ICIMOD

HI-LIFE

Mountain agricultural systems: Essential elements for their sustainability

Linking research to action in the Eastern Himalaya

Sustainability of mountain agricultural systems

Agriculture is crucial to life in mountain regions. Agricultural systems evolve and transform with people–nature interaction, and accordingly help biodiversity conservation, poverty alleviation, and climate change adaptation. More than 70% of the rural population in the hills and mountains of the Hindu Kush Himalayan (HKH) region relies on agriculture.

Unpredictable drivers of change have an amplified impact on mountain agricultural systems, which are already restrained by topographic vulnerability and development marginality. The sustainability context is therefore essential to make these systems resilient and responsive to the systemic dimensions of sustainable development identified by the Sustainable Development Goals: planet, people, dignity, prosperity, justice, and partnerships.

Transdisciplinary research to explore sustainability

A transdisciplinary approach to sustainability helps us understand "systems knowledge" (current state and dynamics), "target knowledge" (future vision and scenarios), and "transformation knowledge" (decisions and enabling mechanisms) to appropriately guide change from current to more improved future states. The International Centre for Integrated Mountain Development (ICIMOD) and its partners assessed the sustainability of mountain agricultural systems by analysing eight cases of farming systems from Bhutan, China, India, and Myanmar. These cases represent examples of heritage, traditional, transforming, integrated, organic, and commercial systems.

This flyer presents the "systems knowledge" on the performance of eight cases of farming systems against seven sustainability markers. The interrelated sustainability markers collectively inform the extent of sustainability in each system.

Sustainability markers

Seven sustainability markers describe the essential elements required for the sustainability of farming systems: i) space organization (SO) or the use of physical land spaces; ii) resource efficiency (RE) or efficiency in the use of ecological and socioeconomic resources; iii) adaptive features (AF) or the capacity to diversify risks and cope with changes; iv) social well-being (SW) or the promotion of local and traditional value systems for better life; (v) economic prospects (EP) or prospects and aspirations for livelihoods and economic development; vi) integrated approach (IA) or interdisciplinary processes and strategies; and vii) external support (ES) or necessary enabling mechanisms, investments, and partnerships.

PREREQUISITES (PHYSICAL SPACE)

Space organization (SO)

PREREQUISITES (SOCIO-ECOLOGICAL RESOURCES)

Resource efficiency (RE)

Adaptive features (AF)

PREREQUISITES (VALUE SYSTEMS) AND LIVELIHOOD ASPIRATIONS

Social well-being (SW)

Economic prospects (EP)

PROCESSES AND STRATEGIES

Integrated approach (IA)

REINFORCING MECHANISMS

External support (ES)

Sustainability of eight cases of farming systems in the Eastern Himalaya

The sustainability potential of different farming systems, visualized in the form of bar graphs, indicates the extent of balance in each farming system against the seven sustainability markers. The bigger the extent of the bar graph, the better are the current conditions of the given marker. Greater cumulative score and uniformity among graphs for different markers indicate greater sustainability potential of the system.

1. Apatani heritage farming, Ziro Valley, India

An example of a heritage- and culture-driven settled mountain farming system used by the Apatani community, involving the unique tradition of fish-paddy cultivation. (Knowledge co-produced with communities from Bamin Mitchii, Hari, Hong Nitii, Suluya, and Tajang villages)

