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The Second Life of Abandoned Orchards: Innovative Approaches to Land Use

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Abstract: As globalization accelerates, the issue of abandoned orchards has become increasingly prominent, posing a major challenge for land resource management. This paper reviews innovative approaches to the land use of abandoned orchards, aiming to explore the ecological services, economic benefits, and socio-cultural values in their transformation process. The article first analyzes the environmental impact of abandoned orchards, including soil quality degradation, water resource pollution, and biodiversity loss. Subsequently, it discusses innovative land use strategies such as smart agriculture, ecological restoration, and landscape design, and assesses the role of policy frameworks and planning in promoting sustainable land use. Through the analysis of successful domestic and international cases, the paper demonstrates the various possibilities of orchard transformation. Finally, the article summarizes the challenges and opportunities of land use transformation in abandoned orchards, providing sustainable solutions for future land management.

Keywords: Abandoned Orchards; Land Use Transformation; Ecological Effects; Economic Benefits; Smart Agriculture.

1. Introduction

In the process of globalization, the management and utilization of land resources have become increasingly prominent issues [1, 2]. Abandoned orchards, as a special type of land resource, have garnered significant attention regarding their reuse. These once-thriving orchards have become desolate due to various reasons, and their existence is not only a testament to the changes in agricultural production methods but also a challenge to modern land use strategies [3, 4] (Figure 1). The issue of abandoned orchards is not isolated; it is closely connected to global climate change, biodiversity conservation, food safety, and the economic development of rural communities. If these abandoned lands are properly managed and planned, they can not only restore their ecological functions but also bring new economic opportunities to the local area. For example, by introducing smart agriculture technologies, abandoned orchards can be transformed into efficient agricultural production areas or become ideal locations for promoting ecological tourism. Additionally, these lands can serve as biodiversity conservation areas, playing a role in protecting endangered species and maintaining ecological balance.

To achieve these goals, interdisciplinary cooperation is required, including the joint efforts of land planning experts, agricultural scientists, environmental protectors, and policymakers. Only through collective wisdom can innovative land use strategies be developed, maximizing the utilization of abandoned orchard land resources and providing sustainable solutions for future land management. This paper aims to explore innovative approaches to the land use of abandoned orchards, in hopes of providing new ideas and plans for the sustainable development of land resources.

The paper will start from a macro perspective, analyzing the current status of abandoned orchards, discussing innovative land use strategies, comparing policy frameworks and planning in different countries and regions, and finally, through case analysis, evaluating the replicability of these strategies and their implications for the world. Through a comprehensive analysis of the land use of abandoned orchards, we hope to provide valuable insights and suggestions for decision-makers and practitioners in land use planning. At the same time, we also look forward to this article inspiring more research and discussion, promoting the development of land use innovation, and paving a new path for the second life of abandoned orchards.

2. Environmental Impact of Abandoned Orchards

2.1. Soil Quality Changes

Abandoned orchards often suffer a gradual reduction in organic matter content due to the lack of regular cultivation and organic matter addition[5]. Soil organic matter is a key factor in maintaining soil fertility, as it enhances the soil's moisture retention capacity and nutrient supply. The decrease in organic matter can lead to poor soil structure, affecting crop growth[6]. In cases of improper irrigation or poor drainage, the soil in abandoned orchards may become salinized. Soil salinization affects soil aeration and water movement, further impacting the normal growth of crops. Soil microorganisms play a crucial role in maintaining soil health and promoting plant growth. Due to the lack of management in abandoned orchards, the diversity and activity of soil microorganisms may decrease, affecting the soil's self-recovery ability[7].

2.2. Water Resource Impact

Abandoned orchards can have a negative impact on surrounding water resources. Residual substances from pesticides and fertilizers may enter surface water bodies through rainwater runoff, leading to a decline in water quality and affecting the survival of aquatic organisms. Groundwater may also be contaminated, affecting the drinking water safety of humans and animals [9].

2.3. Biodiversity

The ecological environment of abandoned orchards is usually fragile and susceptible to invasion by alien species[10, 11]. These invasive species may compete with native species for living space, leading to the loss of original biodiversity. At

the same time, the habitat function of abandoned orchards is weakened, posing a threat to the stability of local wildlife populations [12].

