RESEARCH OF AGROFORESTRY ECOSYSTEM SERVICES AND IT'S IMPLICATIONS FOR INDUSTRIAL REVITALIZATION IN KARST REGIONS

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Abstract: Agroforestry industry is a derivative industry of ecological governance that takes into account ecological environment restoration, sustainable utilization of soil resources and social and economic benefits. Integrating ecosystem services with agroforestry practices are not only one of the main frontiers of global ecosystem services research, but also a specific path to promote the transformation of rocky desertification control to the stage of ecological industry revitalization, ecosystem services improvement and integration. This paper systematically reviewed the research progress and characteristics of agroforestry ecosystem services, revealed the internal relationship between agroforestry ecosystem services and industrial revitalization in karst are as, and discussed the direction of industrial revitalization in karst areas from three aspects of cognition, evaluation and decision-making of agroforestry ecosystem services. It is emphasized that the future karst region should provide decision support for the revitalization of agroforestry industry from the aspects of cascading mechanism, supply-demand relationship, trade -off and synergy, and influencing factors of agroforestry ecosystem services. Thus, it can better serve karst areas to consolidate the effectiveness of rocky desertification control, improve ecosystem services, and help rural revitalization.
Keywords: Ecosystem services; Agroforestry; Industries revitalize; Revelation; Karst regions

1. INTRODUCTION

Ecosystem services are the various benefits that humans and other biological species obtain from ecosystem functions [1-2], is the link between ecological system and human society Build a bridge of close connection. Although the evolution of rocky desertification generally shows a trend of "continuous net decrease", the task of preventing and controlling karst rocky desertification in Southwest China is on the way. Entering a new stage of organic integration of the development of ecological governance derivative industries and the improvement of ecosystem services [3-4], However, rocky desertification and restoration of ecosystem services lagging behind, seriously restricting the sustainable development of the regional social economy in karst areas, which has become the focus and difficulty of promoting the construction of ecological civilization [5-6], It is bound to affect the presentation of the overall effect of rural revitalization. Therefore, it is necessary to revitalize the derivative industries of ecological management to consolidate the results of rocky desertification control and promote the development of ecological systems. It is not only an important way to solve the resource and environment pressure faced by industrial revitalization, but also to protect ecosystem services and regional It is an inevitable choice for domain ecological security.

Ecological industrialization is the carrier of cultivating and transforming ecological advantages in the same geographical space into advantageous resources for economic development [7], in the karst region The development of ecological industry to prevent and control rocky desertification not only alleviates the serious internal consumption of its fragile environmental resources caused by the overload of human activities, but also makes it continuously cycle and add value, forming stock of ecological assets that support human well-being and economic development (natural capital) and flows (ecosystem services) [8]. Taking comprehensive water and soil improvement as the core

The mixed agroforestry management model of rocky desertification has developed into derivative industries of mixed agroforestry ecological management such as forest -fruit, forest -medicine, and forest-grass.

Governance Technology Poverty Alleviation Industry Development Model First, it is playing a win-win role in time and space for ecological and social economic benefits in the way of reconciling the contradiction between man and land. use [9-10], The essence is that agroforestry's own function promotes the overall improvement of ecosystem quality and the enhancement of ecological product supply capacity.

After years of governance benefits, it has been shown that the development of mixed agroforestry in the karst region of Southwest China centered on the Guizhou Plateau can not only bring full play to the agroforestry Maximization of ecological benefits of coupling forestry and soil and water conservation measures [11], It also has the functions of controlling soil erosion, improving the productivity of rocky desertification land and protecting soil animals The positive effects of diversity [12-13], It highlights that agroforestry is one of the effective measures to control rocky desertification. Due to the current agroforestry ecosystem in karst areas However, the research on traditional services has failed to see through its internal development mechanism and mechanism, and the agroforestry ecosystem services explored and analyzed are relatively single (such as soil and water conservation, production application and restoration of land degradation, etc.), often lagging behind the improvement of regional ecosystem services and even becoming a constraint on the coordinated development of human-land relations. Under the new situation How to improve the sustainability of karst rocky desertification control and the level of regional ecosystem services is imminent. agroforestry ecosystem services The exploration and practice of revitalizing the mixed agroforestry industry in karst

