11TH HIMALAYAN POPULAR LECTURE

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September 10, 2024

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Dr. Devina Vaidya currently serves as the Associate Director (Research & Extension) at Regional Horticultural Research and Training Station, Bajaura, Kullu, Dr. YS Parmar University of Horticulture and Forestry, Himachal Pradesh. A distinguished expert in Food Science and Nutrition, Dr. Vaidya has made significant contributions to agricultural research, post-harvest technology, and food processing, particularly within the context of hill and mountain agriculture.

She is the Principal Investigator of multiple nationally funded research projects, including the All India Coordinated Research Project on Post-Harvest Engineering and Technology (PHET) supported by ICAR, and state-level initiatives focusing on the development of value-added food products and agro-processing infrastructure. Her research also includes critical work on assessing post-harvest losses in India, funded by the Ministry of Food Processing Industries (MOFPI).

Dr. Vaidya's extensive publication record spans reputed national and international journals, addressing subjects ranging from nutrient-rich functional foods to innovative processing techniques such as supercritical fluid extraction. Notable recent works include studies on Aloe vera microencapsulation, bioactive compound extraction, and the utilization of Himalayan wild apricot by-products. In addition to her research, Dr. Vaidya has authored several manuals and books that serve as practical guides for students and practitioners in the field of food technology and postharvest processing.

Her contributions have been recognized through numerous accolades, including the Life Time Achievement Award (2020) by the Agro Environmental Development Society and multiple academic and research awards from ICAR and other institutions.

Through her academic leadership, applied research, and community-based training programs, Dr. Vaidya continues to promote sustainable agricultural practices and food security in mountainous regions.

Enhancing Livelihood in North-Western Himalayan Region through Sustainable Horticulture practices

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Introduction

The North-Western Himalayan region is a diverse and ecologically sensitive area where agriculture and horticulture play a crucial role in sustaining livelihoods. However, traditional farming practices often face challenges such as climate variability, soil degradation, and limited market access, which impact the economic stability of local communities. Given the region's dependence on agriculture, there is an urgent need for sustainable solutions that can enhance productivity while preserving the delicate ecosystem (Ahmad et al., 2024).

India's North-Western Himalayan region, covering states such as Jammu & Kashmir, Himachal Pradesh, and Uttarakhand, is known for its rich biodiversity, diverse climatic conditions, and suitability for horticultural activities. The region supports the cultivation of temperate fruits, medicinal plants, spices, and vegetables. However, farmers here face multiple challenges, including erratic weather patterns, declining soil fertility, limited infrastructure, and restricted access to markets. These issues not only threaten the livelihoods of farming communities but also pose a risk to the long-term sustainability of agriculture in the region. Sustainable horticulture emerges as a promising solution to these challenges by promoting eco-friendly farming techniques, efficient resource utilization, and the cultivation of high-value crops (Babu, 2024). By integrating scientific advancements with traditional knowledge, farmers can adopt organic farming, integrated pest management, water-efficient irrigation techniques, and soil conservation methods. Such practices not only enhance crop yields but also contribute to environmental conservation, prevent land degradation, and build

resilience against climate change. Additionally, the promotion of high-value crops like apples, walnuts, saffron, and medicinal herbs can significantly boost farmers' incomes and improve their standard of living (Malik et al., 2018). Recognizing the potential of sustainable horticulture, various government initiatives, research institutions, and local cooperatives are playing a crucial role in supporting this sector. Policies encouraging agroforestry, value addition, and market integration are helping small and marginal farmers seize new opportunities. Moreover, advancements in post-harvest management, cold storage facilities, and processing industries further strengthen the horticulture value chain, ensuring better price realization and reducing post-harvest losses (Kadam et al., 2020).

This initiative aims to explore and promote sustainable horticulture practices in the North-Western Himalayan region by integrating scientific knowledge with traditional wisdom. By empowering farmers with innovative techniques, capacity-building programs, and improved access to national and international markets, the horticulture sector can become a key driver of economic development and environmental sustainability. Strengthening this sector will not only enhance rural livelihoods but also contribute to the long-term prosperity of the region while preserving its fragile ecosystem (Bhardwaj and Sharma, 2012).

