

# The Study on the High-quality Development of Green Cooperative Economy in the Rocky Desertification Region of Yunnan, Guangxi and Guizhou

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**Abstract:** The rocky desertification is evolving in reverse direction with dual carbon and become rich, and green cooperative economy is evolving in the same direction with dual carbon and become rich. The high-quality development of green cooperative economy natural fit for the rocky desertification region both environment and income niche are congenital deficiency. The high-quality development of green cooperative economy natural fit for the rocky desertification region both environment and income niche are congenital deficiency. “Zhaotong Apple” in Yunnan, “Fuchuan Navel Orange” in Guangxi, and “Gangwu Photovoltaic” in Guizhou, which successfully implemented the rudimentary cooperative economy corresponding to green industry chain and green value chain. In addition, it provides inspiration for adapting to local conditions, adhering to local advantages in cooperation, and high-level cooperation between green industries and green value chains. The local advantages of rocky desertification areas in Yunnan, Guangxi, and Guizhou, as well as the high-quality development model of green cooperative economy, provide macro insights for ecological revitalization to support rural revitalization, GEP and GDP co evolution in the southern and northern regions of rocky desertification.

**Keywords:** Rocky Desertification; High-quality Development; Green Cooperative Economy; Green Value Chain

## 1. Introduction

Soil desertification is a process of converting carbon pools into carbon sources, which is causally related to poverty. The Dian-Gui-Qian

rocky desertification area (hereinafter referred to as the rocky desertification area, accounting for 2/3 of the total area of rocky desertification in the country, and 1.5 times the average population density in the country) has a high vulnerability of environmental ecological niche (prone to degradation) coexisting with a weak robustness of income ecological niche (prone to return to poverty), which is inverse evolution with the dual-carbon and get-rich-enrichment visionary goals. Northern sand (desertification) is sparsely populated, and desertification management is mainly a scientific issue. The Southern Rock (rocky desertification) is densely populated, and the management of rocky desertification is not only a scientific issue but also a livelihood issue.

## 2. Rocky Desertification and Dual-carbon and Enrichment Reverse Evolution

### 2.1 Causes of Rocky Desertification and Carbon Sources

Rocky desertification is an extreme form of land degradation in Karst (also known as karst) landscapes. Under the dichotomy, the formation of rocky desertification includes both natural and anthropogenic factors: (1) Natural factors. Karst soil has a dichotomous structural defect between the scarcity of surface soil layers and the development of underground fissures, resulting in a small amount of horizontal loss of soil and water from the surface and a large amount of vertical leakage of soil and water from the underground; (2) anthropogenic factors. Rocky desertification area population density, to karst soil traditional agriculture to ask for more than the natural ecological carrying capacity. It takes 5000-20,000 years for karst soil to

naturally form 1cm thickness of soil, and farmers plant corn for 20 years, which causes 1cm thickness of soil vertical leakage. The human factor accounts for about 74% of the total.[1] Owing to the lack of vegetation and living organisms that play the role of natural carbon sinks, rocky desertification areas not only fail to play the role of carbon neutralization, but are also a serious source of carbon dioxide emission. In the same area, the average carbon emission per unit area of land with rocky desertification (classified by the national standard into five grades: none, light, medium, heavy and extremely heavy) is 2-20 times higher than that of land without rocky desertification; and the average carbon storage per unit area of land with forest is 2-5 times higher than that of land without rocky desertification. In other words, carbon emissions per unit area of extremely heavy rocky desertification land require four times the area of primary forest or top-pole forest to achieve carbon neutrality [2]. Clearly, rocky desertification is a serious source of carbon and runs counter to the dual-carbon goal.