areas is to consolidate the results of rocky desertification control, ensure the smooth flow of service supply and demand, increase the Key actions to improve the well-being of local people. In view of this, this paper reviews the research progress of agroforestry ecosystem services at home and abroad, and summarizes agroforestry ecosystem services. Based on the research characteristics of ecosystem services, the internal relationship between agroforestry ecosystem services and industry revitalization is discussed, with a view to improving the revitalization of agroforestry industries in karst areas. Xing Xing provides corresponding enlightenment, and then contributes to consolidating the ecological security barrier in Southwest China, improving the level and capacity of regional ecosystem services, and ensuring the prevention and control of rocky desertification. and the effectiveness of poverty alleviation and development, and promote the sustainable development of regional social economy.

2. ADVANCES IN RESEARCH ON AGROFORESTRY ECOSYSTEM SERVICES

Also known as agroforestry, refers to the artificial combination of woody plants, crops, livestock and poultry breeding based on the same land unit. The sustainable land use system formed by the combination of different parts [14]. different from the performance of conventional agricultural production systems, the most prominent feature of agroforestry is the multi-Based on annual woody plants, the landscape presents a multi-component, multi-level, and multi-sequence species symbiotic compound agroforestry production system. substantially different According to the principle of mutual benefit and symbiosis among the ecological principles, the comprehensive and sustainable use of land units not only improves the level of biodiversity protection level, and promote the win-win of ecological and economic benefits. Thus enabling agroforestry to play an important role in mitigating climate change, eradicating hunger and poverty, improving There are broad prospects for the livelihood of rural residents, protection of ecological security and sustainable development. Take Daily, costanza and the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, MEA) The upsurge of research on ecosystem services has not abated [1], Especially in recent years, studies on the relationship between agroforestry and ecosystem services have shown that with the land use of agroforestry development increases biodiversity in degraded lands, enhancing ecosystem properties and ultimately ensuring the continued supply of diverse ecosystem services. This is because agroforestry promotes and protects biodiversity by virtue of its outstanding multi-species mutualism principle and multi-level complex sex, Then, on this basis, the intricate ecosystem structure and process of organisms and the environment are formed. Driven by matter and energy, a complex mechanism of action is formed to regulate ecosystem functions, and further based on value orientation, it will serve humans and other biological species provide services. Therefore, the unique resource endowment of agroforestry and the ecosystem services it provides have become important issues in the fields of ecology, geography, Scholars in the field of agroforestry and related managers are concerned, and summarizing the current progress of agroforestry ecosystem services will help provide ideas and inspiration. Di revitalize the agroforestry industry in karst areas.

This article is through CNKI (CNKI), Web of science and Scopus literature databases such as " agroforestry /Agroforestry" and " ecosystem System services /Ecosystem services" is the search term, and since the rise of ecosystem services (1999-2021) involving agroforestry ecosystem services Business-related research is searched, and the research stages are divided according to the research topics that appear in different years, that is, with the growth of time, the research content is gradually diversified. It can be divided into two stages of germination and diversification for characterization.

2.1 Budding Stage

The research in the embryonic stage mainly focuses on the evaluation of ecosystem service value, supplemented by the qualitative description of ecosystem service classification.. in value assessment On the other hand, Qi Ying et al. used the value-quantity method to quantify the adjustment services from agroforestry product supply services, water conservation, soil and water conservation, and environmental purification., cao On this basis, Jianhua et al. added the shadow engineering method, alternative cost method, and opportunity cost method to evaluate the value of agroforestry ecosystem services. These studies the research seems to provide a variety of paths to facilitate the comparison between various ecosystem services, but in the process of value evaluation, it is often selected from the subjectivity of researchers, making the result inaccurate Certainly sexuality state sex. based on Therefore, Alavalapati put forward hypotheses from different perspectives of " spillover effects " and adopting the method of stated preference, explored when adopting agroforestry land use local residents' willingness to pay for related ecosystem services, further from the perspective of payment for ecosystem services, the research on value assessment has been promoted. In terms of taxonomy description of ecosystem services, Jose, Sileshi equal recognition, agroforestry also provides local supply regulation, Many ecosystem services such as culture and support, These scholars take the service classification system is based on de Groot Etc. MEA classification system. Based on the research, although it expounds that the agroforestry ecosystem service category has social welfare, but due to the lack of clear intermediate process and final service issues such as income and income, which can easily lead to the evaluation of service value in the application of classification system. It is estimated that there is double counting. Fundamentally, although less human management decision-making, and the lack of a clear, easy-to-understand and implementable classification system, the agroforestry ecosystem service classification system is moving towards a decision-making and convenient development structure. However, early research on service classification revealed the advantages and potential of ecosystem services provided by agroforestry

