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Development and Impact of the GIES Case on Jinuo Youle Tea

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Abstract: Jinuo Youle Tea is produced in Jinuoshan Township, Jinghong City, Xishuangbanna Dai Autonomous Prefecture, Yunnan Province—one of the core areas of Pu'er tea's ancient six famous tea mountains. The region features an outstanding ecosystem with a forest coverage rate of 94.01%, ancient tea tree resources aged 200–300 years, and distinctive Jinuo ethnic tea culture. However, for a long time it has faced a development dilemma: high-quality tea without high prices, and difficulty in turning resources into market value. In 2024, with support from the "Geographical Indications Environment & Sustainability" (GIES) science-and-technology service team of the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Jinuo Youle Tea was included in a case system of GIES. Through scientific empowerment, brand building, and industrial integration, it achieved a leap from a traditional agricultural product to an internationally awarded product. In 2025, Jinuo Youle Tea won the Gold Award at the 15th International Famous Tea Competition, was showcased at the exhibition celebrating the 80th Anniversary of FAO, and became a knowledge product under the "Better Environment" pillar of the FAO "One Country One Priority Product" Initiative. This paper systematically reviews the development trajectory, key actions, and overall benefits of the Jinuo Youle Tea GIES case, analyzes how GIES supports ecological conservation of ancient tea gardens, quality upgrading of the tea industry, and rural revitalization, and summarizes lessons and insights, with the aim of providing practical reference for realizing the value of ecological products in tea-producing regions worldwide.

Keywords: GIES; Jinuo Youle Tea; ancient tea gardens; rural revitalization; OCOP; international gold award

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1 Introduction

Against the backdrop of global agricultural sustainability and rural transformation, how to convert the advantages of local ecological resources into the market competitiveness of special agricultural products—to achieve a win-win outcome between ecological conservation and economic development—has become a key concern for both scholars and policymakers. Xishuangbanna Prefecture has a forest coverage rate of 74.05%, and its plant and animal species account for about one quarter and one sixth of China's total, respectively, making it a true "gene bank of biodiversity". Such unique natural resources and endowments are Xishuangbanna's most valuable assets, most prominent strengths, and most recognizable ecological brand.

The Geographical Indications Environment & Sustainability (GIES) concept, an innovative vehicle for integrating local ecological resources, place-based specialty industries, and cultural heritage, was first proposed by the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS) in 2021, together with a ten-year action plan[1]. Guided by open science, GIES brings together multidisciplinary approaches and multi-stakeholder participation to systematically study the natural environment, quality attributes, historical culture, and governance/management of high-quality geographical products. It further develops a full-chain support system—"scientific data+science communication+brand empowerment+industrial upgrading"—and provides a replicable and scalable methodology for transforming ecological value into product value.

Jinuo Mountain is in the northeastern part of Jinghong City, Xishuangbanna Dai Autonomous Prefecture, Yunnan Province. Situated in the hilly area of the Wuliang Mountain offshoots of the Hengduan Mountain range, it is one of the ancient six famous tea mountains of Pu'er tea[2]. The area has long been home to the Jinuo people, China's 56th officially recognized ethnic group. With a tea-growing and tea-making history of over a thousand years, it contains more than 266.67 ha of ancient tea gardens, with many tea trees aged 200–300 years[3]. Youle Tea (also known as Jinuo Tea) was once a tribute tea during the Qing Dynasty, when a dedicated local official ("Youle Tongzhi") was appointed to manage tribute-tea procurement[4,5]. However, due to its remote mountainous location, low brand recognition, and information asymmetry in markets, Jinuo Youle Tea remained trapped for years in the dilemma of good tea without a good price. Before 2021, the average local tea price was only 20–30 CNY per kg; although ancient-tree tea had distinctive quality, it was difficult to generate a price premium, leaving tea farmers in the predicament of higher output without higher income. Against the dual backdrop of the profoundly advancing rural revitalization strategy and the exponential evolution and real-world deployment of AI technologies, geographical indication (GI) products, which carry unique natural endowments and historical accumulations, are encountering a crucial strategic opportunity for digital and intelligent brand transformation. Currently, however, the brand construction of GI products faces widespread pain points: vague brand positioning, fierce homogenization, difficult quality management, extensive communication methods, inadequate digital capabilities, and underutilized cultural assets. Moreover, the sector is hindered by the systemic issue of emphasizing application while neglecting operation. Driven by low technology penetration and entrenched data silos, the current paradigm fails to align with the digital era's imperative for refined, targeted, and long-term brand development.

In February 2024, researchers including Dr. LIU Chuang and Dr. WANG Zhenbo from IGSNRR, CAS led a GIES science-and-technology service team to conduct field investigations in Jinuoshan Township. Working with the local government, tea farmers, and cooperatives, they launched the "GIES Case on Ancient Tea Gardens of Jinuo Youle Tea in Tropical Mountainous Regions". Subsequently, with Associate Researcher KANG Lei as the chief scientist, a cross-disciplinary team was formed to carry out systematic surveys and research on the natural ecological environment, soil and water quality, tea quality, history and culture, and management practices of the Youle ancient tea gardens, producing a complete dataset[6] and a set of case outputs[7]. In September 2025, Jinuo Youle Tea stood out at the 15th International Famous Tea Competition and won the Gold Award[8]. In October, it was showcased as a representative China's high-quality geographical product at the FAO's

first “From Seeds to Goods” global exhibition. These breakthroughs mark a transformation of Jinuo Youle Tea from “hidden in deep mountains and unknown to the world” into a “golden leaf” reaching global markets.

This paper systematically reviews the development trajectory, key measures, and integrated benefits of the Jinuo Youle Tea GIES case. It explores pathways through which science and technology can support ecological conservation of ancient tea gardens, quality upgrading of the tea industry, and rural revitalization, and summarizes lessons and insights to provide theoretical references and practical implications for ecological value realization and rural revitalization in ethnic minority regions.

