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The Impact of Restoration and Protection Based on Sustainable Development Goals on Urban Wetland Health: A Case of Yinchuan Plain Urban Wetland Ecosystem, Ningxia, China

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Abstract: Drawing heavily upon the Sustainable Development Goals (SDGs), an SDG–pressure–state–response (PSR)–ecological–economic–social (EES) model and an index system for wetland ecosystem health assessment were constructed from the three dimensions of environment, economy, and society. By using the Yinchuan Plain urban wetlands in the Yellow River Basin of China as a case study, their ecological health status from 2000 to 2020 was systematically evaluated by integrating information from remote sensing technology, geographic information technology, field sampling, information entropy (IE), a landscape index, and a Comprehensive Evaluation Index. The results show that the restoration and protection of wetland ecosystems have achieved remarkable results in the Yinchuan Plain. The wetland ecological health index has significantly increased from 0.26 to 0.67, which is an increase of 157.7%, and the health level increased from poor (II) to sub-healthy (IV). Factors restricting the healthy development of wetland ecology in the Yinchuan Plain include wetland construction, investment, population density, the number of tourists, and fertilizer use. The research results show that the wetland restoration and protection have achieved specific environmental, economic, and social results in the Yinchuan Plain. However, we also need to pay attention to increasing the investment in wetland environmental governance, strictly controlling the intensity of land use and the total amount of chemical fertilizer applied in various regions, scientifically carrying out wetland restoration and protection, reasonably coordinating the relationship between environment and society, and providing technical and decision-making support for wetland management and protection. This study provides a reference for the ecological governance and sustainable development of wetlands in large river basins worldwide.

Keywords: urban wetlands; ecological health; SDGs-PSR-EES model; obstacle degree model; restoration and conservation project

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1. Introduction

Wetlands, the "kidneys" of the earth, provide a unique habitat for many endangered plants and animals. They are one of the world's most productive ecosystems and offer a variety of functions, including water purification, climate regulation, biodiversity conservation, and carbon sequestration [1]. With continuous economic development comes a growing contradiction between the increasing demand for human development and natural resources, leading to serious damage to wetland ecosystems and triggering ecological and

environmental problems, such as wetland degradation and disappearance. As a wetland restoration and protection tool, wetland health assessments have become an important focus of current research. Wetland ecosystem health assessments are the primary means of assessing the status of the regional ecological environment as it relates to wetlands. It can objectively reflect the overall characteristics of an ecosystem and indicate the health status of all ecosystems to provide strategies for wetland restoration and the implementation of appropriate measures that promote the sustainable use of wetlands and associated resources, which is of great significance for regional, ecological, and environmental protection, and economic development. In September 2015, the United Nations proposed Sustainable Development Goals (SDGs) in the 2030 Agenda for Sustainable Development, 17 of which were included in China's implementation of the 2030 Agenda for Sustainable Development Innovation Demonstration Zone Construction Program [2]. Wetland ecosystem health is an extension of sustainable development [3], in line with the global sustainable development path. Therefore, a comprehensive and objective evaluation of the health of wetland ecosystems based on the SDGs is of great scientific significance, both for wetland protection management and sustainable development [4].

Many studies have been conducted on ecosystem health assessment in China and abroad, including the sustainable development of certain regions [5–8] and wetland ecological protection [9,10], which can provide a reference for the health and development of wetland ecosystems. Ecological health assessments have been discussed from several different perspectives, but mainly as they apply to cities [11–13], lands [14,15], rivers [16,17], and wetlands [18–20]. The analysis process has primarily focused on soil [21] and groundwater [22,23], other elements, and so on [24,25]. The ecosystem health evaluation is typically carried out by determining the index weight [26–29] and using an evaluation model. The evaluation models have used a variety of approaches. In the 1990s, OECD (Organization for Economic Cooperation and Development) and UNEP (United Nations Environment Programme) established a causality-based pressure–state–response (PSR) model that reflected the interaction between people and land, in which humans exert pressure on the environment to cause changes and take actions and decisions in response to environmental changes, thereby preventing environmental degradation or restoring environmental health. However, the model ignores the internal interactions of each subsystem, and the selection of indicators is subjective [30–32]. Other models used have included the drivers–pressures–state–impact–response (DPSIR) model [33–35], and the ecological–economic–social (EES) model [36]. The EES multi-attribute collaborative model, with natural, economic, and social characteristics, is a complex environment–economy–society system widely used in ecological, psychological, economic, and other fields. However, this model lacks a causal relationship between systems. One of the most popular wetland ecosystem health assessment methods is the three-layer wetland evaluation method proposed by the US Environmental Protection Agency [37]. This method has been widely used in American wetland monitoring and assessments. Karr [38], Cairns [39], and Connor [40] evaluated the health of wetland ecosystems using different ecological indicators. Some researchers [41] used the ecosystem environment, biological community indicators, and ecological functions as evaluation indicators to construct an ecosystem health evaluation system. In addition, some studies [42] introduced socioeconomic indicators such as population density, cultural quality, and regional per capita GDP to evaluate the regional ecosystem health evaluation system. These studies further enriched the wetland ecosystem health evaluation system; however, the evaluation did not consider the soil pH, water quality index, nitrogen, phosphorus, and organic carbon. The variation in these indicators and their interactions with ecological factors play an important role in wetland ecosystems and are early warning indicators of wetland soil and water system changes. However, they are rarely used for wetland ecosystem health assessments. In addition, indicators based on development goals have not been fully integrated into the assessments.