The North western regions

The Himalayas in India covers about 18 per cent of the geographical area and accounts for more than 50 per cent of the country's forest cover and 40 per cent of the species endemic to the Indian subcontinent. The Himalayan states consists approximately 4 per cent of total population in India and majority of the population depends on agriculture, animal husbandry and horticultural products (Jindal and Sharma, 2004).. Though the Himalayan region is rich in biodiversity, but there are challenges like climate change, degradation of natural resources, soil erosion, fragmentation of land, etc. that poses a great threat to entire Himalayan biodiversity, agriculture, ecosystem and livelihood of its human population. Problems like the loss of biodiversity, forest cover, agricultural productivity and ecosystem services are interlinked in the Himalayan region that threatens the sustainable livelihoods of not only millions of populations living in the mountainous region but also much larger population inhibiting the adjoining Indo-gangetic plains ("Himalayan Resources", 2012). There are also issues like lack of livelihood opportunities, access to jobs, increasing outmigration that need to be addressed and efforts have to be taken for sustainable development. The North-West Himalayan region consists of three states:Himachal Pradesh, Jammu & Kashmir, and Uttarakhand (Haq et al., 2023)

The state of Himachal Pradesh, which is almost wholly mountainous can be divided into five zones:

i. wet sub-temperate zone,

ii. (ii) humid sub-temperate zone,

iii. (iii) dry temperate-alpine high lands,

iv. (iv) humid sub-tropical zone, and

v. (v) sub-humid sub-tropical zone.

Agriculture is the main source of livelihood as it contributes about 16.20 per cent to the net state domestic product and 69 per cent of population directly depend upon agriculture. The sector also employs about 3.10 per cent of total population. The state is extremely rich in hydroelectric resources and it has been estimated that about 20,300 MW of hydroelectric power can be generated (Singh et al., 2023). Due to the geographical and climatic conditions, the fragile ecology of this mountainous state is vulnerable to various natural disasters. The environmental problems that has been created through the increased and consistent pressure on the mountain environment like landslides, heavy snowfall, flash floods, forest fires, land degradation, removal of vegetation and soil erosion is of great concern for agriculture sustainability in the state. It has been estimated that about 58 per cent of the land which is mostly located in Himalayas is subject to intense soil erosion (Govt. of Himachal Pradesh, 2012).

Challenges in Horticulture

Shifting Cultivation and Crop Production

The Himalayan region is home to approximately 34 million people, a significant portion of whom belong to hill farming communities, including those in the mountains. These communities primarily rely on subsistence farming, which they practice on marginal rainfed and some irrigated lands, covering 15.8% of the Himalayas' total area—about 53.8 million hectares. The remaining landscape consists of rangelands, pastures, wastelands, bushland grazing areas, and forests, collectively accounting for nearly 69% of the region. An additional 15.2% of the Himalayas is under permanent snow cover and rocky terrain, serving as a perennial source of clean water for both the hill communities and the rest of the nation (Partap, 2011).

Agriculture remains the backbone of the regional economy, contributing approximately 45% to the total income of the inhabitants. The majority of farming households own less than 0.5 hectares of land, while small landholders cultivate between 0.5 and 1.0 hectares. In Himachal Pradesh, the average landholding size is around 1.2 hectares, while in Uttaranchal, it is slightly smaller at 1.01 hectares. In the northeastern Indian Himalayas, shifting cultivation, or "jhum," remains a dominant practice, accounting for 85% of the cultivated area and supporting approximately 1.6 million people, predominantly tribal communities (Banerjee, and Chhetry, 2017). Traditionally, these communities were self-sufficient in food production, but they now struggle to meet their annual food needs. Swidden farming, an adaptive response to the ecological constraints of humid tropical regions, fosters agroecosystem diversity and resilience against microclimatic variability (Janakiram and Reddy, 2016).