2 Geographical Diversity of Jinuo Mountain and the Ancient Tea Garden Ecosystem

2.1 Natural Ecological Foundation of Jinuo Mountain

Jinuoshan Township is located in the northeastern part of Jinghong City, Yunnan Province. It is the only Jinuo ethnic township in China, situated in the hilly area of the Wuliang Mountain range, an extension of the Hengduan Mountains. The altitude ranges from 575 to 1,691 m, with areas above 1,000 m accounting for 47.61% of the total area, and over 75% of the land having a slope of less than 25°. The combination of medium-to-high altitude and gentle topography provides suitable geomorphological conditions for tea plant cultivation. The climate is classified as tropical monsoon, with an average annual temperature of 18–22 °C, annual rainfall of approximately 1,400 mm, and average annual sunshine duration of 1,966.2 h. High cloud frequency and negative oxygen ion concentrations exceeding 30,000 ions/cm^3 facilitate the accumulation of amino acids and the optimization of catechin composition in tea plants, thereby reducing the bitterness and astringency of tea infusions.

The soil is predominantly acidic red soil (lateritic red soil), with a pH ranging from 4.3 to 5.2. The mean organic matter content is 14.79 g/kg, mean available potassium is 35.36 mg/kg, and mean total nitrogen is 0.088%. The mean cation exchange capacity (CEC) is 12.23 cmol/kg, indicating good nutrient retention capacity. Heavy metal and pesticide residue levels are below the national risk screening values, with no pesticide residues detected, demonstrating excellent soil environmental quality. Vegetation coverage is high, with the forest coverage rate in Youle Village reaching 94.01% and NDVI values ranging from 0.83 to 0.86. Ancient tea trees form stable symbiotic relationships with Dendrobium orchids and wild bee colonies, reflecting rich biodiversity.

Regarding the water environment, the rivers in the township belong to the Lancang River basin[9]. Water quality complies with the national standard for irrigation water quality (GB5084—2021), with key indicators such as total mercury, hexavalent chromium, cadmium, and lead all below detection limits. Tea tree growth relies primarily on natural precipitation and fog. In summary, Jinuoshan Township exhibits excellent coordination and environmental background quality in terms of water, soil, climate, and vegetation, providing a solid natural foundation for the ecological production of high-quality ancient tea trees.

2.2 Resource Endowments of the Ancient Tea Gardens

The Youle ancient tea gardens are the best-preserved and largest ancient tea garden system in Jinuo Mountain, with the core area located in Youle Village (Longpa Zhai, now Yanuo Village). The total tea garden area is 183.01 ha, including 120 ha of ancient tea gardens. Most ancient tea trees have a basal girth of 50–120 cm, a trunk circumference (at breast height) of 30–80 cm, a height of 2–3 m, and a crown diameter of 1.5–3 m. Most trees are 200–300 years old[10], with a density of about 1,500 trees per ha. The main variety is the Youle large-leaf type, together with naturally cross-pollinated landrace populations. Morphological types include long-leaf and elliptic-leaf forms, and two bud-stem color types (red-stem with green buds; green-stem with green buds). The leaves are thick and rich in amino acids and other nutrients, producing a mellow taste and distinctive aroma. This combination of scarcity, uniqueness, and high quality makes Jinuo Youle Tea a premium product among Pu’er teas (Figure 1).

2.3 Historical and Cultural Heritage

Figure 1 Youle ancient tea gardens

The Jinuo people have a long history of tea cultivation, processing, and trade. Jinuo Mountain was historically known as Youle Mountain and is regarded as the first among the ancient six famous tea mountains of Pu'er tea. In the 7th year of the Yongzheng reign of the Qing Dynasty (1729), the Qing government established the office of "Youle Tongzhi", stationed 500 soldiers, and tasked the administration with maintaining social order across the six tea mountains as well as managing tribute-tea procurement and tea trade. By the Daoguang period, Youle Tea had already been exported to India and Europe. The Jinuo have developed distinctive tea culture practices: (1) liangban cha (cold-mixed tea), in which fresh leaves are pounded and mixed with chili, salt, and other seasonings—preserving an early human way of using tea; (2) huoshao cha (fire-roasted tea), where fresh tea wrapped in wild leaves is roasted and then boiled for drinking; and (3) deep integration of tea with festivals and rituals. Intangible cultural heritage such as the Jinuo drum dance also reflects the intergenerational transmission of tea culture.

3 Development Trajectory of the GIES Case on Jinuo Youle Tea

3.1 Historical Constraints: High-Quality Tea Without a Good Price, and Resources Difficult to Monetize

Despite its outstanding ecological resources, long-standing cultural heritage, and distinctive tea quality, the Jinuo Youle Tea industry faced multiple constraints before the launch of the GIES case.

First, ecological advantages were not converted into market competitiveness. Tea farmers lacked a scientific understanding of the ecological value of ancient tea gardens. Tea sales relied mainly on traditional channels and verbal descriptions, with little scientific evidence to support quality claims. As a result, it was difficult to build differentiated competitiveness, and even ancient-tree tea with unique qualities struggled to obtain a corresponding price premium.

Second, brand building lagged behind, and market recognition was fragmented and confusing. Although "Youle Tea" had some level of visibility, it lacked unified brand governance and market standards. Problems such as adulteration and counterfeiting were frequent. Plantation tea was sometimes falsely marketed as ancient-tree tea, seriously undermining brand credibility. Consumers found it difficult to distinguish authenticity, and genuinely high-quality products struggled to gain market recognition.

Third, management was dispersed and the value chain was short. Production was dominated by small household operations, with inconsistent standards and weak quality control. Processing was largely limited to primary processing, with a single product form and little deep processing or professional brand operation. Most tea was sold externally as raw material, resulting in low added value.

Fourth, pressure on ancient tea tree conservation increased. As the Pu'er tea market heated up, some farmers pursued short-term gains, and practices such as over-harvesting and improper management occurred from time to time, threatening the health of ancient tea trees.

As the Township Head, ZENG Song, put it plainly: "In the past, we only knew our tea was good, but we couldn't explain why it was good, and we couldn't sell it at a good price". This simple statement captures the core bottleneck in the development of Jinuo Youle Tea.