itself, which can contribute to the promotion of regional sustainable development. Sustained development has practical significance. To this end, Sharma Promoting rural poverty reduction and governance with Nepalese alder and cardamom agroforestry in the Himalayas The example of ecological protection in Lishan District well confirms this point. By analyzing the progress of the embryonic stage, it is found that before fully understanding the ecosystem services of agroforestry, the types of services provided by human society to agroforestry Other knowledge is still very limited. In order to explore these ambiguous cognitions, the research of the above-mentioned scholars has gone through the process from qualitative description to quantitative analysis, that is, assuming that The existing service classification system recognizes the types of agroforestry ecosystem services, and at the same time is influenced by the ecological economics point of view and evaluates the value of service products. value quantization. From the side, it reflects that the recognition of the category of agroforestry ecosystem services and the assessment of their potential service capabilities are the premise of ecosystem service research and basis. However, in the karst area, the construction of the classification system for agroforestry ecosystem services has not yet been deeply discussed and perfected.

2.2 Diversification Stage

Since 2009, Since the 2nd Global Agroforestry Conference was held in 2010, the potential role of agroforestry's own ecosystem services has attracted much attention. Constrained by the contradictions of population growth, food demand, biodiversity protection and maintenance of various ecosystem services, Whether agroforestry can fully and effectively exert ecosystem services has become a question worth considering in the stage of diversification. The research in the diversification stage mainly focuses on the trade-off and synergy of agroforestry ecosystem services, Rural residents' perception of ecosystem services, selection and innovation of ecosystem service indicators, and ecological asset accounting. This reflects the global Under the macro background of changes and sustainable development policies, the interaction mechanism around the change of agroforestry ecosystem services and human well-being and sustainability is developing toward diversification and deepening, which provides support for relevant regional decision-making support and ecosystem service optimization basis. In terms of ecosystem service tradeoffs and synergies, relevant scholars have explored the relationship between yield supply and regulation of service clusters through local agroforestry industries. balance relationship, and proposed a way to coordinate local farming and forestry management with the ecosystem. These studies are based on the agroforestry ecosystem structure Construct -process -service change mutual mechanism, select and optimize ecosystem service types and make reasonable decisions. Compared with previous scholars' research. Non-linear dynamics between ecosystem services provide evidence. So as to explore and promote the coordinated development of agroforestry industry, social economy and human well-being Appropriate avenues are provided.

In terms of rural residents' perception of ecosystem services, rural residents in the agroforestry industry, as the main production Service perception is related to changes in producers' own ecological behavior and socio-economic activities, thus affecting the supply of ecosystem services. Cerdán, Wagner et al. conducted a survey on rural residents' cognition of ecosystem services provided by agroforestry in the agroforestry industry, most Rural residents and local technicians often take certain ecological management measures to ensure coffee production, and there are differences in the perception of ecosystem services. Selective preference cognition of the same service. The knowledge frameworks of rural residents and experts can thus be complemented to ensure the supply of agroforestry ecosystem services.http://www.ecologica.cn.

And the assumption that the economic status of rural female residents engaged in agroforestry industries is affected by payment for ecosystem services, in Benj amin etc. research It was confirmed in, Make local adoption of PES further promote gender equality and ensure the supply of ecosystem services. but On the other hand, whether social and economic activities can drive changes in the ecological behavior of groups engaged in the agroforestry industry has a great impact on ensuring the stability of the agroforestry ecosystem. It is of great significance for the continuous supply and sustainable development of traditional services.

