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LOCAL KNOWLEDGE IN THE USE AND MANAGEMENT OF LAND RESOURCES: A CASE STUDY OF BAC SON DISTRICT, LANG SON PROVINCE, VIETNAM

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ABSTRACT

Indigenous knowledge plays a vital role in shaping sustainable land use and management practices, particularly in mountainous and ethnically diverse regions. This study explores the local knowledge systems of ethnic communities in Bac Son District, Lang Son Province, Vietnam, focusing on how they utilize and manage land resources. Through a combination of document analysis, expert interviews, and field investigations, the research identifies a range of traditional practices related to land classification, crop rotation, soil conservation, and fertility enhancement.

The findings highlight that local communities have accumulated practical knowledge over generations, allowing them to adapt agricultural activities to complex mountainous terrains and fragile ecosystems. This knowledge includes context-specific solutions for soil rehabilitation, erosion control, and land allocation that align with ecological conditions and cultural values.

The study underscores the importance of preserving and integrating indigenous knowledge with scientific approaches to improve land resource governance in upland regions. Such integration can enhance the sustainability and resilience of agricultural systems in the face of environmental and socio-economic challenges.

Keywords: Indigenous knowledge; resource management; land resource utilization; soil improvement; Bac Son District, Lang Son Province

1. INTRODUCTION

The rapid advancement of science, technology, and the explosion of information technology and artificial intelligence has profoundly impacted all aspects of socio-economic life, introducing new values and applications for economic development. However, despite these modern transformations, indigenous knowledge continues to play a crucial role in everyday life,

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production, and the management of natural resources—particularly among mountainous communities whose livelihoods are closely tied to these resources.

Indigenous knowledge represents a valuable cultural asset of every ethnic group. It encompasses essential lessons on human interaction with the natural environment and the sustainable use of resources necessary for survival and development. This knowledge also embodies behavioral norms governing the actions of individuals, communities, and inter-community relations. It provides a foundational understanding in key sectors such as agriculture, forestry, and natural resource governance. As such, indigenous knowledge holds significant value for scientists, planners, and policy makers alike.

Bac Son District, located in Lang Son Province in the northern mountainous region of Vietnam, is home to various ethnic minority groups, with the Tay people forming the largest population. For generations, these communities have relied heavily on natural resources for their livelihoods, particularly in agriculture and forestry. As a result, they have accumulated extensive experiential knowledge in the use and management of land resources, forming a localized and adaptive system of environmental stewardship.

2. RESEARCH METHODS

To explore the role of indigenous knowledge in the use and management of land resources in Bac Son District, Lang Son Province, this study employed a multi-method research design incorporating both qualitative and quantitative approaches. Four principal methods were applied: document analysis, expert consultation, field investigation, and statistical analysis.

- Document Collection, Synthesis, and Analysis:

The research began with an extensive review and analysis of secondary sources, including peer-reviewed scientific articles, government reports, workshop proceedings, statistical yearbooks, books, newspapers, and previously published academic works. These materials were selected based on their relevance to the themes of indigenous knowledge and sustainable land resource management. All collected documents were systematically reviewed, categorized, and analyzed to establish a theoretical foundation and contextual framework for the study.

- Expert Consultation (Delphi Method):

To strengthen the analytical depth and ensure the scientific validity of the findings, the research team conducted consultations with leading experts, including scholars, policy advisors, and practitioners specializing in indigenous knowledge systems, natural resource governance, and sustainable agriculture. These consultations provided critical perspectives on the opportunities and challenges

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of integrating traditional and scientific knowledge systems, and informed the development of research tools and interpretation of field data.

- Field Surveys and Participatory Observations:

Primary data were collected through direct fieldwork in several communes within Bac Son District. Using structured interviews, focus group discussions, and participatory observation techniques, the research team documented local knowledge on land use practices, soil classification, crop selection, and land improvement strategies. Special attention was paid to traditional farming systems and the rationale behind crop-soil matching, revealing locally adapted strategies that have sustained agricultural productivity in the region over generations.

- Quantitative Data Analysis Using SPSS:

Survey questionnaires were administered to a representative sample of local households. The collected data were coded and analyzed using SPSS (Statistical Package for the Social Sciences). Descriptive and inferential statistical methods were applied to identify prevailing trends, validate qualitative findings, and quantify the extent and variation of indigenous practices among different ethnic and geographic subgroups.

This integrated methodological approach ensured both the breadth and depth of analysis, enabling a holistic understanding of the value and applicability of indigenous knowledge in sustainable land resource management.