3.2 GIES Team Works on the Jinuo Mountain

In February 2024, as spring tea buds began to emerge, the GIES science-and-technology service team from IGSNRR, CAS, visited Jinuoshan Township. Led by Professor LIU

Chuang—an expert of the "Innovative China" thinks tank and the chief scientist of GIES—and Professor WANG Zhenbo, head of the GIES planning group, the team conducted field investigations in the Youle ancient tea gardens. Together with local tea farmers, cooperatives, and government staff, they discussed pathways for conserving ancient tea gardens and promoting sustainable development (Figure 2).

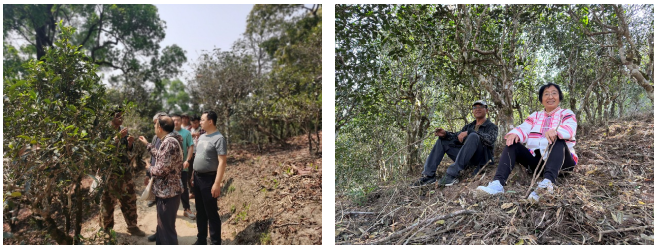

Figure 2 Field visit by the GIES team to the Youle ancient tea gardens

This investigation was a turning point. What the GIES team brought was not only scientific methods, but also a clear idea: "let data speak and let science empower". The team explained to tea farmers that the unique value of Jinuo Youle Tea must be grounded in scientific data that are quantifiable, traceable, and verifiable. Only by validating ecological advantages through scientific testing—and building quality trust through evidence—could the goal of "high quality, high price" truly be achieved.

In May 2024, an interdisciplinary team was formally established, with Associate Researcher KANG Lei serving as the chief scientist. The team brought together 14 participating units, including the local government, research institutes, universities, and tea farmer cooperatives. The Ancient tea gardens of Jinuo Youle Tea in tropical mountainous regions then entered the substantive implementation stage (Figure 3).

3.3 Systematic Research to Identify the Core Value

Guided by the principles of open science, the GIES team carried out a multi-dimensional and systematic study of the Youle ancient tea gardens, covering the ecological environment, quality attributes, historical culture, and governance/management.

For the ecological environment dimension, the team used 30-m DEM data to analyze topography and landforms; collected stratified samples from 9 soil profiles to test physicochemical properties and heavy metal indicators; established water-quality monitoring sites and tested 16 parameters; and, based on Sentinel-2 satellite imagery, produced NDVI maps and land-use classifications to comprehensively characterize the ecological baseline of the ancient tea gardens. For quality attributes, the team commissioned the China National Research Institute of Food & Fermentation Industries (National Quality Supervision and Inspection Center for Subsidiary Foodstuffs) to conduct laboratory testing in line with EU standards. This included both key physicochemical indicators (e.g., moisture, total ash, water extract, tea polyphenols, caffeine, and 16 amino acids) and a full set of 232safety-related indicators. For historical and cultural work, the team systematically reviewed the Jinuo people's history of tea cultivation and processing, traced the origins of Youle tribute tea, and documented local tea traditions. It also explored the contemporary value of

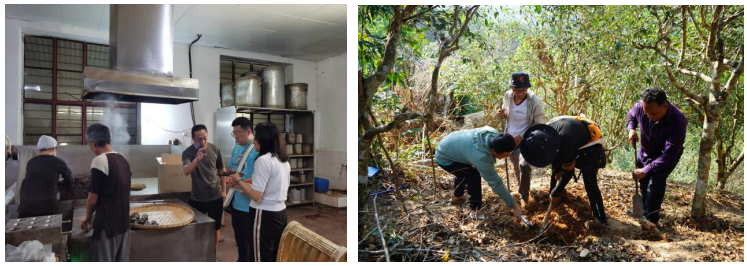

Figure 3 GIES team field survey for the Jinuo Youle Tea case

traditional practices such as liangban cha (cold-mixed tea) and huoshao cha (fire-roasted tea). For governance and management, the team investigated mechanisms for ancient tea garden conservation, production organization models, and market sales channels, and further analyzed key constraints and pathways for upgrading the industry.

In 2025, the team published the paper "GIES case study on ancient tea gardens of Jinuo Youle Tea in tropical mountainous regions" in *Journal of Global Change Data & Discovery* and released the accompanying case dataset in *Digital Journal of Global Change Data Repository*. The dataset includes 4 major categories of data: (1) case-area boundary; (2) physical geography and ecological environment; (3) product characteristics; and (4) historical culture and socio-economic development. It consists of 109 data files with a total size of 163 MB, and is openly shared for global access (Figure 4).

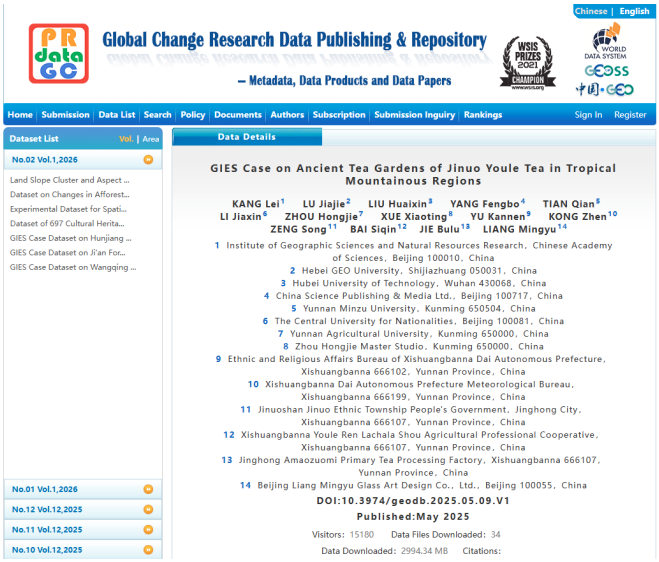

Figure 4 Case dataset

3.4 Scientific Evidence to Support Value Recognition

To reveal the core quality and intrinsic value of Jinuo Youle Tea in a comprehensive, scientific, and objective manner, the GIES team carried out systematic testing and integrated evaluation from 4 dimensions—physicochemical composition, food safety, sensory characteristics, and ecological environment. Using rigorous data and professional standards, the team produced a full scientific "profile" of both the Youle ancient tea gardens and the tea quality.