## 2.2 Causal Chain of Rock Desertification and Poverty

Under natural evolution, the forward evolution of karst desertification (decertified land→grass→scrub→karst forest) and the reverse evolution (karst forest→scrub→grass→decertified land) follow the gradual evolution process of “low state↔high state”, and the two patterns of mutually reversible evolution exist at the same time. However, the population density in the karst landscape area is high, and under the anthropogenic effect of agricultural land reclamation, the forward evolution of rocky desertification has been blocked and the reverse evolution has been accelerated, and the “low state ↔high state” gradual bi-directional (forward and reverse) evolution has been changed into the “high state → low state” leaping unit-directional (reverse) evolution. ) Evolution. Before the Ming Dynasty, Yunnan-Guizhou-Guizhou karst landscape area was sparsely populated, and the reverse evolution of rocky desertification by human action was negligible. From the early years of Hongwu in Ming Dynasty to the 15th year of Yongle (1368-1417), there was a half-century-long planned large-scale

migration to Yunnan-Guizhou-Guizhou area, and the traditional farming and reclamation with high density of population would inevitably lead to the vicious circle of “land vulnerability→ wasteland reclamation→ land degradation→ rocky desertification→ wasteland reclamation” of rocky desertification and land reclamation. The causal relationship between rocky desertification and poverty is manifested in the fact that rocky desertification causes low productivity of the land and poverty, while poverty causes over-exploitation and aggravates rocky desertification, thus falling into the causal chain of “rocky desertification ↔ poverty”. By the end of 2020, it had achieved the great milestone of eradicating absolute poverty in rocky desertification areas. However, the weak ecological position of environment and income in the rocky desertification area still exerts pressure on the revitalization of the countryside and the goal of getting rich in the opposite direction of evolution.

## 3. Green Cooperative Economy and Two-dimensional Governance Mechanisms for Rocky Desertification

The scientific or livelihood school of rocky desertification management can only solve the one-dimensional problem of the ecological niche of the environment or income. Compared with ordinary land, the fragile land of rocky desertification is inherently deficient, and the independent, self-help and balanced faction is unable to solve the two-dimensional problems of environment and income ecological position. The development of green cooperative economy in rocky desertification areas, taking the advantage of “green” from science, the strength of “economy” from people’s livelihood, and the wisdom of “cooperation” (cooperation, other help) from the balanced school, will provide the best solution to the problem of the ecological dimension of environment and income. This provides inspiration for shifting from traditional claims to ecological value innovations in the fragile lands of rocky desertification.

### 3.1 Green Cooperative Economy Evolves in the Same Direction as Dual-carbon and Enrichment

### 3.1.1 Green cooperative economy and quality development

Green cooperative economy refers to the regional economic model of ecological value-oriented, underdeveloped (fly-in) and developed (fly-out) regions, to carry out production factor  $1+1>2$  advantageous and complementary cooperation, and to realize the green development of the underdeveloped specific region through outsourcing, consortium and other new barrel cooperation methods. Green cooperative economy contains two-dimensional elements of green development in the fly-in area and synergistic development between the fly-in area and the fly-out area, and the  $1+1$  complementary cooperation is initiated by the government; unlike transfer payments, charitable donations and other gratuitous “granting of fish” to make up for the shortfalls, the green cooperative economy is a market bond and win-win “granting of fish. The green cooperative economy is a market link, a win-win “fishing” type of economic synergistic development; unlike the inter-industry and intra-industry positioning oriented by the enterprise economic value, the green cooperative economy is the operation of Corporate Citizen (a corporate citizen who takes into account the environment, charities and other externality responsibilities), and it is the green inter-industry and intra-industry positioning oriented by the ecological value of the corporate citizen. Green cooperative economy is in line with the connotation of green and low carbon of high-quality development and development benefiting all people and is naturally suitable for rocky desertification areas. It solves the two-dimensional contradiction between the environment and income, meets the two-dimensional needs of ecology and people’s livelihood, and evolves in the same direction as the two-dimensional goal of high-quality development of dual-carbon and enrichment in rocky desertification areas [3].

### 3.1.2. Green cooperative economy and low carbon

Green cooperative economy is ecological value-oriented green development with 2 low-carbon advantages: (1) stopping traditional agricultural claiming of fragile land in rocky desertification areas and stopping economic value-oriented industries that

damage environmental ecological niches in exchange for income ecological niches; and (2) shifting traditional agricultural claiming to eco-industrial innovation and developing eco-industries with synergistic evolution of environmental and income ecological niches. [4]

### 3.1.3 Green cooperative economy and prosperity

Green cooperative economy is a complementary cooperation and synergistic development in which the first to get rich help the latter to get rich, which has two advantages for getting rich: (1) the new barrel of  $1+1>2$  between the fly-out area and the fly-in area is a win-win situation with the advantages of complementary cooperation and avoidance of shortcomings; (2) the green cooperative economy promotes the synergistic development of the fly-out area and the fly-in area, and creates a special brand of the rocky desertification area, which is a strong foundation for getting rich.