Across the Himalayan region, staple food grains occupy 76% of the gross cropped area. While food grain production has not declined significantly, concerns persist over future reductions due to a growing shift toward cash crop farming. In the western Himalayas, wheat is the dominant crop, alongside rice, maize, millets, barley, buckwheat, pulses, and oilseeds (Kumar et al., 2021). Uttarakhand is distinctive for its higher proportion of land under millets and pulses. In contrast, the northeastern Himalayas primarily cultivate rice, which covers about 81% of the cropland dedicated to food crops. Farmers in this region practice mixed farming, growing a diverse range of 8–10 crops per cycle. Trends indicate a decline in the cultivation of paddy and maize, whereas wheat production remains stable. The expansion of cash crops, including fruits and vegetables, is largely responsible for this shift (Pachiyappan et al., 2022).

Expanding Horticulture in the Himalayan Region

The Himalayan terrain offers favorable conditions for cultivating a diverse array of horticultural crops. Specific microclimatic zones provide optimal conditions for crops such as apples, citrus fruits, walnuts, plums, peaches, bananas, mangoes, and pineapples (Yadav et al., 2003). Additionally, vegetables like tomatoes, radish, potatoes, cabbage, and cauliflower, along with high-value crops such as ginger, chilies, cardamom, saffron, and ornamental flowers (orchids, gladioli, marigolds, chrysanthemums), are widely grown. Horticultural crops now cover approximately 16% of the total cropland, with the western Himalayas exhibiting a higher share (20%) compared to the central and eastern Himalayan states (5%). The growing prominence of horticulture holds promise for enhancing food and economic security among hill farmers. However, the transition to horticulture introduces

new ecological and socio-economic challenges, such as pollination failures, social disparities, and gender inequities (Chand, 1996).

Constraints Facing Hill Agriculture

Hill agriculture is characterized by inherent challenges, including remoteness, inaccessibility, fragile soil conditions, and limited water availability. The short growing season further compounds these difficulties. Socio-economic constraints include small landholdings, low productivity, labor shortages, weak post-harvest management, inefficient market networks, and inadequate entrepreneurship development. These limitations have led to the underutilization of available resources and constrained economic surpluses (Handique ei al., 2022). Despite these challenges, the Himalayan region possesses unique advantages that can be leveraged for agricultural development. Specific niches such as apple orchards in Himachal Pradesh, saffron cultivation in Kashmir's Soppore Valley, pashmina goat rearing in Ladakh, and mithun husbandry in Arunachal Pradesh present opportunities for targeted investments. However, increasing pressure on common property resources (wastelands, rangelands, and forests) has led to encroachment by farming communities, causing ecological stress and an increase in out-migration. As a result, a significant proportion of women now manage farming households, contributing to a "money-order economy" driven by remittances from male family members working in urban areas (Sharma et al., 2022).

Market and Resource Constraints in Horticulture

Despite the potential of horticultural expansion, several constraints hinder its development. Poor orchard management, limited availability of quality planting materials and inputs, inadequate extension services, and weak market linkages pose significant challenges. Farmers struggle with accessing market information, processing facilities, and value-addition techniques. The absence of reliable markets discourages diversification into high-value crops, making farmers hesitant to shift from traditional agriculture. Additionally, acute fodder shortages exacerbate difficulties in livestock management, with many rangelands overrun by invasive, non-palatable plant species such as lantana, eupatorium, and congress grass. Estimates suggest a 70% fodder shortage across the Himalayan farming communities (Melo and Das, 2022).

Scarcity of Arable Land and Water Resources

Land is central to livelihoods in the Himalayan region, yet the availability of cultivable land is rapidly diminishing. For small and marginal farmers, land ownership dictates economic stability, and the fragmentation of landholdings continues to threaten

food security. The region's arable land accounts for only 11% of the total area, yet it supports a disproportionately large farming population. This scarcity is further exacerbated by increasing human settlements, urbanization, industrial expansion, and infrastructure development. The conversion of valley croplands to non-agricultural uses has created significant concerns about sustainability (Tulachan, 2001).

The scarcity of water for both irrigation and drinking purposes is another pressing issue, worsened by climate change-induced variations in precipitation and glacial melt. Addressing cropland and water scarcity is imperative to ensuring the sustainability of hill agriculture (Hussain, et al., 2021).