The results strongly show the outstanding quality of Jinuo Youle Tea. In terms of physicochemical indicators, performance was exceptional: the water extract reached 46.3%, well above the requirement of ≥35.0% for Pu'er raw tea in GB/T 22111—2008. Tea polyphenols measured 29.8%, and 16 amino acids were detected at relatively high levels. This combination—high water extract together with abundant amino acids—provides key material support for the tea liquor's signature traits, including a rich and full body, lingering sweetness, and a refreshing aftertaste.

Food-safety indicators were equally robust. In accordance with EU standards, the team tested 232 safety indicators (including pesticide residues and heavy metals), and all results were not detected. The product also complies with national standards GB 2763—2021 and GB 2760—2024, providing strong assurance for both product safety and access to international markets.

In sensory evaluation, Jinuo Youle Tea presents a clean and pure aroma with evident floral notes; the taste is mellow and full-bodied, with long-lasting sweetness and a lively, smooth mouthfeel. During storage and aging, the aroma can gradually shift from a fresh fragrance to a sweeter fragrance with honey-floral nuances, while the taste continues to evolve from mellow toward a sweeter, smoother, and more silky profile. Compared with small-tree tea,

ancient-tree tea shows clearer advantages in aroma complexity, mouthfeel thickness, and overall drinking experience.

Meanwhile, multi-dimensional habitat data—covering soil, water quality, climate, and related factors—confirm that the Youle ancient tea gardens possess a clean, fertile, self-maintaining, and stable ecosystem, providing a naturally superior environment for high-quality raw material production. Together, these scientific findings transform the long-held, word-of-mouth claims of "good tea" into evidence that is quantifiable, verifiable, and traceable—laying a solid and authoritative foundation for quality certification, value upgrading, and brand development of Jinuo Youle Tea.

3.5 International Gold Award and Global Visibility

Scientific empowerment enabled a leap in the brand value of Jinuo Youle Tea, allowing it to move from a "hidden gem" in remote mountains to a high-quality tea product with global influence. In September 2025, at the 15th International Famous Tea Competition held in Qingdao, China, a total of 463 tea products from multiple countries and regions—including Japan, South Korea, Singapore, Malaysia, Russia, Italy, Germany, Sri Lanka, India, and China—competed on the same stage. The competition adopted a fully anonymous blind-tasting process. Experts conducted strict assessments across 5 dimensions: appearance, aroma, taste, liquor color, and infused leaves.

Figure 5 Jinuo Youle Tea receiving an international Gold Award

The "Jinuo Youle" GIES Pu'er Tea (raw tea), produced by Xishuangbanna Youle Ren Lachala Shou Agricultural Professional Cooperative, stood out for its solid quality and won the Gold Award. It was also the only winning tea product in this competition supported by high-standard, full-process scientific data (Figure 5).

In October 2025, Jinuo Youle Tea, as a representative of China's high-quality geographical indication products, was showcased at the first "From Seeds to Goods" global exhibition held at Food and Agriculture Organization of the United Nations headquarters in Rome. The exhibition drew strong attention and positive recognition from distinguished guests, including Director-General QU Dongyu and Letsie III of Lesotho. Meanwhile, the Jinuo Youle Tea GIES case was successfully selected for the Asia-Pacific regional knowledge-sharing platform under the FAO "One Country One Priority Product" Initiative, and was promoted globally as one of the first knowledge products under the "Better Environment" pillar. In less than 2 years, Jinuo Youle Tea evolved from a locally known mountain tea into a benchmark product—winning an international gold award and gaining visibility on the UN stage—achieving a step change in both brand influence and market value (Figure 6,7).

Figure 6 FAO Director-General QU Dongyu and Letsie III visiting the Jinuo Youle Tea exhibit ©FAO/Giulio Napolitano

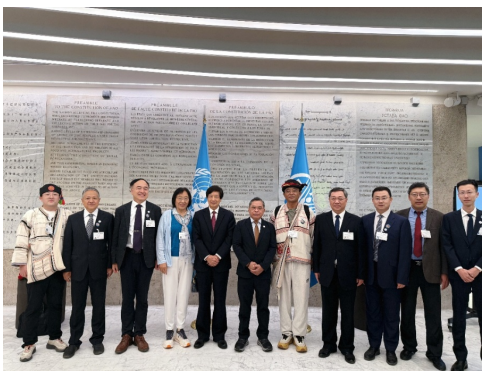

Figure 7 FAO officials and HAN Jun visiting the Jinuo Jinuo Youle Tea exhibit

4 Major Impacts Promoted by the GIES Case on Jinuo Youle Tea

4.1 Technology Empowerment for the Full-Chain Supporting System

Driven by "new quality productive forces" as the core engine, the GIES team focused on the sustainable development of ancient tea gardens and the high-quality upgrading of the tea industry. It innovatively built an integrated, full-chain technical support system that covers ecological conservation, production and processing, quality control, data sharing, and brand communication. Through digital, standardized, and science-based approaches, the system provides solid technical support for the high-quality development of the Jinuo Youle Tea industry.

In terms of ecological environment monitoring, the team relied on the Global Change Scientific Research Data Publishing & Repository to establish a comprehensive habitat monitoring network for Jinuo Youle Tea. It combined multiple methods, including satellite remote sensing to retrieve vegetation cover and NDVI; stratified soil-profile sampling to test physicochemical properties and heavy metal indicators; and the on-site deployment of a self-developed near-real-time geo-positioned observation station for high-quality geographical product habitats. The station enables near-real-time monitoring of a wide range of indicators, such as local meteorology, air quality, soil parameters, vegetation growth, phenology, vegetation productivity, pests and diseases, and oxygen-rich (negative ion) conditions. By integrating multi-source data, the team developed a digital ecological "portrait" of the ancient tea gardens, enabling both precise characterization of the ecological baseline and dynamic, continuous monitoring (Figure 8).