## 3.2 Two-dimensional Mechanism of Two-carbon Enrichment in a Green Cooperative Economy

The inherent inadequacy of the ecological position of environment and income in rocky desertification areas needs to be solved by the new barrel cooperation of self-help and other help; the two-dimensional contradiction between environment and income needs to be solved by the two-dimensional countermeasures of science and people’s livelihood; and the promotion of synergistic and positive evolution of environment and income needs to be positioned in the eco-strategy. Theories related to green cooperative economy, such as the new barrel theory and ecological strategic positioning, cover the mechanism of synergistic evolution of dual-carbon and enrichment, and are conducive to the realization of the two-dimensional high-quality development goals of dual-carbon and enrichment.

### 3.2.1 New barrel theory and synergistic evolutionary mechanisms

The old wooden barrel theory implies the addition of endogenous self-help in rocky desertification areas and the independent lengthening of the short boards of environment and income to realize the two-dimensional goals of “double carbon” and wealth. Due to

the inherent insufficiency of the two-dimensional resources of environment and income, the old wooden barrel theory is limited in its effectiveness and obvious in its disadvantages in terms of complementing the shortcomings of the old wooden barrel theory (lengthening the short boards). The new barrel theory implies that in the rocky desertification area, external sources can help other people, and cooperation can lengthen the short board of environment and income to realize the two-dimensional goal. As the first rich help the second rich to make up for the inherent insufficiency, the new barrel theory can make up for the long and avoid the shortcomings (lengthening the long board and assembling with the external long board to form a new barrel), and the effectiveness of the complementary cooperation of  $1 + 1 > 2$  is obvious and its advantages are obvious [5]. Relying on virtual technology (VT) and information technology (IT), the new barrel theory has the advantage of  $1+1>2$  value chain cooperation efficiency. The rocky desertification area provides human resources, land, characteristic resources and other longboard resources, and the exogenous area provides capital, technology, market and other longboard resources. The governments of two places initiate the market-oriented, inter-temporal formation of the green cooperative economic model such as “out-of-area company + in-area cooperatives + farmers” and “outsourcing, consortium”. “Outsourcing, consortium and other green cooperative economic model. The new barrel advantage value chain brings green income generation beyond traditional agriculture for the fragile land in the rocky desertification area, which is conducive to blocking the causal chain of rocky desertification and poverty and promoting the synergistic evolution of dual-carbon and wealth generation in the rocky desertification area.

### 3.2.2 Ecostrategic positioning theory and synergistic evolutionary mechanisms

Porter, the father of competitive strategy and a representative of the strategic positioning school of thought, believes that inter- and intra-industry positioning determines the competitive advantage of the enterprise from the source (ecological niche advantage oriented to the economic value of the corporate citizen) [6]. Similarly, ecological

inter- and intra-industry positioning determines ecological competitive advantage (ecological value-oriented ecological niche advantage of corporate citizens) from the source. The ecological inter-industry and intra-industry positioning of corporate citizens promote the synergistic evolution of GEP (Gross Ecosystem Product) and GDP in rocky desertification areas from the source of strategy. The essence of inter-industry positioning is vertical green industry chain positioning, i.e., corporate citizens identify the industry (chain) with the most ecological value (environmental value + economic value) among many industries. The essence of ecological intra-industry positioning is horizontal green value chain positioning, i.e., within green industries (industries with positive ecological value, such as eco-positive and eco-blue ocean industries, etc.), to become the corporate citizen with the most ecological value in the value chain. The ecological inter-industry and intra-industry positioning in the form of outsourcing, consortiums and other cooperation between outlying areas and inlying areas in the rocky desertification area not only develops the theory of green cooperative economy, but also facilitates the realization of the two-dimensional goal of high-quality development by means of the green industrial chain and value chain [7].