Emerging Issues in Horticultural Diversification
While some Himalayan states have successfully diversified into fruit and vegetable farming, this transition has introduced several new challenges:

- Many marginal farmers remain excluded from the benefits of diversification due to land and water shortages.
- The emergence of second-generation issues in cash crop farming, such as soil degradation and declining productivity.
- The growing population of educated yet unemployed youth from farming backgrounds who require skills and entrepreneurship training.
- Underutilized comparative advantages in hill agriculture.
- The biological degradation of wastelands and common property resources.
- The impacts of climate change on agricultural productivity and sustainability.
- Weak agricultural research and extension services.

Rethinking Soil Erosion and Degradation in Hill Horticulture
Conventional perceptions regarding land degradation in the Himalayas have often placed blame on farmers for deforestation and soil erosion. However, recent studies challenge these assumptions, arguing that restrictive policies have contributed to unrest and alienation among hill communities. Rather than imposing restrictive regimes, policies should focus on enabling hill farmers to manage resources

efficiently. Given the right conditions, mountain communities have demonstrated their ability to use natural resources prudently and sustainably (Partap, 2011).

The Geographic Knowledge Gap and Policy Implications

Traditional geographic calculations of hill states have failed to account for the verticality of mountains. New GIS-based digital elevation models reveal that the actual land area is significantly larger than previously estimated. For instance, Himachal Pradesh's official area is recorded as 55,000 square kilometers, but advanced measurements suggest an actual area of 88,000 square kilometers. This additional land is largely non-cropland, necessitating policy interventions to account for ecosystem services provided by hill farmers, similar to the Swiss model of economic compensation for mountain agriculture (Subedi et al., 2021).

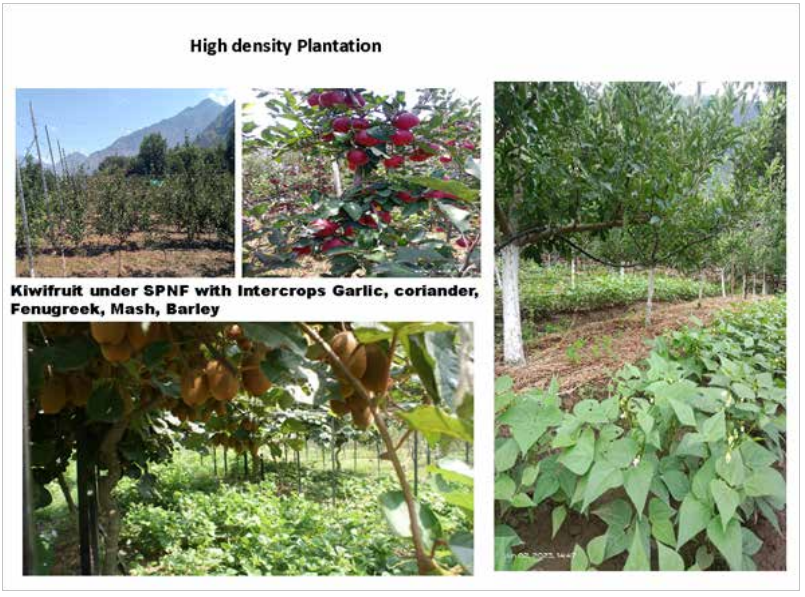
Figure 1: Value Chain Overview

Strategies for Sustainable Horticulture Development

Enhancing Livelihoods through Fruit Farming

Himachal Pradesh highlights the transformative impact of fruit farming on marginal farmlands in the hills. By adopting fruit-based production systems, many hill farmers have successfully alleviated poverty and improved their quality of life. Today, over 86% of the population is literate, with almost 100% literacy among children under 14 years. From the perspective of employment and income generation, fruit and vegetable farming offer high-quality opportunities for hill farmers (Sharma et al., 2006). These agricultural activities also create strong backward and forward linkages, further enhancing their economic viability. Fruit farming in Himachal Pradesh has effectively addressed two major livelihood concerns:

- Optimized use and management of marginal land resources
- Conversion of non-viable subsistence farming into a profitable venture by leveraging the unique niche potential of mountain lands (Sharma and Thakur, 2016)