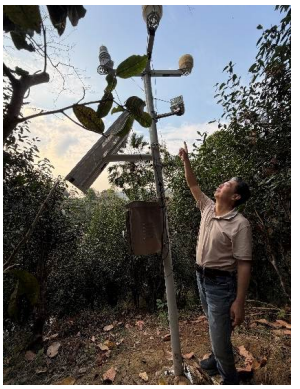

Figure 8 GIES Ground station for the ancient tea gardens

In terms of quality testing and analysis, the team commissioned nationally recognized, authoritative testing institutions to conduct full-coverage testing of both physicochemical and safety indicators. Among these, 232 safety indicators were tested strictly in accordance with EU standards, with all results not detected, while also meeting China's relevant food safety standards—thereby establishing a robust safety baseline for entry into international markets. Meanwhile, data on key physicochemical indicators—such as water extract, tea polyphenols, and amino acids—provide quantifiable and verifiable scientific evidence for the flavor quality and nutritional advantages of Jinuo Youle Tea.


证 书

优质地理产品生态环境保护与可持续发展案例（第24例）

基诺攸乐茶热带山地古茶园案例

Figure 9 Certificate for the Jinuo Youle Tea case

In terms of open data sharing, the team strictly followed open-science principles and formally published the complete case dataset, making it freely available for download to research institutions and the public worldwide. Through a transparent data-sharing mechanism, scientific trust is translated into consumer trust, effectively strengthening brand credibility and international recognition (Figure 9).

4.2 Brand Building to Enable International Communication

To address key challenges—low brand awareness, frequent market disorder, and insufficient product identifiability—relevant stakeholders adopted targeted strategies and established a three-tier brand development matrix: regional public brand + enterprise brand + product brand. Through systematic measures, they advanced brand creation, standardization, and communication, thereby supporting the high-quality development of the tea industry.

To consolidate the foundations for branding, the Xishuangbanna Youle Ren Lachala Shou Agricultural Professional Cooperative was established and successfully registered the dedicated trademark "Jinuo Youle". Led by the cooperative, an operational model of unified production standards, unified quality control, and unified brand authorization was implemented. This effectively broke the previous pattern of fragmented, household-based

operations and uncoordinated competition, and promoted a transition from dispersed individual production toward scaled, standardized, collective brand management—helping to restore market order at the source and reduce destructive competition. On this basis, the brand system was further enriched by cultivating distinctive proprietary tea brands—such as "Xiaopuxi" and "Zebawei"—forming a new structure in which the regional public brand strengthens overall image while differentiated brands expand market reach.

In terms of brand communication, the case innovated both pathways and formats to continuously broaden influence. Since 2024, Jinuo Youle Tea has been showcased at major domestic exhibitions such as the China International Fair for Trade in Services and the GIES New Year Fair, using these platforms to present product quality and cultural value, and steadily promote recognition in the domestic market. In 2025, international communication achieved a breakthrough: the tea not only won a Gold Award at the 15th International Famous Tea Competition, but also appeared as a representative Chinese premium tea product at the FAO global exhibition in Rome, stepping onto the international stage and marking a key leap in global visibility.

At the same time, the case emphasized building brand trust through scientific credibility. Core resources—research data from the GIES case, authoritative testing reports, and expert endorsements—were deeply integrated into the entire brand communication process. With dual support from "scientific data + authoritative certification", the case addressed a common challenge in the tea industry: "good tea is hard to explain, and quality is difficult to quantify". In doing so, it effectively established consumer confidence in the quality of Jinuo Youle Tea and laid a strong foundation for the brand's long-term development (Figure 10).

Figure 10 Trademark of the Jinuo Youle Tea brand

4.3 Promoting Intangible Cultural Heritage Inheritance and Integrating Culture with Tourism

Jinuoshan Township has actively explored and leveraged the distinctive tea-culture resources of the Jinuo people, closely linking cultural narratives with geographical indication products. This deep binding of culture and product has continuously increased the cultural added value of Jinuo Youle Tea, making the brand more compelling and competitive.

In terms of intangible cultural heritage (ICH) transmission, the Jinuo people have preserved a set of distinctive traditional tea-making practices, including liangban cha (cold-mixed tea) and huoshao cha (fire-roasted tea), as well as tea-related cultural forms that carry collective memory—such as rituals honoring the tea deity and ceremonies involving tea offerings to drums. Local efforts have particularly relied on Master JIE Bulu as a key driving force. As a leading figure in the inheritance of Jinuo tea-culture ICH, he has devoted decades to traditional tea-making craftsmanship. He not only masters the essence of these ancient techniques, but—supported by the cooperative—also engages actively in ICH training and transmission. Through oral instruction, hands-on demonstration, and on-site practice, he passes down both the skills and the cultural meanings of traditional tea-making to younger generations, safeguarding the cultural roots of the community and enabling the living continuation of Jinuo tea ICH across generations.

In terms of cultural value realization, the township has adopted a range of measures to integrate tea culture with industry and cultural tourism, turning the ICH craftsmanship represented by Master JIE Bulu into a core cultural symbol of the brand. Building on the ancient tea tree resources and the cultural heritage of the Jinuo people, the township has carefully developed immersive experience programs—such as tea picking, tea making, and tea tasting—with Master JIE Bulu providing on-site guidance. Visitors can wear traditional Jinuo clothing and participate in the full process from fresh-leaf picking to finished tea production under the master's demonstration, experiencing the craftsmanship behind ancient methods. They can also taste Jinuo-style tea foods made by the master, such as cold-mixed tea and tea-leaf-wrapped roasted snacks, thereby engaging with Jinuo tea culture in a comprehensive way.