## 4. Practical Models for the Development of a Green Cooperative Economy in Rocky Desertification Areas

According to the  $1+1>2$  green cooperative economy prototype practice of Shanghai, Yunnan, Guangdong, Guangxi and Zhejiang-Guizhou, combined with the two-dimensional mechanism of dual-carbon enrichment such as ecological strategic positioning and the new barrel theory, the following three modes of practice of the green cooperative economy in rocky desertification areas have been refined.

### 4.1 Yunnan “Zhaotong Apple” Model: Green Industry Chain Development Cooperative Economy

Zhaotong City, Yunnan Province, has 72.2% of mountainous area and 14.3% of rocky desertification area. After several generations of unremitting exploration, it was found that apple trees were conducive to reducing the

vertical leakage of soil and water in karst landscapes and curbing rocky desertification. With the introduction of rocky desertification apple planting technology and the cooperation of Shanghai and Guangdong exogenous capital and market, a virtuous cycle of Zhaotong apple and rocky desertification environment and income ecological position has been gradually formed. Zhaotong apple green industry chain (green industry positioning) relies on the vertical industry chain, integration operation and other green cooperative economic modes to realize the economy of scale of Zhaotong apple industry, Zhaotong city-wide economy and positive feedback of the ecological value of apple green industry (chain). The vertical operation mode of Zhaotong apple green industry chain includes upstream drought-resistant and water-preserving apple planting in karst landscape and ecological conservation technology development, midstream deep processing of apples and environmentally friendly packaging, and downstream green logistics, O2O (Online To Offline) sales, brand promotion of Zhaotong apples, and other vertical industry extensions; and the fusion operation mode includes the integration of the culture of Zhaotong apples, tourism, e-commerce, and urban and rural areas, which is a composite element of the apple industry and culture and tourism. Composite elements of apple industry and culture, tourism, e-commerce, urban and rural integration and other green industry integration, apple industry and “Zhaotong apple” city card, urban and rural integration and other green urban-rural integration [8].

#### **4.2 Guangxi’s “Fuchuan Navel Orange” Model: Green Value Chain Development Cooperative Economy**

Eleven of the 12 townships in Fuchuan County, Guangxi are karst landscapes, with serious soil erosion and 21.8% of the area of rocky mountains in rocky desertification. After long-term practice of mountain people and experts repeatedly demonstrated that citrus can nourish soil and water, greening rocky mountains. Among them, the “Queen of Oranges”, Fuchuan Navel Orange, relying on Guangdong-Guizhou cooperation economy, has achieved a model of synergistic evolution of ecological revitalization and rural revitalization in rocky desertification

areas. The green value chain of Fuchuan navel orange (green industry positioning) relies on the value chain horizontal, integration operation and other green cooperative economic models to realize the competitive advantage of Fuchuan navel orange enterprises, the navel orange brand range of economy and the positive feedback of ecological value of the navel orange green value chain. The horizontal operation of the green value chain of Fuchuan navel oranges includes the optimization of the horizontal value chain of navel orange technological innovation and virtual research and development in the R&D link, ecological planting and green processing in the production link, green logistics, green warehousing and O2O direct marketing in the sales link, and the optimization of the horizontal value chain of the brand link, such as the ISO14001 environmental management system, pollution-free origin, and green food certification, etc.; and the fusion operation mode includes the capital, technology, and sales platforms in the fly-out area. The value chain advantageous links and Fuchuan County land, human resources, navel orange brand and other value chain advantageous links of the new barrel complementary cooperation to form the navel orange green value chain (system) of his organization and integration, “Fuchuan Navel Orange + Cooperative Eco-orchard + Cooperative E-commerce + Farmers”, such as Fuchuan Navel Orange brand-driven green value chain (system) of self-organization and integration [9].

#### **4.3 Guizhou “Gangwu Photovoltaic” Model: Green Industrial Chain, Value Chain Development and Cooperative Economy**

Gangwu Town, Guanling County, Guizhou Province, is the most complex karst landscape area with the most complete grade types of rocky desertification in Guizhou, with a rocky desertification area as high as 33.91%. Relying on the capital of Shanghai, Guangdong and Zhejiang fly-out land, photovoltaic technology, and the cooperation of ecological intercropping and planting technology under photovoltaic panels, Gangwu develops photovoltaic industry. Photovoltaic panels effectively reduce the evaporation of karst surface moisture, promote the planting of forests and grasses to nourish soil and water, and control rocky desertification at the same

time, photovoltaic energy reduces the carbon emission of millions of tons per year, realizing the stone mountain and barren land into “green mountain” and “treasure land”.

