"Ecological Border Protection" Strategy and the Transformation of Governance Models in China's Southwest Borderlands

A Collaborative Perspective on Security, Development, and Ecology

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ABSTRACT

This study takes China's southwest border region as its research object, focusing on the transformation of governance models under the strategic framework of "Ecological Border Protection" (Eco-Border Protection). As a national ecological security barrier, a demonstration zone for ethnic unity, and a hub connecting South and Southeast Asia, the southwest borderlands are undergoing a paradigm shift from a "stability-oriented border governance" model to an "ecology-oriented" one. By analyzing the current state of ecological security, governance challenges, and representative case studies, this paper identifies three major transformation pathways: institutional innovation, technological empowerment, and multi-stakeholder collaborative governance. It further proposes targeted policy recommendations, including the establishment of cross-border ecological compensation mechanisms, the development of value realization mechanisms for ecological products, and the deepening of the theoretical framework of Eco-Border Protection. These proposals aim to provide theoretical support and practical references for advancing the coordinated development of security, development, and ecology in border regions.

Keywords: *Ecological border protection, Southwest borderlands, Governance transformation, Collaborative governance.*

1. INTRODUCTION: THE ECO-BORDER PROTECTION STRATEGY AND GOVERNANCE MODELS IN THE SOUTHWEST BORDERLANDS

1.1 Strategic Position and Ecological Importance of the Southwest Borderlands

The southwest border region, encompassing the border areas of Yunnan, Xizang, and Guangxi provinces, constitutes the longest land border in China and holds irreplaceable ecological strategic importance. Geographically, this area lies at the convergence of the Qinghai–Xizang Plateau ecological barrier, the Loess Plateau–Sichuan–Yunnan ecological barrier, and the southern hilly and mountainous belt, making it a core component of China's "two barriers and three zones" (liangping sandai) ecological security framework. As an extension of the "Asian Water Tower," the region serves as the source or upper reaches of over a dozen international and domestic rivers, including the Yangtze, Pearl, Lancang, and Nujiang rivers. The ecological health of this region directly affects the water security and ecological safety of more than 600 million people downstream. Yunnan Province, for example, is home to three of the world's 36 global biodiversity hotspots (the Mountains of Southwest China, the Eastern Himalayas, and the Indo-Burma region), encompassing complete vertical ecosystems ranging from tropical rainforests to alpine glaciers.

The ecological value of the southwest borderlands extends beyond biodiversity conservation to include critical border security functions. This region shares the longest land border with Myanmar, Laos, and Vietnam, where complex ecosystems form a natural ecological defense line. Moreover, the area is inhabited by over 30 ethnic minorities, each of which has developed unique ecological wisdom and cultural traditions through long-term environmental adaptation—such as the Dai people's "longlin" (sacred hill) water-source forest protection and the Hani people's terraced paddy field systems. This makes the region a model of high coupling between ecological and cultural diversity. Such deep integration of nature and humanity positions the southwest borderlands as an exemplary site for exploring harmonious coexistence between humans and nature, providing a practical foundation for building a Chinese ecological community.

Table 1. Multidimensional analysis of ecological security value in the southwest borderlands

Dimension	Core Characteristics	Strategic Value	Supporting Data
Biodiversity	3 of 36 global hotspots	National germplasm repository	6,080 plant species, 1,341 animal species recorded
Water Conservation	Extension of Asian Water Tower	Secures water resources for 600 million people downstream	13 international rivers, annual outflow >400 billion m³
Border Stability	Multi-ethnic ecological coexistence	Strengthens border ecological defense	26 indigenous ethnic groups, 5,081 km border line
Carbon Sequestration	High forest coverage	Supports national dual-carbon strategy	Yunnan forest coverage rate 57.83%

1.2 Limitations of Traditional Border Governance Models

Ecological security is not a static state but is subject to constant change under multiple influencing factors [1]. Historically, the southwest borderlands have been governed primarily under a "stability-oriented border governance" model. While this model has played a significant role in maintaining border security, it is increasingly showing its limitations under new circumstances. This security-centric governance paradigm overemphasizes political control and military defense, neglecting the multidimensional roles of the borderlands as ecological barriers and economic development spaces. These limitations manifest in three specific areas:

1.2.1 Imbalance between Security and Development

Traditional governance treats the borderlands as "breakwaters" and "buffers," concentrating resources on border defense infrastructure and stability-maintenance forces, resulting in severe economic underdevelopment. In 2023, data showed that the GDP of the nine border provinces accounted for only 13.9% of the national total, with per capita GDP approximately 30% below the national average. In border areas such as Lincang, Yunnan, despite abundant ecological resources, weak infrastructure and insufficient industrial support hinder the conversion of "lucid waters and lush mountains" into "gold and silver mountains," exacerbating the dilemma where border residents "cannot prosper while guarding the border, and find it difficult to guard the border while prospering".

1.2.2 Marginalization of Ecological Protection

Under the "stability-oriented" framework, ecological protection often takes a backseat to the rigid demands of security and development. For instance, in the Hengduan Mountains, blasting and excavation methods were employed to ensure border road access, leading to exposed hillsides and soil erosion. In Xishuangbanna, rubber plantation expansion destroyed tropical rainforests, threatening Asian elephant habitats. Such ecologically costly development not only undermines the ecosystem service functions of the borderlands but also exacerbates cross-border ecological security issues. For example, declining water quality and biodiversity loss in the Lancang–Mekong River basin, caused by developmental activities, have already triggered multiple complaints from downstream countries.

1.2.3 Unitary Governance Actors

Traditional governance relies heavily on government—particularly central government—policy direction and fiscal investment, with

insufficient participation from market mechanisms and civil society. In biodiversity conservation in the southwest borderlands, a "enclosure-style" protection model is often adopted, isolating protected areas from communities and restricting indigenous resource-use rights without providing alternative livelihoods, leading to conflicts between conservation and development. For example, although the Daweishan National Nature Reserve in Yunnan has established strict protection regulations, the absence of community co-management mechanisms means illegal logging and poaching still occur.

1.3 The Emergence of the Eco-Border Protection Strategy

The proposal of the Eco-Border Protection strategy represents a profound transformation of traditional governance models, grounded in theoretical, policy, and practical developments. Theoretically, it applies ecological civilization thinking to border governance, integrating principles such as "lucid waters and lush mountains are invaluable assets" and "the life community of mountains, waters, forests, farmlands, grasslands, and deserts" into the governance system, shifting the borderlands from "security fences" to "composite security–development–ecological barriers".

In terms of policy evolution, the Eco-Border Protection strategy has developed through three phases: Phase I (2012–2017), centered on the "Revitalizing Borders and Enriching the People" campaign, focused on poverty alleviation; Phase II (2018–2022), emphasizing "ecological priority," integrated modern border village construction with ecological protection; and Phase III (2023–present), upgraded to "Border Happy Villages," aiming to achieve coordinated progress in ecological security, border stability, and people's wellbeing through a "happy upgrade." In May 2025, five ministries, including the Ministry of Finance, jointly issued the Opinions on Further Improving the Horizontal Ecological Compensation Mechanism, explicitly articulating the principles of "cost-sharing, benefit-sharing, and cooperative governance," providing institutional support for Eco-Border Protection.

On the practical front, the dual pressures of climate change and geopolitics have driven governance innovation. On one hand, the southwest borderlands face ecological threats such as glacial retreat, increased extreme weather events, and biodiversity loss, directly affecting water security and territorial protection. On the other hand, with the advancement of the Belt and Road Initiative, the border areas have shifted from "peripheral backwaters" to "frontier hubs," necessitating green development to enhance regional competitiveness. Lincang City, for instance, leveraging its National Sustainable Development Agenda Innovation Demonstration Zone, has pioneered a development path of "ecological priority and green growth in underdeveloped multi-ethnic border areas," earning the title of "National Ecological Civilization Construction Demonstration Zone" in 2022, providing a practical model for the Eco-Border Protection strategy.