The township has also strengthened its cultural "festival IP". It has successfully held five editions of the Youle Tribute Tea Cultural Festival, with dedicated sessions for ICH demonstrations by Master JIE Bulu, alongside activities such as tea competitions and tea-song/tea-dance performances. These events showcase the essence of Jinuo tea culture in a concentrated form. At the same time, the local area has officially designated and signposted the "Youle No. 1 Ancient Tea Tree", reinforcing cultural brand identifiers and enhancing reputation. In addition, leveraging the influence of the Jinuo Drum Dance (listed in the first batch of China's national ICH), and using the Jinuo Mountain Village Scenic Area as a platform, the township has organically combined ICH demonstrations, tea-culture experiences, and rainforest ecological sightseeing. This has helped build an integrated development model of "ICH + cultural tourism + tea industry", enabling visitors to experience the unique charm of Jinuo culture and Youle ancient tea in an immersive way and further amplifying the brand's cultural value (Figure 11).

Figure 11 Jinuo Youle Tea showcased at key events

4.4 Integrating Primary, Secondary, and Tertiary Industries to Unlock New Growth Momentum

Building on the unique resources of the Youle ancient tea trees and the area's well-preserved natural landscape, Jinuoshan Township seized the opportunity to establish a pilot zone for integrated development across the primary, secondary, and tertiary sectors in the Youle ancient tea mountain area. By breaking down sectoral boundaries, it promoted an integrated "tea-culture-tourism" value chain and encouraged the tea industry to shift from single-purpose production toward a diversified model combining production, tourism, and cultural creativity, thereby injecting new vitality into the industry and widening local income channels.

For the primary sector and secondary-sector upgrading, the township promoted scaled, standardized, and quality-oriented development. In 2024, it supported one local enterprise to be recognized as a municipal-level leading enterprise, strengthening industry leadership. At the same time, it renovated and upgraded 15 primary tea-processing facilities by introducing advanced equipment, updating techniques, and optimizing processing workflows. These efforts extended the production chain and increased value added in processing. The township also advanced organic certification: 2 organic tea gardens were established, with a certified area of more than 133.33 ha[3]. By applying strict organic cultivation standards, these initiatives improved quality and safety and laid a foundation for premium positioning and branding.

For deep integration of tea, culture, and tourism, the township took Yanuo ancient tea mountain as a core demonstration area and improved supporting infrastructure, including ecological boardwalks, rest pavilions, and viewing platforms. It designed immersive eco-tea-garden routes so visitors can experience both the natural landscape and the cultural heritage of the ancient tea gardens. Building on this, it further developed diversified tourism products based on Jinuo cultural heritage and rainforest resources, such as rainforest hiking, tasting of local cuisine, and ethnic homestay experiences. Together, these efforts formed a new eco-tourism model that combines leisure sightseeing, tea-related experiences, and ethnic culture, enabling mutual reinforcement between the tea industry and tourism.

As tea-tourism integration deepened, the local "hiking economy" expanded rapidly. The township has attracted 24 hiking-tourism companies and developed 22 differentiated rainforest hiking routes that balance ecological sightseeing and outdoor experience. In 2024, the area received 370,000 hiking tourists, which directly increased collective village income by 3.286 million CNY. Through job creation and the sale of agricultural products, it also helped local farmers increase income by more than 20 million CNY, translating ecological resources into tangible livelihood gains.

In the cultural and creative sector, the cooperative supported Baduo Village in establishing a dedicated cultural-creative company. Drawing on Jinuo cultural elements and the distinctive features of Youle ancient tea, it designed and registered 2 exclusive IP characters, "Youyou" and "Lele", and developed more than 20 cultural products such as fridge magnets, folding fans, backpacks, and tea gift boxes. This strengthened the link between tea culture and creative products. Meanwhile, the township improved the rural environment by renovating 15 rural houses into ethnic-style homestays and revitalizing 50 idle courtyards into landscaped household gardens[11]. These measures improved living conditions while expanding tourism services, further consolidating the integrated development pattern of "tea + tourism + cultural creativity".

4.5 Building a Multi-Stakeholder Win-Win Mechanism

Based on local realities, Jinuoshan Township established a "five-in-one" sustainable mechanism featuring government guidance, scientific and technological support, enterprise leadership, household participation, and brand empowerment. Through organizational innovation, stronger village-enterprise cooperation, improved benefit-sharing arrangements, and enhanced talent development, it addressed bottlenecks in stakeholder linkage and enabled win-win outcomes among government, enterprises, village collectives, and farming households, providing lasting momentum for high-quality industrial development.

For organizational innovation, the township built a full-chain collaboration system of "enterprise + cooperative + farmers", integrating 3 tea factories, 14 cooperatives, and 545 primary processing sites, and coordinating 1,820 tea-farming households to develop collectively. This overcame the limitations of scattered household-based operations. With unified branding under "Jinuo Youle" and a full-process traceability management system, product competitiveness improved and tea purchase prices rose significantly. Farmers were therefore able to share the gains from brand value growth, strengthening their willingness to participate in industry development.

For village-enterprise cooperation, the township increased efforts to attract high-quality tea enterprises and created a three-party model of "enterprise + village collective + farmers", enabling close alignment between collective resources and enterprise capital and technology. Through diversified income channels—such as equity participation, land rent, and asset leasing—the village collective achieved steady growth in collective income. This model alone increased collective income by more than 350,000 CNY, while also providing stable employment and broader income opportunities for households, forming a virtuous cycle in which enterprises profit, collectives grow stronger, and households benefit.

For benefit-sharing optimization, Baduo Village served as a pilot to establish a "Party branch + village collective + enterprise" benefit-sharing mechanism so that development gains could be distributed more fairly among residents. In the rainforest hiking program, a resource fee of 15 CNY per person is charged and distributed as 3 CNY to the village Party organization and 12 CNY to the village group, directly increasing revenues for both. The cultural-creative lifestyle store adopts a "235" distribution model, with dividends shared among the village collective, villagers, and the enterprise according to the corresponding proportions. This safeguards collective accumulation while increasing villagers' property income, achieving parallel progress in village strengthening and household prosperity.