Developing the Concept of Economic Forestry

Seabuckthorn cultivation has emerged as a groundbreaking initiative that integrates desert conservation with the economic needs of farmers in China's arid hilly regions. The establishment of seabuckthorn plantations, coupled with research and development in post-harvest processing, has led to the production of valuable products such as medicines. This initiative has significantly benefited both households and the regional economy. China has successfully managed millions of hectares of seabuckthorn forests, and by 2004, the seabuckthorn agro-enterprise had grown into a multi-million-dollar industry. This success story exemplifies how a strategic combination of horticulture and forestry can foster an economically and ecologically sustainable hill farm economy (Singh, 2018). A well-maintained seabuckthorn forest provides the ecological benefits of a natural forest on sloping lands and river valleys while yielding the economic advantages of a productive fruit orchard. Local farmers have a strong economic incentive to

maintain seabuckthorn forests, while government institutions support their long-term ecological benefits. In India, brands like LEH BERRY are yet to replicate this success story for Himalayan farmers in Ladakh, Himachal Pradesh, Sikkim, and Arunachal Pradesh (Sharma and Singh, 2018).

Rethinking Hill Horticulture Development

To ensure the sustainability of hill farmers' livelihoods, it is essential to view hill agriculture comprehensively. Hill or mountain agriculture is best understood as a livelihood system that includes diverse land-based activities such as cropping, horticulture, livestock management, rangelands, pastures, and forestry. The International Centre for Integrated Mountain Development (Jodha et al., 1992) identified six specific characteristics of mountain and hill agriculture: inaccessibility, fragility, marginality, diversity, niche potential, and adaptation mechanisms. These characteristics, encompassing physical, biological, and socio-economic dimensions, determine the effectiveness of any development intervention (Pitt, 2024).

Sustainable hill agriculture requires adherence to specific guiding principles:

- **Hill agriculture is best suited for diversified land use rather than a singular approach.** A balanced relationship between people and land resources is essential, as productivity is influenced by both biophysical factors and socio-economic conditions. While technologies exist, necessary institutions, incentives, and inputs may be lacking.

- **Identifying and harnessing location-specific niches and land-use opportunities** can optimize productivity and sustainability.

Reevaluating Degraded and Marginal Lands

The concept of marginality in hill regions is dynamic, not static. The suitability of land use must be assessed based on specific agricultural activities. For instance, a rainfed sloping farmland unsuitable for irrigated crops like rice may be highly productive for perennial fruit crops that require less moisture and can tolerate occasional droughts. Similarly, land unsuitable for cropping due to terrain or short growing seasons may support livestock, herbal medicine farming, or fruit cultivation (Partap, 2011).

Addressing Institutional Biases and Neglect

Conventional research and development (R&D) approaches often overlook

sustainable farming solutions for sloping lands. Agricultural R&D has historically disregarded areas with slopes exceeding 15%, while regulations have restricted farming on slopes between 18-30% to prioritize watershed protection. Consequently, technological support for sustainable farming in these areas remains limited, despite ongoing cultivation by local farmers. For decades, hill development policies have focused on maintaining forest cover to prevent potential negative downstream effects. However, this approach has inadvertently restricted opportunities for better land-use alternatives, leading to distress among hill farmers (Partap, 2011).

Another challenge arises from the widespread promotion of chemical fertilizers and pesticides in the name of productivity and food security. In contrast, a significant shift toward organic farming has been observed in several Himalayan states since 2001. A nationwide survey by Partap, 2011) identified several factors encouraging farmers to transition to organic farming:

- Improved soil quality and fertility
- Reduced dependence on external inputs
- Lower production costs and enhanced productivity
- Health benefits from reduced pesticide exposure
- Premium pricing for organic products

The cost-benefit analysis of organic farming has shown favorable economic outcomes for small farmers in India. Additionally, organic farming positively impacts the environment, human and animal health, agro-biodiversity, moisture conservation, and farm incomes.

Empowering Hill Women

Women play a crucial role in hill agriculture, yet their contributions often go unrecognized. Generations of knowledge and experience have enabled women to develop flexible and adaptive farming practices. Unlike men, who focus on the commercial value of timber and forest products, women tend to view trees and forests as multifunctional resources. Despite their vital role in food production and household economies, hill women have limited access to income, credit, land, education, training, and information. Only recently have development programs

begun acknowledging the importance of women's participation. However, many extension approaches and tools remain gender-biased, necessitating more inclusive strategies to engage and empower women in hill development. The success of women's self-help groups (SHGs) and **Mahila Mandals** in several hilly states highlights the potential of women's participation in hill agriculture. Encouraging cooperation and partnership with women can significantly enhance the development of hilly regions and ensure a more sustainable agricultural future (Sharma and Sudarshan, 2010).