2. CURRENT ECOLOGICAL SECURITY STATUS AND GOVERNANCE CHALLENGES IN THE SOUTHWEST BORDERLANDS

2.1 Current Ecological Security Status

The ecological security of the southwest borderlands exhibits a complex pattern of "overall fragility, localized improvement, and intertwined risks." In recent years, under the discursive dominance of developmentalism, the region's ecological carrying capacity has been persistently strained, placing immense pressure on border ecosystems [2]. As one of China's most ecologically sensitive areas, it is subjected to dual pressures from global climate change and human activities. In terms of ecosystem stability, the average thickness of the humus layer in southwest mountain soils is less than 30 cm, and once damaged, vegetation in alpine meadows may take decades to recover. Monitoring data from Lincang show that climate warming has accelerated the local species extinction rate to 0.5% per year, significantly higher than the national average.

Despite these challenges, systematic conservation efforts have led to notable improvements in some areas. Yunnan's forest coverage rate has risen to 57.83%, and Lincang City has maintained 100% air quality and surface water quality compliance rates for five consecutive years. In 2024, the Bayanbulak Grassland in Xinjiang successfully applied vegetation concrete ecological protection technology under extreme conditions (2,500 m altitude, -40°C), achieving rapid vegetation restoration and providing technical reference for similar areas in the southwest borderlands.

However, cross-border ecological risks continue to accumulate. Hydrological changes in the Lancang–Mekong basin due to development have affected fisheries in six downstream countries, with seawater intrusion destroying tens of thousands of hectares of farmland in the Mekong Delta. In the China–Myanmar border area, the expansion of monoculture crops such as rubber and bananas has fragmented tropical rainforests, reducing Asian elephant habitats by 30% and increasing human–elephant conflicts by an average of 12% annually. These cross-border ecological issues not only threaten regional ecological security but also risk being exploited by external actors to fuel geopolitical disputes.

2.2 Governance Model Dilemmas

Several structural contradictions currently constrain the implementation of the Eco-Border Protection strategy in the southwest borderlands.

2.2.1 Central–Local Power Imbalance and Deficient Compensation Mechanisms

Ecological barrier construction generates significant positive externalities, yet existing compensation mechanisms fail to cover conservation costs. Although the 2025 horizontal ecological compensation policy articulates the principle of "those who protect, benefit," implementation details remain lacking in key areas such as cross-border basin compensation standards and forest carbon trading. In Cangyuan County, Yunnan, forestry carbon sink projects have been unable to enter the national carbon market due to the absence of national certification standards, preventing border residents from translating their ecological contributions into tangible income.

2.2.2 Insufficient Technological Application and Weak Monitoring Capacity

The complex terrain and diverse ecosystems of the southwest borderlands demand high-performance monitoring technologies. Current ecological monitoring suffers from "three lows": low monitoring station coverage (only 40% of plains levels), low data timeliness (mostly quarterly updates), and low multi-source data integration. For example, the Daweishan Reserve still relies on manual patrols, which are insufficient for timely detection of illegal logging and poaching. In Lincang, 15% of species have yet to be captured in high-definition imagery during biodiversity baseline surveys.

2.2.3 Insufficient Multi-Stakeholder Collaboration and Community Participation Gaps

The existing governance system is heavily government-dominated, with limited channels for market and civil society participation. In cross-border ecological cooperation, local governments, constrained by diplomatic authority, are unable to sign direct agreements with neighboring countries' local governments. At the community level, the lack of participatory mechanisms hinders the implementation of conservation measures. For instance, some nature reserves have imposed blanket logging bans without considering indigenous livelihood needs, generating resistance. Pingbian County's innovative "public welfare forest contracting and stewardship" model, which entrusts 1.3 million mu of ecological public welfare forests to villagers for contracted management, has achieved a win-win outcome for conservation and community benefits, but such innovations have yet to be institutionalized on a broader scale.

2.3 Representative Case Studies

2.3.1 Lincang Ecological Civilization Demonstration Zone

Lincang City, located in the ecologically critical Lancang–Mekong basin, serves as a pilot area for the Eco-Border Protection strategy. Its governance system is built on three pillars: institutional innovation, systematic management, and value transformation.