KEY STRENGTHS

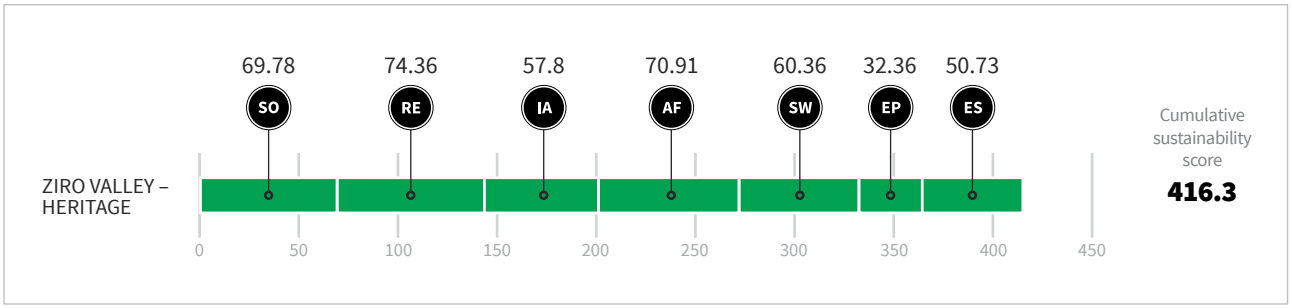
Well-maintained connectivity between farming and natural ecosystems, therefore efficient inflow of services and utilization of land, water, biodiversity resources, and traditional knowledge

KEY CHALLENGES

Decreasing forest cover because of large-scale harvesting for commercial purposes, charcoal making, and the expansion of horticultural crop plantation

Expansion of settlements into highly productive agricultural land

Dilution of traditional ecological knowledge due to urbanization and modernization



2. *Pouk*-based traditional farming, Nagaland, India

An example of traditional land use and resource management system practised by the Ao Naga tribe. The system is based on the traditional shifting agricultural land use and classification system known as *pouk*. (Knowledge co-produced with communities from Mopungchuket and Sangratshu villages)

KEY STRENGTHS

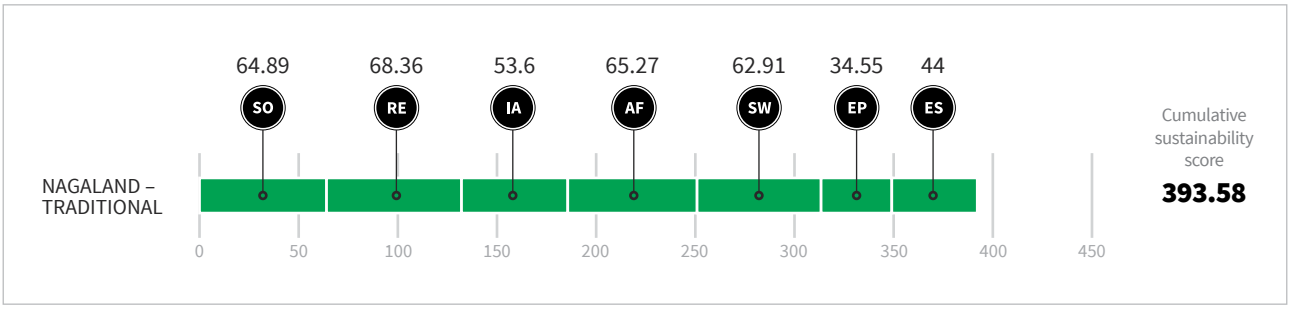
Strong traditional institutions and practices and robust traditional land use governance

Exceptionally rich agrobiodiversity and traditional genetic resources

KEY CHALLENGES

Poor policy and institutional support mechanisms for traditional shifting cultivation governance, including extension services, agribusiness infrastructure, and value chain support for organic crops from *pouks*

Migration to urban areas and declining interest in farming as an occupation, especially by the younger generation



3. *Lopil*-based traditional farming, Chin Hills, Myanmar

An example of traditional slash-and-burn cultivation known as *taung-yar*, based on shifting cultivation land units called *lopil*. (Knowledge co-produced with communities from Kaluh Mon, Thlem Yaw, Lai Lo, Ngwang Muai, and Siang Sawn villages)

KEY STRENGTHS

Land resources are well organized, with cultivated land and *lopil* areas well connected with natural forests and vegetation