#### 4.3.1 Vertical and integrated operation of the Gangwu photovoltaic green industry chain

Gangwu PV green industrial chain (green inter-industry positioning) relies on the new barrel cooperation to form a vertical industrial chain mainly based on PV power generation, and horizontally integrates with diversified industries to develop a green cooperative economy. The vertical operation mode of Gangwu PV green industry chain includes upstream PV silicon material and wafer, midstream PV cell and module in the fly-out area, and downstream ground-based (rocky mountain ground) and distributed (building roof) power generation in the local area of Gangwu; and the fusion operation mode includes the development of complementary agro-photovoltaic and forest-photovoltaic (power generation on the board and planting under the board), integration of PV building materials and PV roof (power generation on the house and property purchase under the house), and integration of PV finance (PV financial (PV power generation on the house, property purchase under the house)). The way of integration includes the development of agricultural and forest light complementation (on-board power generation and off-board planting), PV building materials, PV roof (on-board power generation and off-board home ownership) integration, PV finance (PV loan), PV tourism (PV ecological sightseeing demonstration park) and other composite green industry integration, which builds up a green industry integration development system that is the first one in Guizhou and the leading one in the whole country in terms of the scale of PV in the town.

#### 4.3.2 Horizontal and integrated operation of the Gangwu PV green value chain

Gangwu PV Green Value Chain (Green Industry Positioning) relies on external sources of assistance to form a horizontal value chain mainly based on PV installation (power plant assembly), and develops a green cooperative economy by integrating horizontally with the various segments of the value chain. The horizontal operation mode of Gangwu PV green value chain is mainly to build PV power plants to complete the assembly link of PV

value chain, and the rest of the value chain will be completed by Shanghai, Guangdong, and Zhejiang; the integration operation mode includes the value chain advantageous links such as capital, technology (PV and planting technology), PV equipment manufacturing, etc. of the fly-out places and the value chain advantageous links of Gangwu, such as sunshine, mountainous area, and human resources, etc., to form a PV green value system through the complementary cooperation of the new wooden barrels. The green value system driven by sunshine resources of Gangwu such as “Flying out of the ground PV company + Gangwu PV power station + ecological set of planting forests and grasses + PV eco-park + farmers” is integrated across the border, and then the green value system of PV contributes to the dual objectives of rocky desertification management of Gangwu and “sunshine and well-being”. The dualistic goal of “Sunshine Well-being” is realized by the PV green value system [10].

### 5. Conclusion

Yunnan Zhaotong apple, Guangxi Fuchuan navel orange, Guizhou Gangwu photovoltaic green cooperative economy prototype mode of operation for the rocky desertification area to solve the two-dimensional contradiction between the environment and income, promote the synergistic evolution of the GEP and the GDP, and to achieve the goal of the dual-carbon and get rich, provides a brick and jade enlightenment: (1) green economy positioning revelation. Stop the traditional agriculture such as corn and sweet potato in the fragile land of rocky desertification area, turn to the green industry (industrial chain) and industry (value chain) positioning innovation such as apples, navel oranges and photovoltaic etc., and promote the “one industry in one township, one product in one village”, and implement the positioning of green economy in accordance with the local conditions, so as to solve the two-dimensional contradiction between the environment and income of the rocky desertification area, and to satisfy the two-dimensional demand of ecology and people’s livelihood, People’s livelihood two-dimensional needs, with the green economy to block the chain of causality between rock desertification and poverty; (2) Advantages of new barrel cooperation.