For talent development, the township established a three-tier talent roster and trained more than 300 people, including ICH inheritors, entrepreneurship leaders, and skilled tea farmers, providing strong human-capital support for industrial development. It has delivered 31 training programs covering scientific tea-tree management, tea processing, and tea performance skills, significantly strengthening professional capacity among farmers and

practitioners. Baduo Village also created a youth talent pool and introduced preferential policies to attract 6 young people to return and start businesses locally, enabling 300 villagers to obtain nearby employment. These efforts revitalized local human resources and provided long-term support for the stable operation of the benefit-linkage mechanism.

5 Integrated Benefits of the GIES Case on Jinuo Youle Tea

5.1 Conserving Ancient Tea Gardens and Enhancing Ecosystem Value

Research and implementation under the GIES case have noticeably strengthened ecological conservation in the ancient tea gardens of Jinuo Mountain, reinforcing the area's ecological "buffer" function. The township incorporated ancient tea garden protection into village rules and agreements, explicitly banning tree cutting, over-harvesting, and the use of harmful agrochemicals. Tea farmers are guided to follow a "harvest and nurture in balance" approach—growing, managing, processing, and marketing tea responsibly—and to protect this ecological asset through traditional hand-picking practices. At the same time, the township has worked to establish a national standardized green-food raw material base (tea) and has promoted organic certification. 2 organic tea gardens have been certified, covering more than 133.33 ha.

In the ancient tea gardens, epiphytic dendrobium is often found on the trunks and branches of old tea trees, while the forest understory is dense and provides ideal habitats for wild bee colonies. With a forest coverage rate of 94.01%, the area forms a stable ecosystem and serves as an important carbon sink. As conservation work has progressed, farmers' environmental awareness has increased markedly, reflecting a shift from "living off the mountain" to "nurturing and protecting the mountain".

5.2 From Low-Priced Raw Material to Brand Premium

The GIES case has deeply empowered the high-quality development of the tea industry in Jinuoshan Township. By focusing on standardization, brand-based operations, and diversified integration, it has helped Jinuo Youle Tea achieve a sharp rise in value—from a traditional agricultural product to a core pillar of the local economy—thereby energizing the endogenous momentum of rural revitalization and becoming a new engine for quality and efficiency gains in the township and surrounding areas.

With stronger quality control and brand empowerment, tea prices have increased dramatically, breaking the long-standing "high quality without high price" dilemma. Under the guidance of the GIES case, local rules were further improved to strengthen both ecological protection and quality management. Regular technical training—delivered through the agricultural extension station and the tea association—has steadily improved farmers' cultivation and processing skills. Meanwhile, the "Jinuo Youle" brand operation has been strengthened and the traceability system refined, making quality trackable and value more visible.

By 2025, tea prices in Jinuoshan Township had reached a new level compared with the pre-case period: organic tea stabilized at 200–300 CNY/kg, almost 10 times the previous 20–30 CNY/kg. Prices for ancient-tree tea continued to rise: in the core production area, the range reached 3,000–6,000 CNY/kg, while ordinary ancient-tree tea remained stable at 1,200–4,000 CNY/kg. Single-origin ancient-tree tea from the case area became a sought-after high-end category, exceeding 8,000 CNY/kg. With a "high quality–high price" market mechanism firmly in place, households owning ancient tea trees gained substantially higher returns, with average annual per-household income increasing by about 30,000 CNY.

Through whole value-chain integration and upgrading, the case also drove significant growth in the overall output value of the Jinuo Youle Tea industry, making it a key growth engine for the regional economy. During implementation, the township further optimized the "enterprise + cooperative + farmers" collaboration mechanism, integrating 3 tea-processing enterprises, 14 specialized cooperatives, and 545 primary processing sites, and linking 1,820 tea-farming households into an integrated system spanning cultivation, processing, and sales. Product innovation also advanced, with diversified offerings such as ancient-tree white tea,

black tea, and ripe Pu'er tea, expanding the product portfolio and meeting more diverse consumer demand.

In 2024, the total output value of the township's tea industry reached 350 million CNY, doubling compared with the pre-case level (2021). Annual tea production reached 1,515.2 tons, a year-on-year increase of 4.7%. A typical example shows that during the spring tea season, one household-run primary processing site purchased 13 tons of high-quality fresh leaves and achieved an output value of 700,000 CNY after processing. The case also stimulated coordinated growth in related sectors such as processing, packaging design, and logistics, forming a more complete tea-industry ecosystem and making tea a pillar industry for Jinuoshan Township.

5.3 Rural Revitalization and Better Livelihoods

New business models brought clear income gains. The GIES case helped the Jinuo Youle Tea industry move beyond a single focus on cultivation and primary processing, deepen integration across the three sectors, and foster a wider range of innovative activities. This created multiple income channels for households and supported a more diversified local economy.

Building on the case's approach to ecological protection and industrial empowerment, the township has drawn on the ecological resources of the ancient tea mountains and the cultural heritage of the Jinuo people to develop a multi-industry demonstration system that combines "ancient-tree tea + culture and tourism + wellness". Tourism infrastructure in the ancient tea mountain area has been upgraded, including the construction of the "Healthy Walk in Youle Ancient Tea Mountain" sightseeing trail. The township has also developed an ICH village and a tea-tourism demonstration village, and has held the Youle Tribute Tea Cultural Festival for five consecutive editions, revitalizing the historical brand.

In 2024, rainforest hiking expanded at scale. A total of 22 themed routes were developed in a standardized way, generating 12 million CNY in total revenue from hiking tourism and related industries and directly increasing farmers' income by 21 million CNY. The workforce involved reached 3,200 people. At the same time, 10 types of new business activities were fostered, such as village cafés, rainforest tea rooms, and plant-based tie-dye. These drove the coordinated development of 27 homestays, 48 farm restaurants, and 103 local specialty sales outlets, created 1,720 local jobs, and increased average annual income per worker by 48,000 CNY. Through market-linking platforms such as the "Teneduo" mountain-goods street and mobile supply-and-sales vehicles, tea and other local products were supplied more directly to markets, bringing an additional 2.765,6 million CNY in income gains. Overall, a diversified income structure integrating tea, tourism, and local commerce has taken shape. In 2024, average household income increased by 12,000 CNY, making the tea sector a new driver of prosperity and high-quality regional development.