3. RESULTS AND DISCUSSIONS

3.1. Theoretical Perspectives on Indigenous Knowledge in the Use and Management of Natural Resources

Indigenous knowledge (also referred to as local or traditional knowledge) comprises the understandings, skills, and philosophies developed by members of a community over generations through direct experience with the surrounding environment. This knowledge is grounded in long-term observation, tested through centuries of practical application, and shaped by the cultural and ecological contexts of specific localities. Unlike formal or scientific knowledge—typically developed by academics and codified through written literature—indigenous knowledge originates from the labor and lived experiences of local people. It is transmitted orally within families and communities and is often embedded in cultural expressions such as songs, proverbs, epics, and customary practices [1][6].

Indigenous knowledge spans a wide array of domains relevant to livelihood, including agriculture, forestry, natural resource management, and community governance. In his seminal work

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Indigenous Knowledge of Highland Ethnic Communities in Agriculture and Resource Management, Professor Hoàng Xuân Tý categorized indigenous knowledge into several fields: crop cultivation, animal husbandry, forest and communal resource management, nutrition and human health, and community organization and intergenerational knowledge transfer [15].

Natural conditions, resource endowments, and environmental status provide the objective material foundation shaping how different ethnic groups interact with and adapt to their ecosystems. Depending on their development level, production practices, and cultural norms, each community exerts distinct influences on the environment and utilizes natural resources in culturally specific ways.

Globally, numerous studies have affirmed the centrality of indigenous knowledge in sustainable resource management. For instance, research by Ruguelito M. Pastores and Romeo E. SanBuenaventura emphasizes the pivotal role of local communities in identifying plant species with ecological and biological traits suited to regional conditions. Similarly, Paul Hebinck's study on "Networks of Formal and Informal Knowledge in Forest Conservation in Zimbabwe" demonstrates that effective and sustainable forest governance must be grounded in the knowledge systems of local populations [2][4].

In the article "Applying Indigenous Knowledge in Agriculture and Natural Resource Management in Upland Regions", Professor Lê Trọng Cúc emphasizes that indigenous knowledge plays a critical role in identifying issues and constraints that affect ecosystem management. It also serves as a valuable source of long-term environmental information and records of rare or exceptional events that may not be observed during the limited timeframe of scientific studies conducted in a given locality [2]. Indigenous knowledge is considered a vital national resource that can contribute significantly to development efforts, particularly those that are cost-effective, participatory, and oriented toward sustainability. Development projects grounded in local knowledge tend to attract strong community engagement, as people understand what needs to be done and how to do it—this is often the foundation of successful outcomes [16].

Among all natural resources, land remains one of humanity's most precious assets. Virtually all human activities—residential, agricultural, industrial, and extractive—are directly tied to land use. Land is both the object and the principal means of production. Over the course of history, human societies have accumulated vast experience in utilizing different types of land for habitation and production purposes [10].

However, from a developmental perspective, not all forms of indigenous knowledge are equally beneficial. Some traditional practices yield highly effective outcomes and can be applied directly without modification, while others may be outdated or incompatible with present-day conditions. In such cases, it is essential to improve and integrate indigenous knowledge with scientific

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expertise [4][17]. Despite the rise of modern science and technology, indigenous knowledge remains an area of keen interest to researchers. It continues to serve as a rich source of intellectual insight and has inspired the development of numerous innovative technologies [7].

While the study highlights the enduring value of indigenous knowledge in the sustainable use and management of land resources, a more balanced evaluation requires identifying specific traditional practices that have demonstrated high efficacy, as well as those that may be less effective or outdated under current environmental and socio-economic conditions.

Among the most effective indigenous practices are land classification based on soil texture and indicator plants, intercropping with legumes to enhance soil fertility, and the use of traditional crop varieties adapted to local microclimates. These techniques reflect centuries of empirical observation and adaptive experimentation, contributing to both resilience and sustainability. In particular, the intercropping of maize with nitrogen-fixing legumes such as mung beans and soybeans has shown to improve soil structure, reduce erosion, and support household nutrition and income.

However, certain indigenous methods, such as slash-and-burn cultivation without adequate fallow periods or erosion control measures, have contributed to long-term soil degradation and yield decline. The absence of contour planting, crop residue retention, and organic fertilization are among the practices identified by local farmers themselves as drivers of land exhaustion. Such methods, while historically viable in low-population contexts, may no longer be sustainable in the face of demographic pressure, climate variability, and limited land availability.

Therefore, a critical integration of indigenous knowledge with modern scientific approaches is necessary. For instance, the introduction of agroecological innovations—such as soil testing, composting, terracing, and crop rotation schedules informed by climatic models—could significantly enhance the outcomes of traditional systems. Participatory approaches that respect local authority while introducing scientific tools have proven effective in other mountainous regions globally and could serve as a model here.

Ultimately, the value of indigenous knowledge lies not only in its content but also in its adaptability. Policies and development initiatives should aim to retain the cultural and ecological wisdom embedded in traditional practices, while supporting local communities in upgrading outdated methods to meet current sustainability and productivity needs.