In terms of innovation in the selection of ecosystem service indicators, relevant scholars have expanded new indicators to recognize other ecosystem services based on the purpose of supplying and maintaining services. ecosystem service. For example, the ant biological community interferes with the cocoa bean agroforestry system supply service in the intermediary regulation service ; Leaf area index in Application of agroforestry ecosystem services. However, relevant scholars have developed a multi-group customized agroforestry ecosystem service assessment tool, which combines multiple The integration of measured data provides rural residents with decision-making comparisons of land use patterns and ecosystem services. These studies compared with the embryonic stage, More attention is paid to how to develop new indicators and new methods based on the reality of agroforestry ecosystems to comprehensively and objectively evaluate agroforestry ecosystem services, It has undergone a profound cognitive transformation from system guidance to independent decision-making.

In terms of ecological asset accounting, relevant research mainly focuses on providing support for land management decision-making and improving the application of agroforestry ecological assets. System of National Accounts (SNA) Defects in calculation of intermediate services, ecological asset stock and flow account sustainability quantification, etc., These studies The research is based on the comprehensive environmental and economic accounting system (SEEA) and the European Environmental Economic Information Collection System (SERIEE) Based on the accounting system, the A newly developed agroforestry accounting system based on a large amount of physical data, Characterizes the natural resource use and management of agroforestry and the currency value of ecological assets Circulation. In essence,

ecological asset accounting management connects social and economic management, and manages different ecological assets in agroforestry to improve use efficiency. multiple interrelated interests in the service of human well-being.

In general, based on the perspective of man-land system coupling, in order to make agroforestry ecosystem services beneficial to industrial revitalization and human sustainable development of human well-being. This paper argues that we should grasp the cascading laws among the pattern, process, service and well-being of the agroforestry ecosystem, and fully consider the agroforestry ecosystem. The effects of changes in agroforestry ecosystem services on the karst ecological environment, especially the participation of agroforestry in rocky desertification control and the services it provides, constitute a model for it. The classification system of agroforestry ecosystem services in type karst ecologically fragile areas, the evaluation, trade-off and synergy of quantifying agroforestry ecosystem services at multiple scales Influencing factor analysis, supply and demand analysis, scenario prediction and optimization regulation, etc., coordinate service supply at different scales to meet the needs of different interest groups to participate in the promotion To meet the needs of the agroforestry ecological industry and promote the high-quality development of the agroforestry industry in karst areas.

3. RESEARCH CHARACTERISTICS OF AGROFORESTRY ECOSYSTEM SERVICES

According to the retrieved documents, the number of articles is counted according to the spatial scale of the research area defined by each document. The statistical results show that agroforestry Ecosystem services focus on large regions (7 articles), region (25 articles) and fields (18 Article) 3 a non-zonal spatial scale in which these scales do not represent The relationship between the absolute size of the levy is only used as an idea and method to reveal the needs of agroforestry ecosystem services to solve different problems at different spatial scales, and to screen The selected representative literature is summarized according to the research scale, research area, research object, research goal, index selection and evaluation method (Table 1).

Table 1 Study Feature Of Agroforestry Ecos System Services

spatial scale Spatial scales	study area study area	Research objectives study goals	research object study objects	Index selection Study indicators	Evaluation method Evaluation method
Region [twenty two]	Northern Europe, South Europe, West Europe, East Europe and middle Europe, South Africa, Southeastern Brazil	Characterizing agroforestry producing ecosystems Contribution and Impact of System Services	Representative mixed farmers in Europe and Africa forest system	Selection of Ecosystem Service Indicators by MEA and international ecosystem	Meta analyze
Region	Northwest Switzerland, Costa Rica, West Northwestern Spain, Northeastern India, Egypt Southeastern / Northern Ethiopia	Characterization of agroforestry production system design Evaluation and comparison of rural residents willingness to participate	forest -grassland and other mixed agroforestry	Common Classification of Services (CICES) Forquestion example, supply, regulation and control services Services : erosion control, nutrient cycling	Certainly tap Sample point analysis / roll investigation
field	San Martín, Peru, Western Kenya Trans Nzoia, northwestern El Salvador las Vueltas, China	Characterizing agroforestry provisioning services to Trade-off coordination between different service clusters relation	pastoral, agriculture- forestry and other mixed agroforestry	Conservation, Biodiversity Conservation, Carbon/ fixation, oxygen release, etc.	Certainly point Pick Sample point analysis half Knot structure Interview / Questionnaire