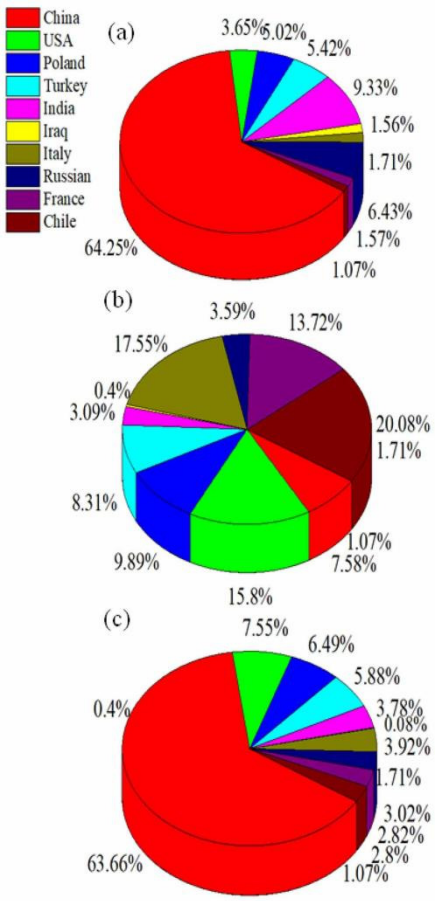

Figure 1. The apple (a) Yield (b) Production and (c) Area harvested percentage of the top ten countries in the world [8]

2.4. Socio-Economic Impact

Abandoned orchards mainly impact surrounding agricultural production by potentially becoming breeding grounds for pests and pathogens, causing damage to nearby crops. Additionally, the presence of abandoned orchards may affect the quality of life of local residents, including reducing land available for agricultural production and affecting landscape aesthetics and community recreational activities. Due to the lack of vegetation protection, the soil in abandoned orchards is susceptible to wind and water erosion. Soil erosion not only leads to the loss of soil fertility but also causes pollution to downstream water bodies.

3. Innovative Strategies for Land Use

3.1. Application of Smart Agriculture Technology

Using satellite positioning systems (such as GPS) and geographic information systems (GIS), precision agriculture technology can conduct detailed surveys of abandoned orchard land, analyzing soil types, moisture conditions, and nutrient levels. This data can help agricultural producers make more precise planting decisions, such as choosing crop varieties best suited to current soil conditions or applying fertilizers and irrigation accurately [13, 14]. By installing soil moisture sensors and automatic control systems, smart irrigation technology can automatically adjust water quantities based on the actual needs of the soil. This not only saves water resources but also prevents soil degradation due to over-irrigation. Drones can be used to monitor the land conditions of abandoned orchards, including vegetation cover, pest and disease occurrence, and crop growth. High-definition cameras and multispectral sensors mounted on drones can provide real-time land monitoring data, helping to identify and solve problems promptly. The vast amount of data collected can be analyzed using machine learning and artificial intelligence technologies to predict crop growth trends and potential risks (Figure 2). These predictive models can help agricultural producers prepare in advance, such as taking measures to prevent pests and diseases.

Figure 2. IoT-enabled farming applications [15]

3.2. Ecological Agriculture and Organic Farming

By transitioning to ecological agriculture and organic farming, abandoned orchards can be transformed into eco-friendly agricultural production areas[16]. This approach emphasizes the use of natural and renewable agricultural practices, reducing the use of chemicals, protecting and enhancing biodiversity, and providing healthy agricultural products[17].

3.3. Multifunctional Land Use

The land of abandoned orchards can be planned as multifunctional areas, combining agricultural production, recreation, and ecological protection. For example, agricultural tourism can be developed, educational centers established, community gardens built, or they can be part of urban greening. Such multifunctional use not only provides new activity spaces for local residents but also offers venues for ecological tourism and education.

3.4. Ecological Restoration and Landscape Design

For those abandoned orchards no longer suitable for traditional agricultural production, ecological restoration methods can be employed to restore their original ecosystem functions[18]. Combined with professional landscape design, these lands can be transformed into parks, nature reserves, or wildlife habitats, enhancing the ecological network of cities and villages[19, 20].

4. Case Analysis

In the field of land use transformation and ecological restoration of abandoned orchards, there are many successful cases around the world. These cases not only demonstrate the

effectiveness of innovative strategies but also provide valuable experiences for other regions. Here are detailed introductions to a few typical cases:

Orchard City in Hamburg, Germany

The city of Hamburg launched a project called "Orchard City," transforming abandoned orchards into public orchards where citizens can freely pick fruit. This project has improved the quality of life for residents by increasing urban green spaces and has also promoted the recovery of biodiversity.