3.2. Indigenous Knowledge of Land Use and Management in Bac Son District, Lang Son Province

Integrating Indigenous Knowledge into Land Management Policies and Legal Frameworks in Vietnam

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While indigenous knowledge plays a crucial role in sustainable land use at the local level, its formal integration into Vietnam's national land governance system remains limited. To bridge this gap, a multi-tiered policy strategy is needed—one that recognizes, legitimizes, and operationalizes traditional ecological knowledge within existing legal and institutional structures.

Legal Recognition of Indigenous Knowledge as a Legitimate Resource

Vietnam's Land Law and related environmental statutes currently emphasize scientific planning, technical assessment, and top-down land allocation. To integrate indigenous knowledge effectively, the law must explicitly acknowledge it as a legitimate form of knowledge with value equal to scientific expertise. This could be realized through amendments to the Land Law, Forestry Law, or Biodiversity Law, introducing clauses that define and protect traditional knowledge systems in land planning, agricultural zoning, and conservation initiatives.

Participatory Land Use Planning Involving Ethnic Minority Communities

One promising avenue for integration is through community-based land use planning (CBLUP). This participatory model allows ethnic minority communities to engage directly in land-use mapping, crop zoning, and natural resource planning using their own classification systems, seasonal calendars, and customary laws. These community-generated plans can be harmonized with official land use master plans at the district or provincial level, with technical support from local government units and extension agencies.

Pilot programs in provinces like Lao Cai and Ha Giang have demonstrated that involving local knowledge holders in planning yields more contextually relevant, ecologically sound, and socially accepted outcomes. Formalizing such practices as part of the national land planning process would enhance legitimacy, improve enforcement, and increase sustainability.

Institutional Mechanisms for Inclusion and Dialogue

The integration process should also be institutionalized through inter-agency working groups or Indigenous Knowledge Committees under the Ministry of Agriculture and Rural Development (MARD) or the Ministry of Natural Resources and Environment (MONRE). These bodies could coordinate research, policy harmonization, and capacity-building efforts that center on the co-production of knowledge between local communities and scientific institutions.

Additionally, district-level Land Use Advisory Boards should reserve seats for representatives from ethnic communities—particularly elder councils or village heads who are bearers of ecological knowledge. Their participation ensures that customary perspectives are considered in decisions affecting land rights, agricultural extension, and environmental impact assessments.

Legal Pluralism and Customary Law Recognition

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Vietnam's Constitution and legal system predominantly reflect civil law traditions, yet many upland regions operate under customary norms governing land inheritance, use, and conservation. A legal pluralism framework could allow for the coexistence of statutory and customary law, especially in communal land and forest management. This approach has precedent in the 2004 Law on Forest Protection and Development, which allows collective community forest rights.

Codifying traditional rules regarding soil protection, spiritual taboos, and resource boundaries—as seen in Bắc Sơn District—within commune-level regulations or district ordinances would provide legal protection and enhance long-term compliance.

Integration into Extension and Education Systems

To sustain integration efforts, agricultural and forestry extension curricula should be revised to include indigenous knowledge. Training programs for government officials, local planners, and extension workers should emphasize respectful engagement with ethnic communities, participatory techniques, and the co-validation of knowledge systems.

In parallel, community schools and local learning centers could document and teach IK to younger generations, ensuring knowledge transmission while fostering pride and agency. These centers could serve as innovation hubs where traditional practices are tested, adapted, and shared across regions.

3.2.1. Land Use Types and Cropping Systems

To date, the primary livelihood activities of local residents in Bac Son District continue to revolve around wet rice cultivation and farming on sloped terrains. Rice remains the dominant staple crop in the region, with a strong reliance on traditional, locally adapted rice varieties.

A household survey conducted with 142 families across three communes—Bac Quynh, Tran Yen, and Chien Thang—revealed a substantial degree of continuity in the use of indigenous rice varieties. The survey identified and documented the specific types of local rice still in use, as well as the proportion of households cultivating them. These findings reflect the deep-rooted agricultural knowledge passed down through generations and the adaptive resilience of local cropping systems in relation to land conditions and cultural practices.