3.1 Regional Scale

In Europe, Torralba Etc. Meta An analytical approach to study the impact of agroforestry on biodiversity conservation and other ecosystem services found that http://www.ecologica.cn _
(c)1994-2023 china Academic Journal Electronic publishing House rights reserved. http://www.cnki.net. Agroforestry has significantly improved its own ecosystem in terms of soil and water conservation, nutrient cycling, and biodiversity protection. system Clothes service water Ping. same Sample Fagerholm Wait for Meta Methods explore the evolution of ecosystem services provided by agroforestry in the European region, identifying the different supply, support and and regulation services, especially regulation services such as soil and water conservation, nutrient cycle and biodiversity protection are more prominent. From this it was found that in the regional study In terms of scale, research on the ecosystem services provided by agroforestry tends to be based on Meta The method of analysis is mainly aimed at comprehensive analysis of individual samples through research Its cognition and evaluation of the ecosystem services provided by agroforestry provide objective decision-making basis for promoting the development of agroforestry industry and rural planning. and The methods of the above two are similar, Kuyah found that agroforestry not only

increased crop yields in South Africa, but also enhanced soil and water conservation, nutrient cycling and Ecosystem services such as biodiversity conservation, and also found that there is a trade-off relationship between soil available phosphorus and soil moisture in the African continent, thus proposing Suggestions on reasonable intercropping distance, tree species configuration and tree crown pruning.

3.2 Regional Scale

The research on agroforestry ecosystem services has also achieved some results in the agroforestry systems formed in different regions. Wegari by Esser Evaluation of the value of agroforestry ecosystem services in the upper and lower reaches of southeastern Russia and farmers' perceptions of agroforestry ecosystem services for land use Variation and provision of conservation policy decisions; Similarly, in the northern region of Ethiopia, Haile and other questionnaire surveys and interviews with local rural residents The willingness to pay for ecosystem services whether to adopt agroforestry planting was discussed. Although this method is popular among local rural residents in planting willingness and their willingness to pay for ecosystem services are logically simple, but the evaluation purpose is clear and practical. Kay waiting in the northwestern part of switzerland in europe Separately designate cherry orchard agroforestry system and agricultural land as experimental and control plots for ecosystem service assessment, Selected water purification, water Soil conservation, carbon sequestration and other main regulating service indicators show that the cherry orchard agroforestry system in northwest Switzerland plays a significant role in regulating services, and is based on The spatial mapping method is intuitively displayed, providing a new perspective for presenting ecosystem service assessment results and decision support.

3.3 Field Scale

At the field research scale, Jezeer and other fixed-point monitoring of the Peruvian banana and coffee agroforestry industry, and at the same time increased the use of coffee production, shade management. According to the investigation and interviews on management and agricultural production input information, it was found that tree shading measures not only had little impact on coffee yield, but also promoted the growth of Lepidoptera. The improvement of ecosystem services such as biodiversity richness and carbon sequestration effect, the impact of shading management on coffee yield and Lepidoptera species biodiversity and carbon sequestration effect There should be no trade-off synergistic relationship, and it shows that it is possible to maintain ecosystem services to coordinate farmers' livelihoods and coffee production stability. this ecosystem a collaborative Research Approach to System Service Tradeoffs in Northwest El Salvador Las Vueltas City is also applied, Kearney developed ecosystem services composite index method can better integrate and calculate various indexes of soil and water conservation, carbon sequestration, nutrient cycle and biodiversity protection. The calculation method is easy for fixed-point sampling and long-term monitoring, and can identify the trade-off synergy between service clusters under different agroforestry production methods, and Conducive to the design and transformation of industrial models. Chinese scholars mainly focus on this scale of research, taking the agroforestry model as the evaluation unit, forming an ad valorem value assessment and benefit description, assessed the ecosystem services provided by agroforestry models in eastern and central China, quantified and described different The value difference between service clusters and the benefits of service products.