Institutionally, Lincang has established a joint mechanism integrating "river (lake) chiefs + police chiefs + chief prosecutors," which resolved 237 river/lake issues in 2024. Ecological environmental protection has been incorporated into the performance evaluation of party and government officials, accounting for 30% of the total weight—significantly higher than the national average. In terms of management, a "space–air–ground–people" integrated monitoring system has been implemented, leading to 11 environmental violation cases being investigated and penalized in 2024. The "bald hill" forest restoration project has improved 1,897.2 mu of low-quality forest, raising forest coverage to 57.83%. In value transformation, 300,000 mu of organic farming has been developed,

and the under-forest economy has grown at an annual rate of 15%. Anshi Village in Fengqing County, through a "tea + tourism" model, has transformed from a poverty-stricken village into a "National Rural Tourism Key Village," with average household annual income exceeding 100,000 RMB.

2.3.2 Daweishan National Nature Reserve Community Co-Management Model

The Daweishan National Nature Reserve in Yunnan preserves China's only continental humid rainforest and a complete vertical tropical mountain forest spectrum, hosting 7,421 recorded species and earning the title "gene bank of flora and fauna." To address the conservation–development conflict, the reserve has pioneered a community co-management model.

Public Welfare Forest Contracting: 1.3 million mu of ecological public welfare forests are contracted to surrounding villagers for stewardship, with the government paying 50 RMB/mu in management fees, simultaneously increasing border residents' incomes and reinforcing conservation responsibilities. Tao Wenguo, a forest ranger in Huoshan Village, has managed 9,000 mu of forest for 16 years, evolving from a novice to a seasoned professional.

Ecological Industry Support: In buffer zones, "under-forest planting + eco-tourism" is promoted. Pingbian County provides free saplings for economic forests; one farmer, Li Baoming, now earns over 10,000 RMB annually from fruit trees, affirming that "planting trees and protecting mountains is better than growing corn."

Cultural–Ecological Integration: The reserve taps into Miao traditional ecological wisdom to create a county townscape characterized by "forests surrounding the city, clear water enlivening the city, flowers and trees adorning the city, and Miao culture beautifying the city," earning the title of "National Ecological Civilization Demonstration County".

2.3.3 Qinghai–Xizang–Sichuan–Yunnan–Gansu Border Ecological Cooperation Mechanism

In 2024, the joint governors' meeting of border prefectures and cities from five provinces (Qinghai, Xizang, Sichuan, Yunnan, and Gansu) made breakthrough progress in ecological collaboration, establishing three major cooperation mechanisms.

Basin Co-Governance: Gannan Prefecture in Gansu proposed the establishment of "upstream–downstream ecological compensation," while Hainan Prefecture in Qinghai promoted the integration of river/lake chief and forest/grassland chief systems.

Biodiversity Joint Protection: Changdu City in Xizang and Diqing Prefecture in Yunnan cooperated on "cross-border snub-nosed monkey protection," establishing shared observation networks.

Engineering Synergy: Aba Prefecture in Sichuan advocated for "integrated management of mountains, waters, forests, farmlands, grasslands, and deserts" and jointly applied for national ecological restoration projects.

These mechanisms transcend administrative boundaries and provide a model for regional collaboration in southwest border ecological governance.

Table 2. Comparative table of typical ecological governance cases in the southwest borderlands

Case	Innovation	Outcome	Scalability Value
Lincang Eco-Demonstration Zone	Party–government joint accountability, trilateral law enforcement	100% water quality compliance; 15% annual growth in under-forest economy	Institutionalized pathway for border city ecological governance
Daweishan Community Co-Management	Public welfare forest contracting, ecological industry support	1.3 million mu forest under management; 45% reduction in illegal logging	Social participation mechanism addressing conservation–development conflict
Qinghai–Xizang–Sichuan–Yunnan–Gansu Regional Cooperation	Governors' joint meetings, project co-promotion	Coordinated advancement of major projects like Sanjiangyuan	Cross-administrative coordination mechanism for ecological governance

3. GOVERNANCE MODEL TRANSFORMATION PATHWAYS UNDER THE ECO-BORDER PROTECTION STRATEGY

3.1 Institutional Innovation Pathway: From Stability-Oriented to Ecology-Oriented Governance

Institutional innovation is fundamental to the implementation of the Eco-Border Protection strategy and requires the construction of a legalized, market-oriented, and internationalized institutional system.