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Table 1: Traditional rice varieties of people in Bac Son district

	Unit administration	Description of the morphological characteristics of the crop	Proportion of households cultivating local rice varieties
1	Khau Pay Lẹng	Small grains, white husk. Tasty, fragrant, and sticky (glutinous). Drought-tolerant, low yield. Growth duration is 3 months (from May to August).	5,3
2	Khau Pay Thai	Long grains, grey husk. Tasty and expands well when cooked. Good drought tolerance, but low yield. Growth duration is 3.5 months.	10,2
3	Khau Hien	White hull, rice grains have needle-like pointed tails, pink rice grains, delicious. Drought-resistant, good pest resistance. Low yield. Growth period 4 months	12,3
4	Khau Pet	Red rice grains, sticky and delicious. Plants are not more than 1m tall, low yield. Growth period is 4 months.	9,3
5	Khau Nhat	Round seeds, not tasty (hard like corn) with quite high yield. Growth period 3 months	3,1
6	Nep Heo	Tall tree, big round seeds, white-yellow shell, itchy rice husk. Delicious, fragrant, sticky. Low yield. Growth period 4 months	15,6
7	Khau Nua Vang Bo	Lychee-colored shell, round white rice grains, not sticky, not fragrant. High yield. Growth period 4 months	19,1
8	Khau Nua Ca	Black shell, white rice grains, sticky, not fragrant. Quite high yield. Growth period 4 months	8,7
9	Khấu Lấu	Long seeds, not sticky. (only used to make wine, delicious wine). Low yield. Growth period 4 months	4,6

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10	Khau Bao Lạc	Long seeds, small. Tree 1.3m-1.5m tall. Not fragrant but sticky (usually used to make wine). Growth period 4 months	4,7
11	Other types		7,1

Following rice, maize represents the second most important staple crop for local communities in Bac Son District. Due to its strong adaptability to temperature fluctuations, low soil requirements, and minimal cultivation demands, maize is widely grown across the region. Local farmers continue to preserve and cultivate several indigenous maize varieties that are well-suited to the mountainous environment.

Table 2: Indigenous Maize Varieties Cultivated by Residents in Bac Son District

	Local name	Characteristics	Percentage of households growing local corn varieties
1	Mec Luong (yellow corn)	Big corn, sweet. Low yield. Growing period 120 days.	4,5
2	Mec Khao (Khau Rẹ hay white, hard-kernel corn)	Sticky but not sweet. Low yield. Growing period 160 days.	13,3
3	Mec Khau Nua (sticky corn)	Sticky, sweet, aromatic. Low yield. Growing period 90 days.	42,5
4	Mec Kheu Lau (Hard-kernel corn)	Hard, not sticky but sweet. Low yield. Growing period 120 days.	31,6
5	Other maize varieties		8,1

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Table 3: Main land use types of people in Bac Son district

	Soil types	Type of Land Use	Pattern of Land Use
1	Paddy land	Land for 2 rice crops	Spring rice - Summer rice
		Land for 1 rice crop, 1 color crop	Spring corn - Summer rice
		Land for 1 rice crop	Fallow - Summer rice
		Land for specialized colors	Corn, Beans, Potatoes, Tomatoes, Tobacco
2	Upland farming land	Land specializing	corn, peanuts, soybeans, green beans, white beans, taro, black beans
3	Land for perennial crops	Land for growing fruit trees	plums, tangerines, oranges, grapefruits
		Land for vegetable gardens	sweet potatoes, pumpkins, cassava, ginger
4	Forest land	Forest growing land	anise, cinnamon, acacia, eucalyptus, bamboo, bamboo, etc.
		Natural forest land	ironwood, ironwood, lim

Field investigations revealed that the majority of households actively classify their land prior to cultivation. The proportion of families engaging in land classification is notably high across all three surveyed communes: 82% in Bac Quynh, 89% in Tran Yen, and 97% in Chien Thang. Farmers use various criteria for this classification, such as soil texture, color, and structure; the topographical position of the plot; and the presence of specific indicator plant species. These assessments inform their decisions on crop selection and land-use prioritization.

Typically, paddy fields are categorized into three quality levels: good, moderate, and poor. In the case of upland swidden (slash-and-burn) fields currently under cultivation, local communities employ a more nuanced system of four categories: good, moderate, poor, and very poor. Each land type is matched with specific crops deemed suitable for its condition, thereby optimizing productivity and sustainability.

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The classification system is illustrated in the following table:

Table 4: Classification of Swidden (Upland) Soils on Sloped Terrain

Type	Soil color	texture Indicator	species Indicator plants	Priority crops
good	Dark brown	fluffy Earthworms (++) Crickets (++)	Pigweed Grass Glutinous	corn, potatoes
Medium	Reddish brown; less fluffy	Earthworms (+) Crickets (+)	Cyperus rotundus, clover, and cogon grass	Corn, legume
Bad	Red; high adhesion	Termites (++) Ants (++)	Cogongrass	Legumes, cassava
Too bad	Black; dry loose	Termites (+) Ants (+)	Ginger Grass Turmeric Grass	Cassava(-)

Table 5: Classification of rice fields

Type	Characteristics	Indicator Plants	Priority Plants
Good	Dark brown	Deep layer Duckweed	Sticky rice Duckweed
medium	Reddish Brown; Medium Tone	Beargrass Bilegrass	rice
Bad	Silver Black	Shallow layer of color, Dogtail	seaweed Rice

The table 4, and table 5 presents the traditional land classification system used by local farmers in Bac Son District for swidden fields located on sloped hillsides. This classification guides land-use decisions by identifying soil quality levels and matching them with appropriate crops.