Shanghai, Guangdong, Zhejiang, and other places that have the advantage of being the first rich to fly out of the country and Yunnan, Guizhou, and Qian that do not have the advantage of being the second rich to fly in to the country are cooperating in the 1+1>2 new barrel, with the places that fly in providing long-term resources such as human resources, land, and special resources to make up for the shortness of the resources through cooperation, and the places that fly out providing long-term resources such as capital, technology, and market, and carrying out the “first-rich to help the second-rich” fishery assistance, so as to promote the development of East-West economic cooperation and to maximize the advantages of the new barrel and the scope of economic advantages of the community of destiny. The Community of Destiny will maximize the advantages of the new barrel of cooperation and the economy of scope of the cooperative economy; (3) Revelation of the dualistic power of other-help + self-help. The governments of the outbound and inbound areas have jointly initiated the implementation of the “Thousand Enterprises for Thousand Villages” in the rocky desertification area with the concepts of ecological value orientation and the concept of citizenship of the community of destiny, and with the economic dynamics of other-help (exogenous source) +self-help (endogenous source), to win the overall performance of the value of the multi-dimensional cooperation, the multi-dimensional value, the multi-dimensional goal and the synergistic effect;(4) Green cooperative economy operation revelation. The green industrial chain and value chain of “Zhaotong Apple”, “Fuchuan Navel Orange” and “Gangwu Photovoltaic” have vertically, horizontally and integrally developed the cooperative economy, and have formed the operation mode of “out-of-area company + in-area cooperative + in-area farmers” outsourcing and consortium in the rocky desertification area across space and time. Green cooperative economy operation modes such as outsourcing and consortium of “out-of-area company + in-area cooperative + in-area farmers” have opened the idea of high-quality development of green cooperative economy in rocky desertification areas; (5) Inspiration for popularization in ecologically fragile areas. The successful

practice and exploration of green cooperative economy in Yunnan-Guizhou-Guizhou rocky desertification area can be further promoted and applied to the national rocky desertification area, and provide wide-angle inspiration for ecological revitalization to support rural revitalization in ecologically fragile areas such as southern rocky areas, northern sandy areas, wind erosion, saline and alkaline areas, so as to realize synergistic evolution of ecologically fragile areas and the East-West Destiny Community in terms of two-dimensional goals of dual-carbon and enrichment.

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### References

- [1] Xu Jinlong, Lu Xinhai, Huang Tianneng et al. Spatial and temporal evolution of ecosystem carbon stocks and its driving factors in Yunnan-Guizhou-Guizhou rocky desertification area Soil and Water Conservation Research, 2023(6):406-414.
- [2] Tang Yingying, Wu Xiuqin. Response of karst carbon sinks to climate change and rocky desertification control measures in Guangxi. Journal of Peking University (Natural Science Edition), 2023(2):189-196.
- [3] Li Ming, Wang Wei. Mechanism and Path of High-Quality Development of Regional Economy Based on Enclave Economy Perspective. Economic Vertical and Horizontal, 2023(6):90-98.
- [4] Jiang Xianzhi, Yu Shuang. Research on ecological compensation in rocky desertification area of Guangxi based on “provincial hectare” ecological footprint. Modern Agriculture, 2023(5):105-112.
- [5] Sampson S E, Santos R P. Reengineering Professional Services Through Automation, Remote Outsourcing, and Task Delegation. Journal of Operations Management, 2023, 69(6): 911-940.
- [6] Porter M E. Industrial Ecology and

- Competitiveness: Strategic Implications for the Firm. *Journal of Industrial Ecology*, 2008, 2(1): 35-43.
- [7] Sahoo S, Jakhar S K. Industry 4.0 Deployment for Circular Economy Performance Understanding the Role of Green Procurement and Remanufacturing Activities. *Business Strategy and the Environment*, 2023, 17(8): 305-328.
- [8] Zhang Meng, Tang Shikai. Research on the path of improving quality and efficiency of Zhaotong apples under the strategy of rural revitalization. *China Collective Economy*, 2023(2):33-36.
- [9] Mao Yuanbin, He Tangxi, Wei Zhimin et al. Exploration on the development status quo and countermeasures of navel orange industry in Fuchuan Yao Autonomous County, Guangxi. *Southern Horticulture*, 2023(5):57-61.
- [10] Zhang Xiaoyu. Study on the Advantages and Dilemmas of the Development of “Agricultural Photovoltaic Complementation” in the Context of Rural Revitalization--Taking Photovoltaic Projects in Ecologically Fragile Areas as an Example. *Environmental Science and Management*, 2023(9):180-184.