Enterpreneurship development opportunities

Niche-Based Production Systems

The diverse agro-climatic conditions of the Himalayan region present numerous opportunities for niche-based production systems that can significantly improve the economic status of hill communities. Several underutilized yet highly valuable niches can be effectively harnessed to enhance the livelihoods of local farmers. These include organic and natural farming, cultivation of indigenous and underutilized crops, conservation of unique landraces, and the promotion of cold-water fisheries such as trout farming (Tulachan, 2001). Many Himalayan regions are naturally organic, as the use of synthetic agrochemicals is either minimal or entirely absent. This provides a competitive advantage in the organic market, both domestically and internationally. Underutilized crops like buckwheat, which is rich in essential nutrients, and Amaranthus, which holds immense potential for value addition, can fetch premium prices for hill farmers. Additionally, various landraces of traditional crops possessing unique traits such as distinct aroma, superior taste, and enhanced nutritional value are at risk of extinction. These crops can be

conserved and cultivated to ensure biodiversity preservation while also generating income for farmers (Aguerre and Bianco, 2023).

Enhancing On-Farm and Off-Farm Employment Opportunities

Increasing employment opportunities in both on-farm and off-farm sectors is crucial for the economic upliftment of hill communities (Anang et al., 2020). Providing vocational training in various agricultural and allied activities can empower local populations and promote self-reliance. Key sectors with high potential in hilly regions include:

- **Post-Harvest Management:** Effective post-harvest management is essential to reduce losses and enhance the value of farm produce. This includes activities such as food processing, packaging, and marketing, which help farmers increase their income. Establishing processing units for fruits, vegetables, and medicinal plants can open up new avenues for employment and entrepreneurship.

- **Mushroom Cultivation:** Growing high-value mushrooms such as oyster and shiitake offers a lucrative income source for hill farmers. Mushroom farming requires minimal land and investment while providing quick returns. Training

programs and support for setting up mushroom farms can boost the economic prospects of rural communities.

- **Protected Cultivation:** The use of greenhouses and polyhouses enables farmers to grow high-value crops throughout the year, reducing dependency on seasonal agriculture. This technology enhances productivity, protects crops from adverse weather conditions, and allows the cultivation of exotic vegetables and flowers that have a high market demand.

- **Cold-Water Fisheries:** Trout farming is highly suitable for the pristine streams of the Himalayan region. Promoting scientific trout farming practices can create sustainable livelihoods and boost fish exports. Providing technical training and financial support for fish farming infrastructure can further enhance its viability.

- **Beekeeping:** The Himalayan region has great potential for high-quality honey production due to its rich floral diversity. Beekeeping not only provides income from honey but also supports pollination, improving crop yields. Encouraging beekeeping as an allied activity can significantly benefit small farmers and entrepreneurs.

- **Dairy and Poultry Farming:** Enhancing livestock productivity through improved breeds, better feeding practices, and veterinary support can make dairy and poultry farming more profitable. Establishing milk collection centers, processing units, and poultry hatcheries can strengthen the supply chain and ensure better income for farmers.

- **Organic Farming:** Promoting sustainable cultivation practices through organic certification can help farmers access premium markets. By reducing dependency on chemical inputs and adopting eco-friendly techniques, organic farming enhances soil health and biodiversity while increasing farmer incomes.

- **Agricultural Mechanization:** Training programs in machinery repair and maintenance can help farmers reduce dependency on external service providers and ensure timely operations. Mechanization also improves efficiency and productivity in farming activities (Ma et al., 2018).

- **Agri-Clinics and Extension Services:** Setting up agri-clinics and extension services can provide farmers with expert guidance on crop management, pest control, and modern farming techniques. These services can bridge the knowledge gap and enhance agricultural productivity in hilly regions.