Good-quality upland soils are typically prioritized for cultivating staple crops such as rice and maize—particularly glutinous rice and glutinous maize varieties. Soils of moderate quality are

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often used for growing non-glutinous maize and legumes, while poor soils are generally allocated to less demanding crops like cassava and certain legume species. Very poor soils are often left uncultivated or used only for cassava production due to their low fertility and limited productivity.

3.2.2. Land Use and Management Practices

Land is a vital natural resource intimately tied to the livelihoods of individuals and communities. In Bac Son District, land management operates under a dual system that includes both formal state regulations and traditional community practices. While national policies and legal frameworks govern land allocation and usage at the administrative level, customary systems of land governance remain prevalent in local villages.

At the community level, land is managed through two main categories: communal land and household-managed land. In each village, all members have the right to reclaim and cultivate land for agricultural and livestock purposes. Elders play a critical role in transmitting knowledge about land boundaries, land use traditions, and village territory to younger generations.

Among the Tày people and other ethnic minorities in Bac Son, a strong communal ethos is evident in land management practices. Today, under state oversight, land use and tenure rights are administered by local authorities at the commune and district levels—such as land offices, forestry units, and farmers' associations. Although there are differences between traditional and official systems, both maintain the dual structure of communal and household land management. This approach reflects values of equity and voluntariness, ensuring benefits for both individual households and the broader community.

Importantly, the implementation of state land policies and laws must consider local customary practices and indigenous regulations to harmonize formal governance with traditional management systems.

In local cosmology, land, forests, water sources, and vegetation are believed to be inhabited and protected by spiritual entities or deities. As a result, strict taboos and communal rituals are observed to honor and protect these natural resources. Unauthorized access or exploitation is often forbidden unless sanctioned by the community. These indigenous beliefs are codified in local customary laws and have played a significant role in conserving land and natural resources in the region.

Currently, land use in Bac Son District follows two principal models. The first involves cultivation in valleys and lowland fields at the base of mountains, primarily for wet rice farming and swidden (slash-and-burn) agriculture on sloped terrain. The second model is based on the use of steep hillsides, where the land is utilized for upland cropping systems, including long-term industrial crops, fruit trees, and afforestation efforts.

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Field survey data, based on interviews with 142 household heads from the communes of Chien Thang, Bac Quynh, and Tran Yen, reveal a consistent pattern: in the early years of clearing and cultivating swidden fields, crop yields and quality—particularly for maize, rice, and tubers—are relatively high. However, over time, productivity significantly declines. According to the respondents, repeated cultivation exhausts soil nutrients, causing the land to become increasingly degraded, thinner, and less fertile.

In several locations, the absence of stone terraces or contour vegetation barriers has led to severe soil erosion during the rainy season. Without proper slope stabilization measures, the topsoil is easily washed away, resulting in reduced agricultural productivity and long-term land degradation.

Table 6: Summary of Local Perceptions on the Causes of Land Degradation

	Questionair	Agree		Disagree		Other reasons	
		Quantity	Percentage (%)	Quantity	Percentage (%)	Quantity	Percentage (%)
1	Due to multiple cropping	92	64,78	34	23,94	16	11,26
2	Due to no fertilization	103	73,53	27	19,01	12	8,45
3	Due to no stone embankment, no planting along the contour	58	40,84	43	30,28	41	28,87
4	Due to no intercropping/crop rotation	80	56,33	35	24,64	27	19,01
5	Due to heavy rain	41	28,87	71	50,0	30	21,12
6	Due to harvesting all by-products	91	64,08	41	28,87	10	7,04
7	Due to planting beans	13	9,15	102	71,83	27	19,01

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The following table summarizes the responses of surveyed households in Bac Son District regarding the perceived causes of land degradation. These insights reflect the lived experiences of local farmers and their observations of environmental change over time, particularly in relation to agricultural practices and natural factors.

Many households indicated that the complete removal of crop residues after harvest (64.08%) is one of the primary causes of soil degradation. A large majority of respondents noted that leaving rice straw and other plant residues on the field results in healthier crop growth in the following season. Through years of cultivation, farmers have also come to understand that the absence of intercropping and crop rotation practices (56.33%) contributes to soil exhaustion and nutrient depletion.