Thorough engagement of farming communities and use of traditional knowledge

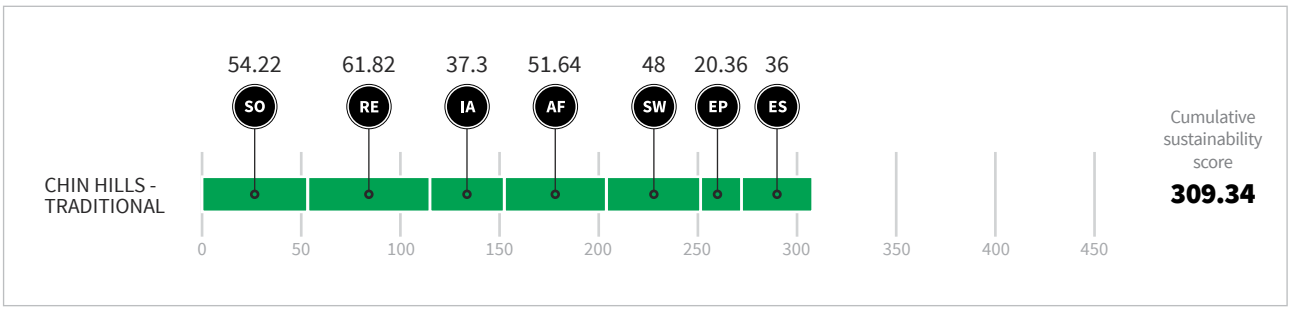
Availability of a wide range of agrobiodiversity, local cuisines, and traditional foods

KEY CHALLENGES

Fragile landscape and top soil erosion

Inadequate capacities and interventions for agribusiness and integrated soil and water management

Lack of investment and support for agribusiness and agro-tourism, leading to low motivation among farming communities



4. Transforming traditional farming, Dulongjiang, China

An example of sloping hill farming practised by the Dulong ethnic community. Placed under the Grain for Green Programme, most of the traditional lands have been converted into walnut *Juglans sp.* and Chinese cardamom *Amomum sp.* plantation areas. (Knowledge co-produced with communities from Dulongjiang and Kongdang villages)

KEY STRENGTHS

Good connectivity between farms and forests

Upland areas are protected through agroforestry practices

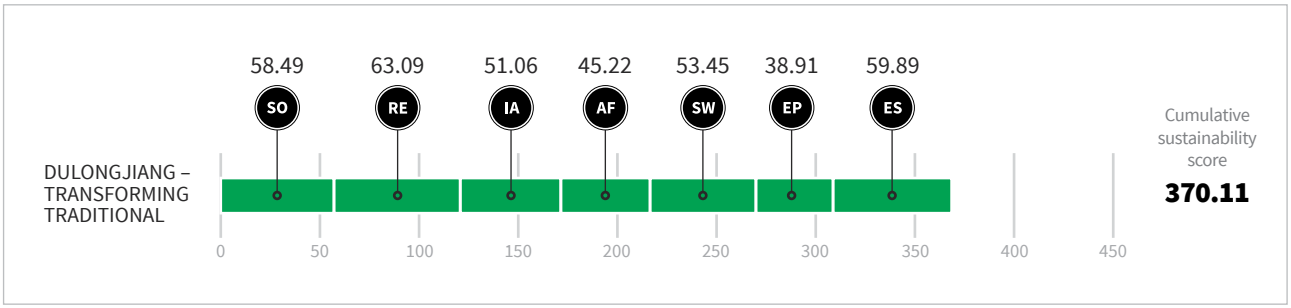
Good development infrastructure and extension services support from the government, including support for the development of homestays and community museums

KEY CHALLENGES

Lack of value chain mechanisms and promotion of local niche farm produce and commodities, including modern knowledge of community enterprise development

Inclination towards growing more hybrids than using locally adaptive cultivars/breeds, leading to loss of use of local cultivars and variety

Loss of farm produce because of damage by wild animals



5. Transforming agroforestry, Dima Hasao, India

An example of transforming shifting agriculture into an innovative agroforestry system. Different tribal communities are spearheading this transformation using scientific knowledge in harmony with their culture, traditions, and practices.