Deepening Ecological Compensation Mechanisms. Guided by the 2025 Opinions on Further Improving the Horizontal Ecological Compensation Mechanism, the southwest borderlands should promote a "three-dimensional expansion" of compensation: from water-quality compensation to multi-factor compensation (including water conservation, biodiversity, and carbon sinks); from provincial compensation to cross-border compensation (e.g., establishing a six-country Lancang–Mekong compensation fund); and from government compensation to market-based compensation (developing forest carbon sinks, water rights trading, etc.). Yunnan can leverage national park development to explore a "carbon sink + ecological compensation + border livelihood" linkage model. For example, Nujiang Prefecture could receive 200–300 million RMB annually from forest carbon sink projects, benefiting 100,000 border residents.

Optimized Territorial Spatial Control. Based on the "three zones and three lines" (sanzone sanxian) delimitation, differentiated spatial governance should be implemented: in ecological red-line areas, strict no-development policies apply, with special protection for 1.546 billion mu of permanent basic farmland; in border development zones, the Pingbian "mountain–water–forest–Miao–city" five-in-one model should be promoted to establish a coordinated "production–living–ecological" spatial pattern. Lincang has divided its entire territory into 115 environmental control units for precise zoning management, providing a model for border territorial planning.

Cross-Border Ecological Cooperation Mechanisms. A "diplomatic authorization + local practice" model for cross-border ecological cooperation should be innovated, and three breakthroughs should be advanced: multi-level cooperation frameworks should be established, including central government-led GMS Environment Ministers' Meetings and local mechanisms like the Yunnan–Northern Laos Working Group; transboundary protected area networks should be set up, such as the China–Laos–Myanmar–Vietnam "Green Triangle" biodiversity joint protection; and mutual recognition of ecological product certifications should be created, e.g., Pu'er tea organic certification, so that market competitiveness can be enhanced.

3.2 Technology Empowerment Pathway: Enhancing Smart Governance Capacity

Technological innovation is key to overcoming ecological governance challenges. The southwest borderlands should focus on developing three major technology systems.

Ecological Monitoring and Early Warning Technologies. A "satellite–air–ground–people" integrated monitoring network should be built: high-resolution satellites and UAV remote sensing should be used for broad-area monitoring; intelligent sensor networks should be deployed for real-time water and air quality data; and AI should be applied for ecological risk early warning. Lincang's "space–air–ground" integrated system has reduced response times for illegal activities from 30 days to 72 hours. In the Nujiang Gorge, a landslide early warning system combining geotechnical sensors and InSAR satellite imagery provides 72-hour advance alerts, safeguarding border residents' lives.

Integrated Ecological Restoration Technologies. The implementing agency should on the basis of the region's unique terrain and climate, develop and disseminate adaptive ecological technologies: in alpine meadows, it should adopt the "vegetation concrete ecological protection technology" validated at Bayanbulak, using polymer regulators, ecological fertilizers, and plant straw to construct artificial soil layers capable of rapid vegetation recovery even at -40°C; in mine rehabilitation, it should apply Maccaferri's "high-performance ecological substrates" combined with gabion nets and reinforced MacMat® for concurrent erosion control and vegetation restoration. The Fengshan mine rehabilitation project in Guangxi increased vegetation coverage from under 20% to over 85%.

Blockchain-Empowered Ecological Governance. Blockchain should be utilized to build an "Eco-Chain" platform, by which the following should be enabled: ecological asset registration and title management (forestry, grassland, carbon rights) should be conducted to resolve property disputes; compensation payments should be automatically triggered through smart contracts; and full-chain traceability certification for ecological products (organic tea, wild mushrooms) should be provided. Following blockchain adoption in Pu'er's tea industry, premium tea prices rose by 30%, benefiting 56,000 tea farming households.