Table 7: Summary of Local Perceptions on Soil Improvement Measures

	Questionair	Agree		Disagree		Other reasons	
		Quantity	Percentage (%)	Quantity	Percentage (%)	Quantity	Percentage (%)
1	No protection, natural	15	10,56	116	81,69	11	7.74
2	Crop rotation, multi-species cultivation	104	73,23	26	18,3	12	8,45
3	Intercropping legumes on sloping land	118	83,09	9	6,33	15	10,56
4	Industrial crops + fruit trees	83	58,45	17	11,97	42	29,57
5	Planting a single crop	72	50,70	46	32,39	24	16,9
6	Covering the ground and less tilling	79	55,63	33	23,23	30	21,12
7	Increasing the use of green manure	107	75,35	3	2,11	32	22,53
8	Leaving fallow for a period of time	58	40,84	66	46,47	18	12,67

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The table below presents the opinions of local residents regarding effective methods for restoring and maintaining soil fertility, based on their practical experience with long-term land cultivation.

In agricultural and forestry production, each harvest cycle removes a portion of biomass from the ecosystem, leading to a gradual decline in soil fertility. Based on accumulated experience passed down through generations, local communities in the surveyed area—despite some differing opinions—have generally reached a consensus on effective soil restoration methods.

To address soil degradation, common practices include crop rotation, intercropping, the use of green manure, surface mulching, and minimizing excessive tillage. The majority of farmers advocate for multi-crop systems, emphasizing the benefits of planting legumes alongside staple crops. Many households expressed a preference for growing beans in swidden fields due to their ease of cultivation, moisture retention, and soil-enriching properties. However, some households are hesitant to plant legumes due to concerns about pest infestations and low yields.

In practice, intercropping is frequently applied, particularly combining maize with various leguminous species. The selection of legume types depends on intended uses: white beans are grown for consumption of young pods, while mung beans and black beans are planted for seeds used in traditional ceremonies. Among these, soybeans are the most commonly intercropped with maize.

The intercropping technique offers several agronomic and ecological benefits: it creates ground cover to retain soil moisture, reduces rainfall-induced erosion, provides green manure through biomass decomposition, fixes nitrogen through legume root systems, conserves land area, and enhances household income with minimal investment by enabling multi-crop harvests from the same plot.

3.2.3. Recommendations for Preserving and Promoting Indigenous Knowledge in Sustainable Development

The indigenous knowledge systems held by local communities are invaluable assets for the sustainable management and conservation of natural resources. However, evaluating these knowledge systems requires a balanced approach that considers both their strengths and limitations. Outdated customs or obsolete practices should be critically reassessed, while effective, time-tested knowledge related to environmental stewardship must be preserved and promoted.

To maintain and enhance the role of indigenous knowledge in resource management and environmental protection, several practical and targeted strategies are recommended:

Policy and investment support should prioritize ethnic minority communities in mountainous areas, promoting economic, cultural, and social development to improve livelihoods. Ensuring

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long-term settlement and land security is foundational to sustaining and transmitting local knowledge.

Community cohesion must be strengthened by revitalizing customary laws and clan-based rules concerning resource use and conservation. These traditional regulations often contain sophisticated, context-specific mechanisms for sustainable management.

Public awareness and cultural recognition of indigenous knowledge should be enhanced through documentation, dissemination, and educational campaigns. Broadcasting the value and effectiveness of local knowledge via mass media, storytelling, songs, and visual arts can help foster pride, participation, and intergenerational transmission.

By recognizing and integrating indigenous knowledge systems within broader environmental governance frameworks, we can develop more inclusive and resilient models for sustainable development.

In the process of development, it is essential to integrate indigenous knowledge with modern scientific knowledge. In practice, many forms of traditional knowledge remain highly effective and are still actively employed by indigenous communities. However, a stable community is not a static entity—it must demonstrate adaptive capacity in response to changing conditions. The synergy between indigenous and scientific knowledge allows for complementary strengths, offering a more sustainable development pathway than the wholesale imposition of external models.

In several countries, indigenous knowledge systems have been successfully combined with and enhanced by scientific advancements, resulting in tangible benefits for farmers and practitioners engaged in sustainable rural and agricultural development, particularly in mountainous regions. This integration is often facilitated by agricultural and forestry extension agencies operating at the local level.

In many cases, indigenous knowledge can be improved through the participatory development of appropriate technologies, managed and implemented by local communities themselves. Once adapted, this improved knowledge can be scaled and disseminated through extension services, demonstration centers, and a variety of educational and communication channels.

What remains crucial is to support ethnic communities in applying scientific knowledge to improve the efficiency of natural resource use and management—while safeguarding their rich cultural heritage. The challenge is not to replace one knowledge system with another, but to foster a respectful and strategic integration of both, aimed at enhancing the sustainable exploitation, conservation, and governance of natural resources.