KEY STRENGTHS

Multi-tier cropping with reduced operational costs and minimized use of fertilizers

Maintenance of year-round vegetation cover that helps prevent soil erosion and nutrient leaching

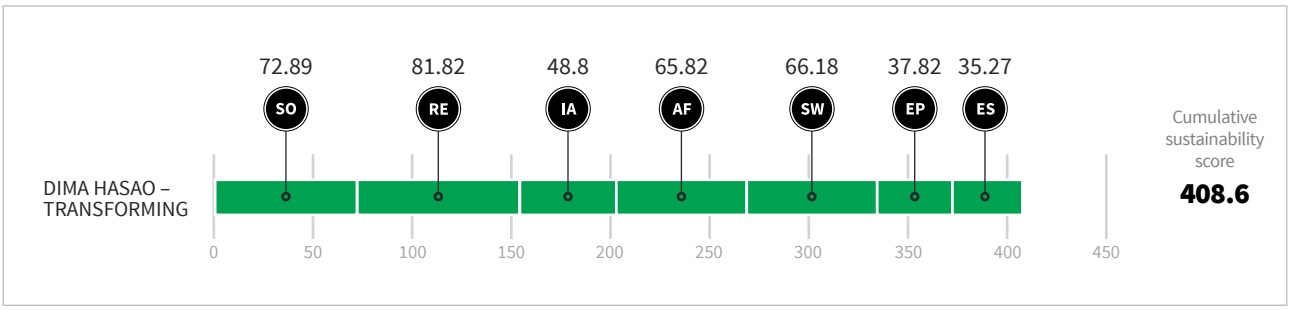
Maintenance of forests and community-conserved areas

KEY CHALLENGES

Long gestation period of tree species disrupts the local economy as most of the tribal farmers are largely dependent on agriculture for their livelihood sustenance

Greater farm investments required compared with traditional farming, adding financial burden for poor farmers

Agroforestry management is a knowledge- and technology-intensive process, therefore requires greater hand-holding and capacity enhancement



6. Integrated mixed farming, Barshong, Bhutan

An example of a typical Bhutanese subsistence farming system, featuring integrated crop-livestock-forestry system. (Knowledge co-produced with communities from Barshong Maed, Barshong Toed, Daragaung, and Gangtoka villages)

KEY STRENGTHS

Good agrobiodiversity

Diversified use of land spaces and agro-ecological spaces, with farming communities making sustainable use of locally available resources

Good flow of inputs from forests into farmland, hence resilient and less reliant on external inputs

Efficient policy support and extension services from the government

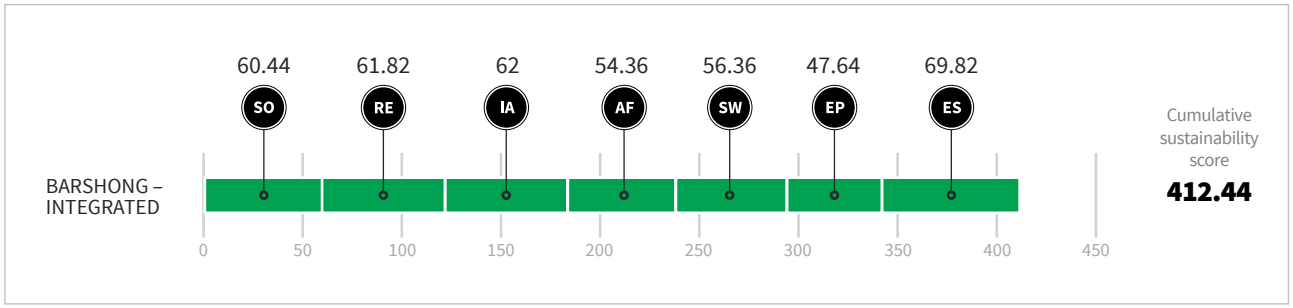
KEY CHALLENGES

Topsoil erosion and degradation due to hilly land topography

Unsatisfactory return on investment from agriculture compared with other non-farm activities