3.3 Multi-Stakeholder Collaborative Governance Pathway

Successful implementation of the Eco-Border Protection strategy requires synergistic participation from government, market, and society to build a co-constructed, co-governed, and shared governance community.

Government-Led Cross-Sectoral Collaboration. Vertically, government should improve the four-tier responsibility system: "central planning – provincial overall responsibility – prefecture/city organization – county/township implementation." Horizontally, government also should promote the Qinghai–Xizang–Sichuan–Yunnan–Gansu border governors' meeting mechanism to foster "ecological co-governance, industrial co-construction, cultural and tourism co-integration, and project co-promotion." Changdu and Diqing's joint snub-nosed monkey protection network offers a model for cross-administrative species conservation.

Market-Driven Resource Operations. The government should assist the market in innovating the mechanism for realizing the value of ecological products and explore the operation mode of the "Two Mountains Bank". For example, establishing a provincial-level ecological asset operation company to collect, store, integrate, and develop fragmented ecological resources in a market-oriented manner; Issuing green bonds to support border ecological industries, such as Yunnan Urban Investment Group issuing a 1 billion yuan "Ecological Border Protection Special Bond" in 2024 for sewage treatment in border villages and ecological tea garden construction; The market should also develop ecological finance and introduce financial instruments such as "carbon pledge loans" and "ecological insurance". In Napo County, Guangxi, the "Thousand-Household Solar Action" enables households to earn an average of 4,800 RMB annually through rooftop photovoltaic power sales.

Community-Based Grassroots Governance. government should help and Stimulate border residents' agency by building "work-for-relief, reward-for-participation" mechanisms. For example, scale up Pingbian's public welfare forest contracting model; Government also should establish community ecological monitor programs, hiring residents as biodiversity observers (e.g., 30 Wa villagers in Banhong Township, Cangyuan, trained to monitor Asian elephants, earning an additional 1,500 RMB/month); In terms of tourism, the government should also cultivate ecological cooperatives and develop characteristic industries such as agroforestry and ecotourism. Bingdao Village in Shuangjiang County, leveraging ancient tea tree resources, has achieved average household annual income exceeding 100,000 RMB through eco-tourism, demonstrating "tea-based prosperity and forest-protection border stabilization".

4. POLICY RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

4.1 Policy Recommendations

Based on the challenges and practical experiences in southwest border ecological governance, the following targeted policy recommendations are proposed:

4.1.1 Establishing Cross-Border Ecological Compensation Mechanisms

Government should leverage the Lancang–Mekong Cooperation mechanism to promote the establishment of a six-country basin ecological compensation fund, with contribution ratios determined by the principle of "common but differentiated responsibilities". For example, design multi-dimensional compensation standards (water quality improvement + water quantity assurance + biodiversity protection) in line with the 2025 Horizontal Ecological Compensation Opinions. Pilot "trade-back-to-ecology" policies at ports such as Mengla (China–Laos) and Ruili (China–Myanmar), allocating 1–3% of import/export tariffs to ecological compensation funds.

4.1.2 Improving Value Realization Mechanisms for Ecological Products

Government should also develop the Guidelines for Gross Ecosystem Product (GEP) Accounting in the Southwest Borderlands to standardize methodologies; Such as introduce concession pilot programs in national nature reserves, allowing communities to reasonably develop ecological products; establish "Green Enclave Economic Zones" (e.g., Shenzhen–Lincang cooperation parks) where eastern regions provide capital and technology while the southwest supplies ecological products, achieving mutual empowerment. Ultimately, promote the inclusion of carbon sequestration projects in the national unified carbon market and support forestry carbon sequestration pilot projects such as Lincang Fengqing to participate in CCER trading.

4.1.3 Strengthening Digital Governance Capacity

The government should establish a "Digital Border Protection" special initiative to achieve full ecological monitoring network coverage in border counties within three years; develop an "Eco-Border Protection" big data platform integrating biodiversity, pollution, and disaster risk data; deploy digital twin technology in protected areas to support management decisions. For example, Daweishan Reserve could deploy an infrared camera network and AI identification system for real-time monitoring of snub-nosed monkey populations.