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3.2.4. Comparative Perspectives: Indigenous Knowledge and Sustainable Land Use in Other Regions

To situate the case of Bac Son District within a broader global context, it is valuable to compare similar indigenous knowledge systems from other regions that have contributed meaningfully to sustainable land management. These comparisons not only validate the insights drawn from Bac Son but also enrich the discussion of how traditional knowledge can inform contemporary environmental governance.

1. The Ifugao Rice Terraces (Philippines)

In the mountainous Cordillera region of northern Philippines, the Ifugao people have maintained elaborate rice terrace systems for over 2,000 years. These terraces are not only a UNESCO World Heritage site but also a testament to sophisticated indigenous knowledge in water management, soil conservation, and agroecological planning. Like Bac Son's paddy land classification and seasonal rotation, the Ifugao system relies on local indicators—such as water flow, slope, and microclimates—to decide cropping patterns.

Government-led efforts in the Philippines have integrated these traditional practices into local development plans, especially by creating community-managed heritage conservation districts, providing a potential model for Vietnam's northern provinces.

2. The Maasai Pastoralists (East Africa)

Among the Maasai communities in Kenya and Tanzania, land use decisions are guided by traditional grazing calendars, rainfall indicators, and clan-based rotational access systems. Although very different ecologically from Bac Son's agricultural systems, the Maasai example underscores the importance of customary governance in managing scarce and variable resources, particularly under climate stress.

Programs like Kenya's Land Policy of 2009 have made strides in legally recognizing pastoralist systems and traditional land tenure, suggesting how legal frameworks can accommodate flexible, indigenous-based land use models.

3. The Quechua Communities of the Andes (Peru, Bolivia)

In the Andean highlands, Quechua farmers practice ayllu-based communal agriculture, which integrates terracing, seed conservation, and microclimate zoning. Similar to Bac Son's intercropping systems, the Andean chacra model emphasizes polyculture, soil regeneration, and crop resilience. Local farmers select seeds based on multi-generational knowledge of slope, soil color, and frost risk—echoing the soil classification criteria observed in Bac Son.

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The Peruvian government, in partnership with international NGOs, has supported "Indigenous Biocultural Heritage Territories," which secure land rights and fund agroecological research led by community members themselves.

Implications for Vietnam's Policy Landscape

These global cases illustrate that indigenous knowledge is not static folklore but a dynamic system of environmental intelligence. Across diverse cultural and ecological settings, traditional communities have demonstrated context-specific strategies for sustainability, many of which outperform top-down interventions when it comes to long-term resilience.

By incorporating such comparative insights, Vietnam can benefit from international models of legal pluralism, participatory planning, and community-led innovation, thereby enhancing the credibility and scalability of initiatives like those observed in Bac Son District.

4. CONCLUSION

In the process of development, it is essential to integrate indigenous knowledge with modern scientific knowledge. In practice, many forms of traditional knowledge remain highly effective and are still actively employed by indigenous communities. However, a stable community is not a static entity—it must demonstrate adaptive capacity in response to changing conditions. The synergy between indigenous and scientific knowledge allows for complementary strengths, offering a more sustainable development pathway than the wholesale imposition of external models.

In several countries, indigenous knowledge systems have been successfully combined with and enhanced by scientific advancements, resulting in tangible benefits for farmers and practitioners engaged in sustainable rural and agricultural development, particularly in mountainous regions. This integration is often facilitated by agricultural and forestry extension agencies operating at the local level.

In many cases, indigenous knowledge can be improved through the participatory development of appropriate technologies, managed and implemented by local communities themselves. Once adapted, this improved knowledge can be scaled and disseminated through extension services, demonstration centers, and a variety of educational and communication channels.

What remains crucial is to support ethnic communities in applying scientific knowledge to improve the efficiency of natural resource use and management—while safeguarding their rich cultural heritage. The challenge is not to replace one knowledge system with another, but to foster a respectful and strategic integration of both, aimed at enhancing the sustainable exploitation, conservation, and governance of natural resources.

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5. RECOMMENDATIONS FOR FUTURE RESEARCH: THE VALUE OF LONGITUDINAL STUDIES

While this study offers a rich cross-sectional understanding of indigenous land use practices in Bac Son District, future research would greatly benefit from longitudinal studies that track changes in land use behavior, agricultural productivity, and ecological conditions over extended periods. Such an approach would allow for more dynamic insights into how traditional knowledge systems adapt—or fail to adapt—to evolving socio-economic pressures, environmental degradation, and climate change.

1. Monitoring Land Degradation and Restoration Over Time

Longitudinal field data could provide a clearer picture of soil fertility dynamics, erosion patterns, and the long-term effectiveness of traditional soil conservation techniques. For example, tracking the same swidden plots over a 5–10-year period would reveal whether intercropping practices truly maintain soil health, or whether degradation continues despite indigenous methods.