Lack of support for value additions and agri-enterprise development

Water scarcity threatening the diversity of crops, especially upland rice production



7. Integrated organic farming, Sikkim, India

An example of an organic, integrated system with cardamom as a principle cash crop. (Knowledge co-produced with communities from Upper Martam and Uttarey villages)

KEY STRENGTHS

Diversified production habitats with agroforestry approach and organic orientation and focus on low-volume, high-value perennial crops

Strong family farming networks for exchange of agrobiodiversity resources and associated knowledge

High demand for local organic (chemical free and safe) farm produce

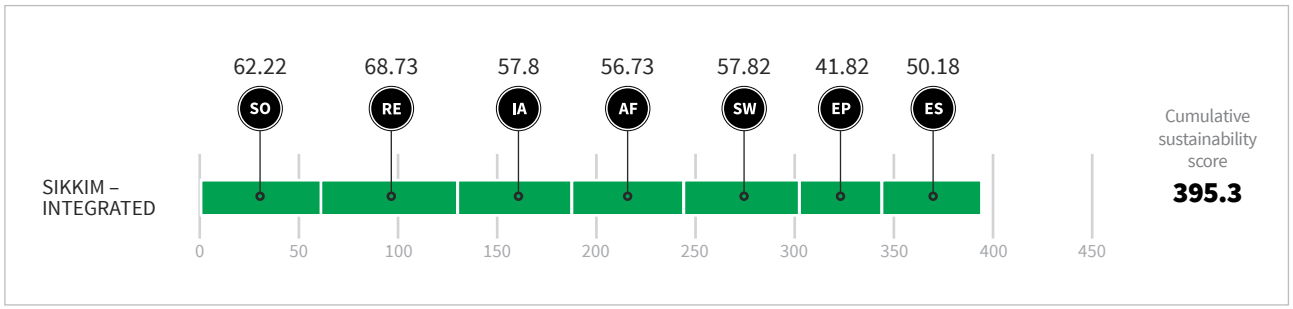
KEY CHALLENGES

Decreasing land spaces for growing traditional crops

Fluctuation of market prices for major crops and livestock and lack of a buy-back mechanism

Difficulty in selling organic products in local markets; extension of wider market connect required

Issues with pest and diseases



8. Integrated commercial farming, Luzhang, China

An example of integrated commercial farming carried out in settled, allocated farm lands where diversified crops (mostly commercial vegetables) are grown, catering to both local and city markets. (Knowledge co-produced with communities from Langbazhai and Sang He villages)

KEY STRENGTHS

Good rural infrastructure, farm roads, houses, and other development facilities, including connectivity with natural ecosystems

Availability of wider market commodities

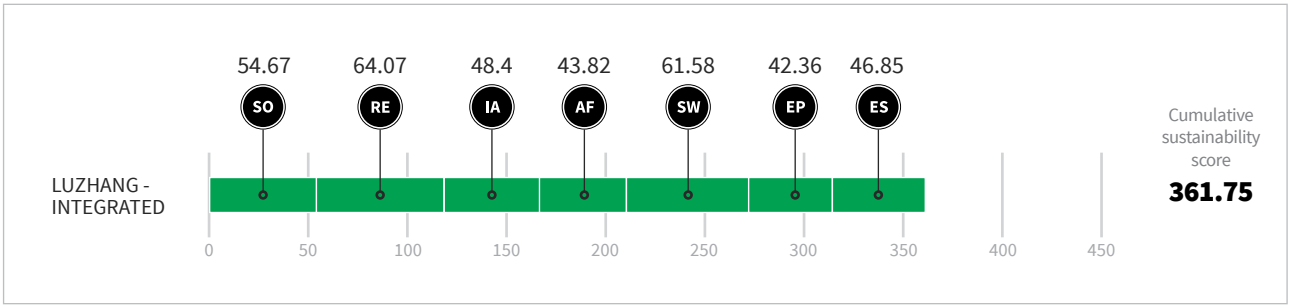
Community-wide cultivation of cash crops