Urban Farms in Detroit, USA

With industrial decline, Detroit saw a large amount of abandoned land. Local community organizations and NGOs collaborated to transform these abandoned orchards into urban farms and community gardens, providing fresh vegetables and fruits, while also creating job opportunities for residents[21].

Ecological Park in Beijing, China

Beijing has incorporated abandoned orchards into the construction of ecological parks in its urban planning. Through ecological restoration and landscape design, these orchards have been transformed into ecological parks with educational and recreational functions, becoming part of the city's green infrastructure.

Forest Therapy Bases in Japan

In Japan, abandoned orchards have been transformed into "forest therapy" bases, offering natural healing experiences [22]. These bases not only restore ecosystems but also provide opportunities for people to have close contact with nature, promoting physical and mental health.

5. Ecological and Economic Benefits

The land use transformation of abandoned orchards is related not only to ecological restoration but also to how ecological services can be converted into economic benefits.

5.1. Ecological Effects

Abandoned orchards can absorb carbon dioxide from the atmosphere through vegetation restoration, helping to mitigate climate change. The value of this service can be realized economically through carbon credits or carbon trading markets. Restored orchards can improve water quality and increase groundwater replenishment, which is particularly important for arid regions[23, 24]. Through water resource management, this service can be converted into economic benefits of water-saving measures and water quality improvement. Biodiversity Conservation: Ecological restoration increases biodiversity, which is crucial for maintaining ecological balance and providing resources for ecological tourism. The value of biodiversity can be economically transformed through ecological tourism and educational projects.

5.2. Economic Benefits

By participating in carbon trading markets, the carbon sequestration service of abandoned orchards can be converted into direct economic income[25]. Ecological Tourism: Developing ecological tourism projects, such as bird watching, nature walks, and educational activities, can attract tourists and drive local economic development[26].

6. Conclusion

This paper has conducted a comprehensive discussion on the innovative approaches to land use, which is the second life of abandoned orchards. We analyzed the environmental impact of abandoned orchards, explored innovative land use strategies, and demonstrated successful transformation cases through case analysis. Now, we draw the following conclusions:

Dual Value of Ecology and Economy: The land use transformation of abandoned orchards can not only restore ecological services but also create economic benefits. Through smart agriculture, ecological tourism, and educational projects, these lands can become important assets for the sustainable development of the community. Necessity of Policy Support: Government policy support is crucial for the land use transformation of abandoned orchards. Financial incentives, legal regulations, and public participation mechanisms are key factors in ensuring the success of the projects. Continuous monitoring and evaluation of transformation projects can ensure the achievement of project goals and timely adjust strategies to meet new challenges.

Finally, we believe that the land use transformation of abandoned orchards is a complex but feasible process. It requires interdisciplinary and interdepartmental cooperation, as well as innovative thinking and continuous effort. We hope this paper can provide valuable insights and suggestions for decision-makers and practitioners, jointly promoting innovative approaches to land use, and painting a sustainable future blueprint for the second life of abandoned orchards.

References

[1] Rada P, Halda JP, Holuša J, Maliňáková K, Horák J. Urban fruit orchards: Biodiversity and management restoration effects in the context of land use. Urban Forestry & Urban Greening. 2022;75.

[2] Zerriffi H, Reyes R, Maloney A. Pathways to sustainable land use and food systems in Canada. Sustainability Science. 2022;18(1):389-406.

[3] Bolan N, Swain D. Foreword: Issues and innovations in land application of farm wastes. New Zealand Journal of Agricultural Research. 2010;47(4):387-8.

[4] Pramanik P, Phukan M. Assimilating atmospheric carbon dioxide in tea gardens of northeast India. Journal of Environmental Management. 2020;256.

[5] Zhou E, Lyu S, Du G, Lyu D. Evaluation of the Effects of Returning Apple Shoots In Situ on Soil Quality in an Apple Orchard. Agronomy. 2022;12(11).

[6] Ayoubi S, Mohammadi A, Abdi MR, Abbaszadeh Afshar F, Wang L, Zeraatpisheh M. Assessment of Soil Redistribution Following Land Rehabilitation with an Apple Orchard in Hilly Regions of Central Iran. Agronomy. 2022;12(2).