5.4 Stronger ICH Transmission and Cultural Confidence

The GIES case enabled Jinuo tea culture to move from "living inheritance" toward real economic and social value creation, significantly strengthening cultural confidence. As a key inheritor of Jinuo tea culture, JIE Bulu has spent more than 3 decades specializing in traditional tea-making. He has systematically mastered ancient techniques such as cold-mixed tea and fire-roasted tea and, while preserving their core features, has actively promoted training and public engagement.

Through a three-dimensional approach—classroom explanation, hands-on practice, and cultural interpretation—tea-making skills and their cultural meanings have been passed on to younger generations, supporting the continued living practice of Jinuo tea-related heritage. Meanwhile, other local heritage elements, including the Jinuo drum dance and traditional textile craftsmanship, have also received more systematic protection. Demonstrations led by JIE Bulu have become a central component of tourism experiences, and the inherited techniques have evolved into distinctive cultural experience programs. The close integration of Jinuo food traditions and tea culture has also produced a series of related products, enriching cultural tourism offerings.

As industry collaboration has grown, villagers have shifted from passive observers to

active co-builders of culture. JIE Bulu's work has strengthened community cultural identity and ethnic pride. With support from inheritance groups represented by him, cultural symbols such as Jinuo tea culture, the drum dance, and the folk instrument "Qike·Bugu" have gained wider visibility, helping Jinuo culture expand from local transmission toward broader international outreach.

5.5 Contributing a Jinuo Local Approach to Sustainable Development

In 2024, FAO and IGSNRR, CAS signed a memorandum of understanding. This incorporated the GIES approach and related techniques into the support framework of the FAO "One Country One Priority Product" Initiative, providing an institutional basis for Jinuo Youle Tea to expand internationally.

Building on this foundation, the case achieved a notable rise in international influence in 2025. In September, it won the Gold Award at the 15th International Famous Tea Competition. In October, as a representative of China's premium tea products, it was invited to participate in activities celebrating FAO's 80th Anniversary and showcased outcomes at the first "From Seeds to Foods" global exhibition, offering an international demonstration of China's pathway for turning ecological value into product value.

Tea farmer representative JIE Bulu was invited to take photos with FAO Director-General QU Dongyu and King Letsie III of Lesotho. Both guests spoke highly of the scientific value that the GIES technical system brought to Jinuo Youle Tea. During the same period, the case was officially included in the FAO "One Country One Priority Product" Asia-Pacific regional knowledge-sharing platform as one of the first knowledge products under the "Better Environment" pillar and promoted globally. Its technical model has also been applied to specialty agricultural product cases in countries such as Bhutan and Nepal, providing a demonstrative Chinese approach for global efforts to realize the value of ecological products.

6 Discussion and Conclusion

The successful practice of the Jinuo Youle Tea GIES case offers several important lessons.

Precisely identifying the potential of ecological resources is the foundation for value realization. By building a strong link between local ecological endowments and product characteristics, and by using systematic scientific testing to turn ecological advantages into quantifiable evidence, the case helps address the central challenge that ecological value is hard to measure. For regions rich in ecological resources, this suggests a shift from a resource-oriented mindset to a value-oriented one: clarify what makes the ecosystem distinctive, and make "lucid waters and lush mountains" a value carrier that can be quantified, converted, and priced with a premium.

Stronger science and technology empowerment is the key driver for unlocking value conversion. A full-chain technical support system—covering ecological monitoring, quality testing, data sharing, and standardized production—can turn scientific evidence into the backbone of brand premium. The lesson is that new quality productive forces should guide closer integration between innovation and industry, moving from proving value with technology to creating value through technology, and making scientific data a market passport for ecological products. The paradigm of technological empowerment in GI product brand building is firmly validated through 4 core mechanisms. Specifically, intelligent quality control and traceability act as the core foundation of brand development. Intelligent brand identity and design serve as the key driver for brand differentiation. Precision in market demand analysis and consumer profiling offers fundamental support for accurate brand positioning. Lastly, intelligent brand communication and marketing represent the critical avenue for enhancing brand influence. Interdependent and mutually supportive, these four mechanisms constitute a comprehensive intelligent empowerment system, propelling GI brand development toward an intelligent, high-quality future.

Coordinated government leadership is essential for building an enabling safeguard system. Through top-level planning, local specialty industries can be incorporated into broader regional development strategies. By coordinating resources, improving infrastructure,

establishing collaborative industry organizations, and regulating market order, government can provide critical support. This suggests that GIES development should break down administrative silos, build a coherent policy support framework, and create an efficient environment for collaboration—while fully leveraging the government's guiding role in resource coordination and institutional innovation.

A sound market operating mechanism is the core pathway to stronger development vitality. By developing a three-tier brand matrix— "regional public brand + enterprise brand + product brand"—and using unified standards and brand authorization, the case achieves both differentiation and cluster-based scale effects. By innovating marketing and communication strategies and converting scientific trust into consumer trust, the industry can upgrade from "selling raw materials" to "selling products" and "selling culture", ensuring that high quality is rewarded with high prices.

A robust benefit-sharing mechanism is the fundamental safeguard for inclusive outcomes. Innovative multi-stakeholder models—such as "enterprise + cooperative + farmers" and "Party branch + village collective + enterprise"—help build distribution systems that share risks and benefits through equity participation, dividends, and resource-fee sharing. The lesson is that villagers should become direct participants and beneficiaries of ecological value conversion, sharing more of the value added along the chain, and advancing ecological protection and livelihood improvement together.

Deeper integration across the three sectors is an important direction for expanding the value space. By moving beyond the boundaries of traditional agriculture and promoting the integration of "tea industry + cultural tourism + wellness", the case cultivates new activities such as rainforest hiking and intangible cultural heritage study tours. By extending the industrial chain, upgrading the value chain, and strengthening the supply chain, it achieves a leap from "green leaves" to "golden leaves", releasing the combined ecological and economic benefits of healthy ecosystems.

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