KEY CHALLENGES

Topsoil loss due to landslides and land erosion

Declining interest in growing locally adapted traditional crops; widespread use of hybrid seeds, resulting in loss of local crop/livestock genetic resources

Extensive use of chemical fertilizers and other chemical additives, including artificial rain



Immediate investments

Ethnobotanical scoping studies: Highlights use and future prospects of domesticated and wild edibles in the landscape; enhances awareness on the multiple values of mountain agrobiodiversity

Food-based value chain development: Converts agriculture into enterprises and industries, and promotes farmers as entrepreneurs

Mapping of traditional food and cuisine diversity with focus on nutrition: Promotes nutrition-efficient local food and cuisines and heritage-based agro-tourism

Regional database on agrobiodiversity: Includes checklists and inventories of production systems, species and germplasm, and cuisine diversity

Action recommendations

Listed below are action recommendations that can help mountain agricultural systems in the Eastern Himalaya become more resource-efficient, resource-conserving, environment-friendly, socially acceptable, and commercially competitive:

Enhance both **in-situ and ex-situ conservation infrastructure** for traditional agro-germplasm, including conservation-oriented extension services. Investing in participatory plant breeding programmes, especially to improve seed systems for high-value cash crops, new generation food crops, and lesser-known or underutilized mountain crops would be crucial.

Recognize and use **traditional knowledge** in maintaining crop/livestock genetic resources and the entire production systems; and ensure that farmers' knowledge is integrated in the formulation of a comprehensive agriculture policy.

Develop a multilateral **system for access and benefit sharing** suited for mountain crop/livestock. Ensuring the future sustainability of agriculture and food security will require access to a wider genetic resource base and the engagement of farming communities in the continual development of crop/livestock germplasm. Creating and strengthening a farmers' seed network can help.

Support the development **of mountain agri-enterprise** and link it to newer market avenues that cater to both farmers' income and conservation of agrobiodiversity. This entails the diversification of agro-produce farm commodities, local food and cuisines, and farm-based craft linked to ethnic cultures, festivals, and traditions. This motivates younger generations to explore wider agriculture-based livelihood options.

Drive **policy support for organic orientation** for mountain agricultural systems, supporting them with certification and branding processes and linking with high-end markets. Organic certification can serve as an incentive mechanism for healthy farming practices and can maintain farm–forest ecological connectivity in terms of nutrients, water, and pollinator flow.

Strengthen **local institutional capacity and farmers' skills** by broadening participatory approaches and collaborative learning and by promoting greater technical collaboration between farmers and formal technical institutions. These approaches must respond to farmers' need for biodiversity and livelihood alternatives.

Design appropriate **incentive or payment measures** for mountain agrobiodiversity and mountain farming communities, including risk mitigation measures. The incentive measures would incorporate farmers' investments to maintain wider services from mountain agricultural landscapes.

SWEDEN

This flyer was developed under ICIMOD's Landscape Initiative for the Far Eastern Himalaya (HI-LIFE), which is a transboundary landscape conservation and development initiative jointly implemented by ICIMOD and its partners in China, India, and Myanmar. ICIMOD would like to thank communities and village heads in the respective villages in the four countries, and the institutions co-leading the research: College of Natural Resources (Bhutan), Kunming Institute of Botany (China), North Eastern Region Community Resource Management Project (India), Sustainable Development Forum Nagaland (India), The Mountain Institute-Sikkim (India), and Yezin Agricultural University (Myanmar).

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ICIMOD gratefully acknowledges the support of its core donors: the Governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Sweden, and Switzerland.

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