2. Observing Generational Shifts in Knowledge Transmission

Extended research would also shed light on how indigenous knowledge is passed down (or lost) between generations, particularly in the face of rural outmigration, formal education, and shifts in livelihood strategies. Understanding these trends is critical for designing educational or policy interventions that support cultural continuity.

3. Evaluating Policy Impact on Local Practices

With Vietnam increasingly formalizing land management through state-led mechanisms, longitudinal studies can assess how legal and institutional changes affect indigenous practices in real time—do villagers continue customary classification and planting decisions, or are they overridden by standardized agronomic protocols? Such studies could help refine policy alignment with community-based systems.

4. Capturing Climate Variability and Adaptive Strategies

Over time, climate variability (e.g., rainfall shifts, extreme weather) may test the resilience of local cropping systems and land-use logic. Multi-year studies would help document how indigenous farmers adjust their planting calendars, crop choices, and land allocations in response to climatic disruptions, providing valuable lessons for climate adaptation research in similar mountainous regions.

REFERENCES

[1]. Lê, T. C. (1996). The role of local knowledge in sustainable highland agricultural development on sloping land – Challenges and potentials [In Vietnamese]. Vietnam Agriculture Publishing House.

[2]. Lê, T. C. (1999). Indigenous knowledge of highland ethnic groups in agriculture and natural resource management [In Vietnamese]. Vietnam Agriculture Publishing House.

[3]. Vũ, V. C., & Trần, T. (2017). The role of indigenous knowledge in climate change adaptation. Vietnam Journal of Climate Change Science, (2), 25–30. [In Vietnamese]

[4]. Phạm, Q. H. (2005). Local knowledge in natural resource management of ethnic minorities in the northern mountainous provinces [In Vietnamese]. Thematic Paper.

[5]. Conference Proceedings. (2010, December). Environment and natural resources in the northern mountainous region of Vietnam: Current situation and sustainable development orientation [In Vietnamese]. Thái Nguyên.

[6]. Ngô, P. L. (2013). Indigenous knowledge: Research approaches. Vietnam Journal of Social Sciences, 11(183), 72–79. [In Vietnamese]

[7]. Grenier, L. (1996). Working with indigenous knowledge: A guide for researchers. International Development Research Centre.

[8]. Bàn, T. N., & Hoàng, T. C. (2014). Cultural identity and traditions of ethnic groups in Bắc Sơn district [In Vietnamese]. Vietnam Ethnic Culture Publishing House.

[9]. Đặng, T. N., & Dương, Q. P. (2013). Indigenous knowledge of the Dao people in the northern mountainous region in selecting land, terrain, and crop systems. Journal of Science and Technology, Ho Chi Minh City University of Education, 1(44), 175. [In Vietnamese]

[10]. Dương, Q. P., Nguyễn, X. T., & Đồng, D. K. (2022). Indigenous and scientific knowledge in agricultural and forestry development in the northern midlands and mountainous region. TNU Journal of Science and Technology, 227(17), 110–117. https://doi.org/10.34238/tnu-jst.5207 [In Vietnamese]

[11]. Dương, Q. P., Nguyễn, X. T., & Nguyễn, H. H. N. (2020). Indigenous knowledge of ethnic minorities in responding to climate change in the northern mountainous region of Vietnam. Thai Nguyen University Journal of Science and Technology, 225(7), 257–264. [In Vietnamese]

[12]. Dương, Q. P. (Ed.), et al. (2019). Geography and ethnography of Bắc Sơn district, Lạng Sơn province [In Vietnamese]. Labor Publishing House.

[13]. Đồng, T. T., Nguyễn, T. B., Nguyễn, B. L., & Hoàng, C. D. (2020). Indigenous knowledge in climate-adaptive agroforestry of the Dao people in Bắc Mê district, Hà Giang province, Vietnam. Journal of Forestry Science and Technology, (1), 94–102. [In Vietnamese]

[14]. Ngô, Đ. T. (2006). Culture, ethnic culture, and Vietnamese culture [In Vietnamese].

ISSN: 2455-6939

Volume: 11, Issue: 03 "May-June 2025"

Vietnam Social Sciences Publishing House.

[15]. Hoàng, X. T., & Lê, T. C. (Eds.). (1998). Indigenous knowledge of highland ethnic communities in agriculture and natural resource management [In Vietnamese]. Vietnam Agriculture Publishing House.

[16]. Vietnam Academy of Forest Sciences. (2001). Methods for collecting and using indigenous knowledge (Vol. 2) [In Vietnamese]. Vietnam Agriculture Publishing House.

[17]. Waren, D. M. (1995). The cultural dimensions of development: Indigenous development systems. Leiden.