3.4 Research Characteristics

In terms of research objectives, different research scales in Table 1 have different focuses, that is, the regional scale only focuses on the ecosystem services of agroforestry The contribution and impact of the study at the regional scale ; the regional scale focuses on regional land use comparisons and the willingness of rural residents to participate ; while the field scale focuses on The same production mode responds mainly to the trade-off synergistic relationship between ecosystem service clusters. This shows that under the influence of the ecosystem service research paradigm in recent years, and deepen with the advancement of research.. The choice of subjects depends on the research target, and most of the research objects are regionally representative agroforestry systems (such as European Mediterranean forest -pastoral agroforestry systems, tropical coffee, cocoa agroforestry. In terms of research indicator selection and evaluation methods, when Meta in the analysis, most studies based on the large-scale regional scale of the existing research results database construction ; and when sampling plot monitoring and survey and interview methods are adopted, most studies are based on field survey sampling and interview research. these methods Mainly through MEA and CICES Classify and subdivide the supply, regulation and support services of agroforestry ecosystem services again, and establish the crop production Quantity, soil and water conservation, nutrient cycle, biodiversity protection, carbon fixation and oxygen release, etc. Selected indicators show commonality according to ecosystem service classification. Indicators, and with the increase of the research scale, mainly adopt easy-to-quantify indicators. In the evaluation method, since the ecosystem services of agroforestry are at different scales The resulting complexity, the evaluation model is mainly based on comprehensive evaluation. For Meta There are mainly response ratio and response ratio index to analyze the specific operability. To express and quantify the size and impact of two different effects of agroforestry on ecosystem services. The size and influence between the different effects were also examined Inspection and Evaluation. On the other hand, on-site sampling and monitoring, survey and interview, and data obtained through indicators are used for independent and comprehensive evaluation of agroforestry ecosystem services. The main statistical methods used are index accumulation method and spatial cartographic expression, and methods such as analysis of variance, hypothesis

testing, and principal component analysis are used. Supplemented by application, there are even diversified integrations of research methods and means to explore agroforestry ecosystem services.

To sum up, clarifying the research objectives has a decisive effect on the research objects, and the research indicators and methods show that the diversification of research paths can be rationalized agroforestry ecosystem services. Therefore, the characteristics of the research basically follow the " establishment of research objectives clarify research objects-Select research indicators and evaluation methods-The technical route of "outputting research results ". Although there are differences in research objectives, research objects and evaluation methods, each spatial scale is Convergence in technical route. The research objectives and objects of different spatial scales mostly emphasize the ecosystem services provided by agroforestry, rather than a single agroforestry as a means of production in agroforestry. Researches from the regional scale to the field scale also show that different stakeholder groups have differences in the importance of ecosystem services and trade-offs in management strategies. This is in contrast to the diversity, inequalities, and human The class value orientation is basically the same. Therefore, under the influence of the research paradigm of ecosystem services, the selected indicators of agroforestry research methods not only cover most In addition to reflecting the indicators of ecosystem services, it also shows the versatility of technical routes at various scales.

4.THE INTERNAL RELATIONSHIP BETWEEN INDUSTRIAL REVITALIZATION AND AGROFORESTRY ECOSYSTEM SERVICES

Industrial revitalization and agroforestry ecosystem services as responses to China's rural revitalization strategy and the National Important Ecosystem Protection and Restoration Key Master Plan for Major Projects (2021—2035 Year) (Hereinafter referred to as planning), the specific actions are internally consistent in achieving the goals. Agroforestry Revitalization also refers to the revitalization based on the development of the existing agroforestry industry, and to help local rural areas and residents achieve the goal of common prosperity through industrial driving. The agroforestry ecosystem service is to provide high-quality services for the survival and development of local rural residents without compromising the stability and integrity of the ecosystem. target material and service products. The former is to consolidate the achievements of poverty alleviation and focus on maintaining the stability and integrity of the ecosystem, while the latter is to promote production Industry revitalization takes the road of ecological priority, green and high-quality development. For government decision-making groups and rural residents, improving agroforestry ecosystem services It is the short-term goal, and the revitalization of the agroforestry industry with the short-term goal of high-quality development is the long-term goal, showing the synergy between the two goals. inner relationship.