4.1.4 Innovating Green Financial Instruments for Border Areas

The People's Bank of China should take the lead in establishing an "Eco-Border Protection Relending Facility" to support border ecological industries; encourage commercial banks to develop "Eco-Loans" and "Carbon-Sink Loans"; explore issuing "Eco-Lotteries" to raise social funds for border ecological construction; introduce social capital through PPP models for "Border Happy Village" construction in Guangxi and Yunnan.

4.2 Future Research Directions

As the Eco-Border Protection strategy deepens, the following research areas require urgent attention:

4.2.1 Theoretical Innovation in Border Ecological Security

A theoretical framework for "Border Ecology" should be explored, with the structure, function, and succession patterns of land-border ecosystems examined; "Pressure–State–Response" models should be developed to assess ecological security risks; and research on the "human–land–border" coupling mechanisms should be deepened to reveal the interplay between ecological security and border stability.

4.2.2 Technical Standards for Eco-Border Protection

Government need to develop adaptive technical standards for border ecological restoration, such as alpine slope restoration specifications (drawing on Bayanbulak case) and transboundary biological corridor design guidelines; establish material standards for ecological restoration in border areas (e.g., Maccaferri substrate parameters for hot and humid environments); build species-specific conservation technology systems for iconic species like Asian elephants and snub-nosed monkeys.

4.2.3 Governance Effectiveness Evaluation Methods

In terms of constructing an evaluation index system, it's important for government to Construct a three-dimensional "security–development–ecology" evaluation index system and develop a Border Governance Performance Index (BGMI); apply spatial econometric methods to quantify the impact of ecological compensation policies on border residents' incomes; conduct cost–benefit analyses of Eco-Border Protection to inform policy optimization.

5. CONCLUSION

Security is the prerequisite for development—an eternal theme in every nation's modernization process [3]. The governance model of China's southwest borderlands is undergoing a strategic transformation from "stability-oriented border governance" to "Eco-Border Protection," a shift necessitated by the imperative to coordinate security, development, and ecological objectives. This study demonstrates that the Eco-Border Protection strategy, through three pathways—institutional innovation, technological empowerment, and multi-stakeholder governance—

drives three major transitions in the southwest borderlands:

In the security dimension, from unitary territorial security to comprehensive ecological security. By building biodiversity protection networks and cross-border ecological cooperation mechanisms, the borderlands become an ecological barrier against invasive species and climate change. The 2023 establishment of the "Asian Elephant National Park" in Yunnan exemplifies this transition, enhancing the "ecological defense function" of the borderlands and making lucid waters and lush mountains an integral part of national territorial security.

In the development dimension, from poverty-alleviation through subsidization to self-sustaining development. Leveraging ecological resource endowments, green industries—specialty agriculture, ecotourism, under-forest economy—enable border residents to benefit directly from ecological protection. Cases like Bingdao Village's household income exceeding 100,000 RMB and Napo's photovoltaic poverty alleviation demonstrate that ecological industrialization can reconcile "border guarding" with "prosperity," providing lasting momentum for border revitalization.

In the governance dimension, from unitary government dominance to multi-stakeholder collaborative governance. Innovative practices such as the Qinghai–Xizang–Sichuan–Yunnan–Gansu governors' meetings and Pingbian's public welfare forest contracting have built a "government–market–community" collaborative governance network. The 2025 improvements to horizontal ecological compensation further reinforce the governance philosophy of "cost-sharing, benefit-sharing," injecting new momentum into border governance modernization.

Successful implementation of the Eco-Border Protection strategy will transform the southwest borderlands from a "development depression" into an "ecological highland," and from an "open-backwater" into a "green frontier," offering a Chinese model for sustainable development in global border regions. This transformation is not only an innovation in border governance paradigms but also a vivid application of ecological civilization thinking in border areas, manifesting the superiority of the Chinese path to modernization characterized by harmonious coexistence between humans and nature.

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