- **Marketing and Agribusiness Development:** Strengthening market linkages through cooperative societies, farmer-producer organizations (FPOs), and digital platforms can help farmers get fair prices for their produce. Encouraging direct-to-consumer models and value chain development can further enhance profitability.

Given the crucial role of women in hill agriculture, special attention should be given to their empowerment through training and skill development programs. Women-centric initiatives can enhance productivity and ensure equitable participation in the rural economy (Partap, 2011).

Horticultural Potential in the Indian Himalayan Region (IHR)

The agro-climatic diversity of the IHR is conducive to cultivating a wide range of horticultural crops, including fruits, vegetables, flowers, and cash crops. These high-value crops offer greater profitability compared to traditional cereal cultivation. The region supports the production of:

- **Fruits:** Apples, walnuts, plums, peaches, cherries, almonds, citrus fruits,

bananas, mangoes, pineapples, and kiwis.

- **Vegetables:** Tomatoes, radishes, potatoes, cabbages, cauliflowers, and broccoli.
- **Flowers:** Orchids, gladioli, marigolds, and chrysanthemums.
- **Cash Crops:** Ginger, chilies, cardamom, saffron, and medicinal and aromatic plants.

Currently, fruits and vegetables occupy around 16% of the total crop land in the IHR, with a significantly higher proportion (20%) in the western Himalayan states compared to the central and eastern Himalayan states (5%). The western Himalayan region, in particular, is renowned for the cultivation of apples, peaches, pears, cherries, walnuts, and almonds (Partap, 2011).

Recognizing the immense horticultural potential in the region, the Government of India launched the 'Integrated Horticulture Development' program during the 8th Five-Year Plan to promote diversified farming systems. However, the shift towards horticulture has brought new challenges, including ecological concerns (such as marginal lands being converted into fruit orchards) and socio-economic issues related to equity, gender, and ethnicity. These emerging sustainability concerns need to be addressed through targeted policies, community participation, and the promotion of sustainable farming practices to ensure the long-term viability of hill agriculture. By leveraging niche-based production systems, enhancing employment opportunities, and promoting sustainable horticultural practices, the economic prosperity of hill communities can be significantly improved while ensuring ecological balance and long-term sustainability (Davis et al., 2009).

Conclusion

The Indian Himalayan Region (IHR) holds a unique and crucial position in the mountain agro-ecosystem, providing essential resources such as water and supporting the livelihoods of over 1.3 million people. Despite its inherent challenges—fragile geography, limited infrastructure, climate change impacts, and socio-economic pressures—agriculture has remained a key pillar of sustenance for the region. However, to ensure its long-term sustainability, a strategic approach is required that integrates scientific knowledge, climate-resilient practices, and community participation. The IHR's rich biodiversity, traditional knowledge, and niche opportunities offer immense potential for sustainable agricultural and economic development. Organic farming, horticulture, floriculture, medicinal

plant cultivation, and agri-based enterprises like apiculture, fisheries, and value-added processing can significantly enhance the region's economic prospects. To harness these opportunities, site-specific policies rooted in mountain-specific needs, infrastructural investments, and training programs are essential. Engaging local communities in decision-making processes will foster ownership and improve land-use planning. The global and national focus on sustainable development, as reflected in various international agreements and government initiatives, further reinforces the need for immediate and long-term interventions. By adopting a holistic, inclusive, and climate-resilient approach, the IHR can overcome its challenges and thrive as a model of sustainable mountain agriculture.

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Himachal Pradesh Regional Center (HPRC)

Himachal Regional Center is located in Mohal of the Kullu district of Himachal Pradesh state. The Himachal Regional Center was established on July 01, 1992, in a rented building at Dhalpur, District Kullu, and continued up to June 1993. The foundation stone of the center's office and residential complex was laid by Shri Kamal Nath, Hon'ble Union Minister for Environment and Forests on June 2, 1993, in Mohal village of Kullu district. During the construction of the office and residential complex, the work of Himachal Regional Center was conducted from June 1993 to March 1999 at the rent building of Shamshi, Kullu. After the construction of a permanent building in Mohal in the year 1998, on April 02, 1999, the office and residential complex were duly inaugurated by Hon'ble Shri Suresh Prabhu, Environment Minister, Ministry of Environment and Forests, Government

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