[7] Wang H, Sheng Y, Jiang W, Pan F, Wang M, Chen X, et al. The effects of crop rotation combinations on the soil quality of old apple orchard. Horticultural Plant Journal. 2022;8(1):1-10.

[8] Karimi Alavijeh M, Yaghmaei S. Biochemical production of bioenergy from agricultural crops and residue in Iran. Waste Management. 2016; 52:375-94.

[9] Chen M, Shao Ma, Wei X, Li T, Shen N, Mi M, et al. Response of the vertical distribution of soil water and nitrogen in the 5 m soil layer to the conversion of cropland to apple orchards in the Loess Plateau, China. Agriculture, Ecosystems & Environment. 2022;333.

[10] Cohen M, Godron M, Cretin-Pablo R, Pujos R. Plant biodiversity in Mediterranean orchards is related to historical land use: perspectives for biodiversity-friendly olive production. Regional Environmental Change. 2023;23(2).

[11] Kajtoch Ł. The importance of traditional orchards for breeding birds: The preliminary study on Central European example. Acta Oecologica. 2017; 78:53-60.

[12] De Paz V, Asís JD, Holzschuh A, Baños-Picón L. Effects of Traditional Orchard Abandonment and Landscape Context on the Beneficial Arthropod Community in a Mediterranean Agroecosystem. Insects. 2023;14(3).

[13] Idoje G, Dagiuklas T, Iqbal M. Survey for smart farming technologies: Challenges and issues. Computers & Electrical Engineering. 2021;92.

[14] Li J, Liu G, Chen Y, Li R. Study on the influence mechanism of adoption of smart agriculture technology behavior. Scientific Reports. 2023;13(1).

[15] Huo D, Malik AW, Ravana SD, Rahman AU, Ahmedy I. Mapping smart farming: Addressing agricultural challenges in data-driven era. Renewable and Sustainable Energy Reviews. 2024; 189:113858.

[16] Niedermayr A, Landert J, Albanito F, Carolus J, Desjeux Y, Heinrichs J, et al. Assessing farming systems in transition to agroecology. EuroChoices. 2022;21(3):48-9.

[17] Liu WY, Chiang CY, Yap JL, Lin CC. Assessing the ecosystem service values of tea plantations using conventional and organic farming methods: Is organic farming always better? Ecological Indicators. 2024;158.

[18] Petit S, Alignier A, Allart R, Aviron S, Boussard H, Franck P, et al. Building capacities for the design of agroecological landscapes: The added-value of Landscape Monitoring Networks. Agriculture, Ecosystems & Environment. 2023;342.

[19] Li D, Xu E, Zhang H. Multiscale and multifunctional analysis of the coupling relationship between land use and desertification. Land Degradation & Development. 2023;35 (1): 183-95.

[20] Wan Y, Wan X. Ecological landscape environmental optimization design for environmental protection under economical environment: Lake Wetland ecological landscape design. International Journal of Environmental Science and Technology. 2023;20(11):11931-42.

[21] Hashim N. Reversing food desertification: examining urban farming in Louisville, Chicago and Detroit. Local Environment. 2014;20(6):611-36.

[22] Li H, Xu M, Li J, Li Z, Wang Z, Zhuang W, et al. Spatial Distribution Characteristics of Japan's Forest Therapy Bases and Their Influencing Factors. Sustainability. 2022;14(22).

[23] Gao J, Lu Y, Chen Z, Wang L, Zhou J. Land-use change from cropland to orchard leads to high nitrate accumulation in the soils of a small catchment. Land Degradation & Development. 2019;30(17):2150-61.

[24] Havu M, Kulmala L, Lee HS, Saranko O, Soininen J, Ahongshangbam J, et al. CO2 uptake of urban vegetation in a warming Nordic city. Urban Forestry & Urban Greening. 2024;94.

[25] Ho S-T, Gonzalez Nieto L, Rickard BJ, Reig G, Lordan J, Lawrence BT, et al. Effects of cultivar, planting density and rootstock on long-term economic performance of apple orchards in the Northeastern U.S. Scientia Horticulturae. 2024;332.

[26] Oliveira PTS, Leite MB, Mattos T, Nearing MA, Scott RL, de Oliveira Xavier R, et al. Groundwater recharge decrease with increased vegetation density in the Brazilian cerrado. Ecohydrology. 2016;10(1).