Agroforestry ecosystem services lay the foundation for the revitalization of agroforestry industry. The planning points out that the integrated protection and restoration of mountains, rivers, forests, fields, lakes and grasses should be coordinated, from the two important goals of the overall improvement of the quality of natural ecosystems and the supply capacity of ecological products will be vigorously promoted. Agroforestry as a land use http://www.ecologica.cn. This method not only develops the three-dimensional and efficient allocation of vegetation in a limited space, but also uses its own land system as the carrier of ecosystem services to promote agroforestry The industry takes ecological priority and the road of green development lays the groundwork. At present, the ecosystem services of agroforestry in karst areas exist under the guidance of human values. Selective preference, too much emphasis on regulating services, while ignoring the degree of emphasis on supply services and cultural services, will lead to more intensified conflicts between man and land and The balance and demand of ecosystem services are more different, which leads to a decline in the quality of organic coupling between rocky desertification control and industrial development. Therefore, embarking on the ecosystem System services are the key to reveal the mechanism of ecosystem protection, restoration and reconstruction, It is also the need to continue the long-term development of the agroforestry industry chain.

The revitalization of agroforestry industry can consolidate and improve the quality of ecosystem services. The revitalization of the mixed agriculture and forestry industry must take the high-level of environmental protection, green and sustainable Quality development path, but also give full play to the advantages of the overall ecosystem service endowment of agroforestry. How to prevent the degradation and decline of services in agroforestry ecosystems, Consolidating the service level of agroforestry ecosystem has become a key issue to be solved urgently. In the current agroforestry industry, the stand structure is monotonous, the relationship between species and Problems such as industry disconnection, It brings risks to exacerbate the vulnerability of karst ecosystem and the stability of rocky desertification control. agroforestry Systematic service revitalizes the agroforestry industry in karst areas, eliminates the above-mentioned risk problems and promotes industrial optimization and upgrading to ensure long-term stability of ecological restoration The essence is to fully organize and revitalize the combination of various resources in the agroforestry ecosystem by giving full play to the advantages of the high efficiency of ecological agriculture based on the characteristics of the agroforestry itself. Coordination effect, to achieve multi-level and efficient utilization of energy and material cycle, to consolidate regional economic development in karst areas and improve the quality of ecosystem services offers possibilities.

5. Enlightenment of agroforestry ecosystem services on industrial revitalization in karst areas

Different from other agroforestry development areas in the world, the inherent characteristics of the hydrological system and the ecological system in the karst area are based on the structure -function -habitat framework.

In terms of the underlying characteristics, unreasonable human activities aggravate the further degradation of the fragile ecosystem pattern and function, frequent geological disasters and the spread of rocky desertification. Yan and other ecological issues. Based on this, there is an increasing call for the development of ecological mountain agriculture based on agroforestry planting in karst areas according to local conditions. rise, Has been supported and adopted by many scholars, This consensus implies that the sustainable development of mountain agriculture in karst areas Driven by the continuous deconstruction and objective laws of spatial reorganization according to local conditions around the governance of regional ecology, society and economy. Visible, through the Promoting the revitalization of the agroforestry industry in the Sturt area can prevent rocky desertification and protect biodiversity, and also change the local traditional agricultural structure to promote the ecological system. improve traditional services, and promote the long-term maintenance of local rural revitalization and ecological civilization construction. In order to be able to revitalize agroforestry products with development potential industry, and promote the long-term maintenance of local rural revitalization and ecological civilization construction. According to the analysis of the above chapters, there are mainly the following revelations :

(1) A full understanding of ecosystem services is a necessary prerequisite for the revitalization of agroforestry industries in karst areas

