pits become the part of the riparian buffers. This technique conserves water, retains soil moisture, and creates a healthy microclimate, which helps to promote the growth of native plants. The roots of these plants retain water, allowing it to seep gradually downslope as gravity pulls it. People can then collect this water at the bottom of the valley and use it to meet their daily needs. They mostly practice these structures in the Thalisain tehsil of Pauri Garhwal district in Uttarakhand. Phaldia village is a prime example, where the community still collects water from Gadhera and rivulets.

Boulder pit near Kosi, Almora

CULTURAL AND ECOLOGICAL SIGNIFICANCE OF NAULAS AND TRADITIONAL WATER HARVESTING STRUCTURES

A naula is a small groundwater harvesting system, resembling a stepwell, that is designed to collect water from a natural groundwater source. It consists of a stone wall constructed over the source. In the cultural landscape of Kumaon, these traditional water systems are revered alongside temples and are often built in a similar architectural style. This intentional design may have been made to evoke a sense of sacredness and encourage the protection of natural water sources. To keep these water sources safe and clean, people often place herbs, medicinal plants, and fruits like amla (Phyllanthus emblica) around the naula. Additionally, some craftsmen place a small copper plate or pot at the bottom of the naula to help purify the water. Large crowned trees like banj oak (Quercus leucotrichophora) are planted near naulas to decrease evaporation and provide green cover in the surrounding recharge zones. These abovementioned structures also serve as cultural spaces, often used for social gatherings and community events. This cultural connection is especially prominent in Almora, where people regularly walk to collect water from local sources throughout the day. This water is often used for daily religious rituals and social ceremonies.

This article emphasizes the significance and conservation of traditional water structures in mountainous landscapes, such as naulas and dharas, which have often been overlooked in academic literature and cultural representations of these regions. However, these systems deserve more protection due to their multifaceted importance. Recognizing the significance of traditional water systems, it is essential to address the challenges they face and revive them as sustainable freshwater sources for both present and future generations.

"Long before pipes whispered and pumps roared, ancient water wisdom coaxed rain into grain, quietly nourishing the land." ■

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