has made achievements in the contribution of ecological restoration and greening, and the " net reduction " of rocky desertification area [5], But the improvement of ecosystem services concrete path is needed. Relevant studies are based on natural and socioeconomic factors such as karst landform features, ecological migration, and land use changes, focusing on karst landforms. The promotion of regional ecosystem services has been explored in the early stage, show that human activities affect ecosystems through different land-use types Differences in service supply in karst areas are the main factor in the trade-off between ecosystem services. Revitalizing the derivative industries of ecological governance not only regulates the above-mentioned ecological The trade-off relationship between system services, and the promotion of targeted rocky desertification governance, promote the task of rocky desertification governance to the revitalization of ecological industries and regional ecosystems. The transformation of the integration stage of service improvement, and the revitalization of the agroforestry industry is a specific action in response to the " transformation ". As described in this paper, agroforestry ecosystem services In promoting industrial revitalization, it not only consolidates the quality of the agroforestry ecosystem and the supply capacity of ecological products, but also provides high-quality products for regional development and human well-being. Material and service products. Therefore, the main content of revitalizing the agroforestry industry should be reflected in several aspects. First, analyze the pattern and process of the agroforestry ecosystem. The cascading mechanism of processes, services and well-being ; thirdly, take inventory of the stock of ecological assets in the agroforestry ecosystem, and use ecological assets to account, evaluate, manage and promote Relevant management decisions and optimal allocation of benefits ; finally, through agroforestry ecosystem services trade-off synergies, influencing factors, and supply and demand flows to promote The improvement and space optimization of the mixed agroforestry industry will provide support for the revitalization path and decision-making of the mixed agroforestry industry with ecological priority and green development, and will help To promote the gradual improvement of regional ecological security and sustainable development.

(2) It is an important link to revitalize the agroforestry industry to clarify and quantify the relationship between supply and demand of ecosystem services, trade-offs and synergies and influencing factors

The research characteristics of this paper indicate that the research objectives, objects, indicators and evaluation models focus on reflecting the evaluation and trade-off of agroforestry ecosystem services. However, in the process of revitalizing the agroforestry industry in karst areas, the increase of ecological products and the supply of services are heterogeneous in time and space. Difficulty in sexual and industrial development Factors such as self-sustainability and the intensification of human-land conflicts under the background of long-term relative poverty have seriously restricted the requirements for rural revitalization to promote green development, making mixed farmers

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It is difficult for the forestry industry to pass a single The production application sidesteps this problem. With the supply and demand relationship and trade-offs and coordination of supply and regulation services provided by agroforestry It has gradually become the core of agroforestry ecosystem services, based on the mapping from the established assessment objectives to the pattern and process of agroforestry ecosystems, driving Agroforestry ecosystem service assessment develops towards multi-dimensional and multi-scale scattering. Therefore, it should be combined with rocky desertification control, ecological process and agroforestry industry impact. The conditions of benefit groups, comprehensive consideration of the actual needs of stakeholders on different spatial scales, and the supply and use of multi-scale and multi-type services The transmission expression of the spatial flow relationship, clarify the trade-off or synergistic relationship between service clusters and their scale dependence and spatial difference characteristics, and reveal the influence of mixed farming Natural and socioeconomic factors of spatial and temporal distribution of forest ecosystem services and selection preferences, in order to enhance decision makers to develop management measures for green development and increase The service value of the agroforestry ecosystem is one of the measures to consolidate and ensure the effectiveness of rocky desertification control, and it is also an important link in the revitalization of the agroforestry industry.

(3) Improving the decision-making support capacity of agroforestry ecosystem services is a management practice for revitalizing industries in karst areas

The improvement of the decision-making support ability of agroforestry ecosystem services lies in the scientific cognition of the trade-off relationship between different service clusters, which is not only to realize the ecosystem The

need for sustainable management, It is also the choice for the revitalization of sustainable management of agroforestry industry in karst areas. Agroforestry ecosystem services must exist Multiple non-linear relationships, trade-off characteristics, formation mechanisms and their spatio-temporal patterns, through the framework of sustainable development to identify the trade-off relationships of different service clusters, are beneficial Make decision-making management goals not driven by short-term interests. While the current research on the interaction of ecosystem service clusters (e.g. tradeoffs, synergies and compatibility) have have a certain understanding, However, in exploring the interaction characteristics and modeling of service clusters, it has not reached the level of decision-making application. Therefore, future research should In karst areas, the evaluation of negative service products of agroforestry ecosystem services, the change trajectory between service clusters, and the service of agroforestry planting patterns should be strengthened. service supply and demand and optimization of ecological compensation, further integrate agroforestry ecosystem services with karst ecological processes, and improve relevant indicators and evaluation method to effectively promote the deepening of the research on agroforestry ecosystem services, which not only provides support for rocky desertification control, revitalization of related industries, and sustainable regional development. The multi-objective regulation plan can also provide a specific path for the revitalization of the agroforestry industry and the improvement of ecosystem services.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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