Drawing upon the above literature, although SDGs, PSR, and EES were widely used in ecological environment evaluation, few studies have comprehensively evaluated wetland

ecosystem health based on a combined SDG–PSR–EES coupling model. The Yinchuan Plain in the Yellow River basin of China was used as a case study. Considering the SDGs, we constructed an SDG-PSR-EES coupling model based on the three aspects of pressure–state–response economic development, ecological environment, and social security. The Comprehensive Evaluation Index (CEI) method was used to evaluate the sustainable ecological health development of lake wetlands in key cities in the study area from 2000 to 2020. This study analyzes wetland health and sustainable development's spatial and temporal evolution characteristics and applies Information Entropy (IE) theory to determine index weights. The crucial factors hindering the sustainable development of wetlands were identified through obstacle factor diagnosis and used to explore new directions for improving wetland health and sustainable development. It provides theoretical support for ecological protection and high-quality development in the Yellow River basin and also provides a reference for wetland ecological management and sustainable development in the world's major river basins.

2. Materials and Methods

2.1. Study Area

The Yinchuan Plain (105°51′–106°54′ E, 37°41′–39°23′ N) is located in the dry zone of northwestern China and has a temperate continental climate, with year-round drought and little rain, long winters and short summers, a frost-free period of about 160 days, average annual precipitation of less than 200 mm, average evaporation of about 1800 mm, and a drought index of about 10 [43], as shown in Figure 1. Since 2000, it has become the earliest developed irrigation area in northwest China. It is the area with the largest and most concentrated distribution of wetland lakes in the dry zone of Ningxia in the Yellow River Basin, known as the "seventy-two consecutive lakes".

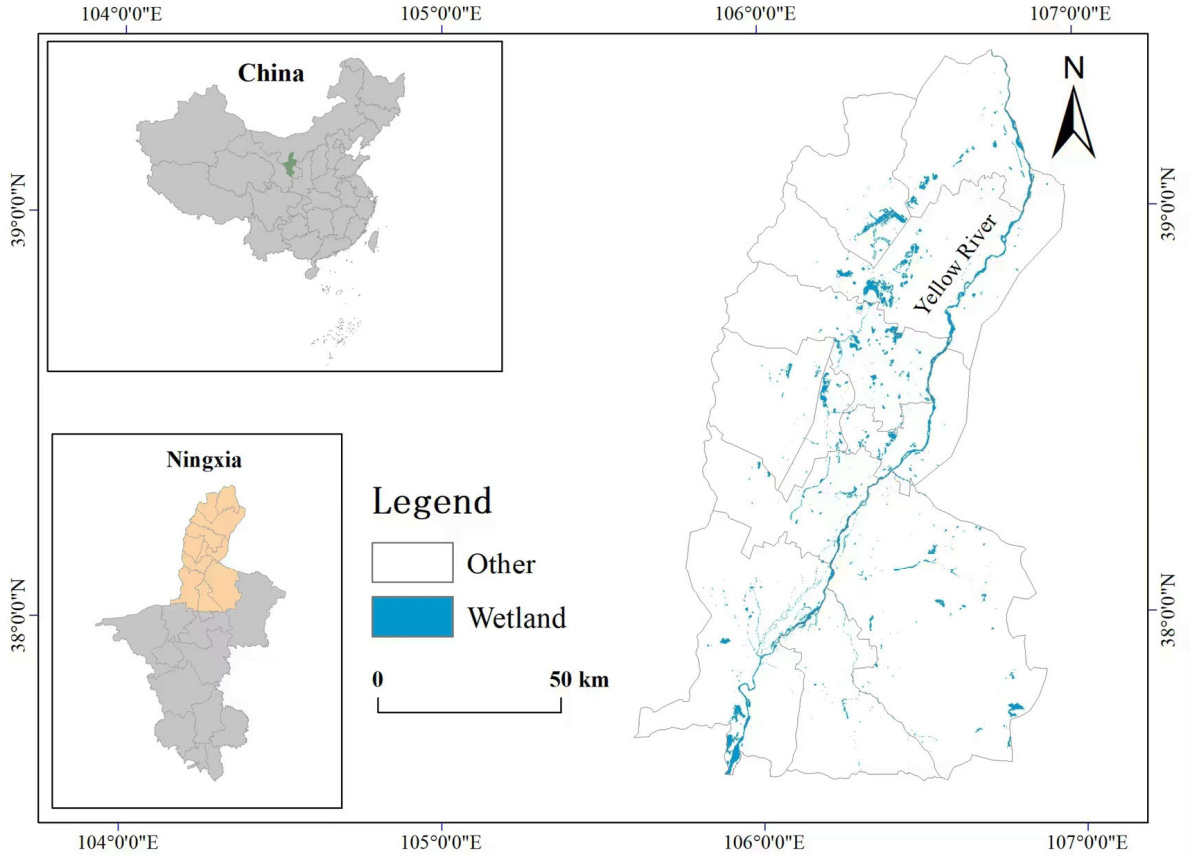

Figure 1. Location map of the Yinchuan Plain, Ningxia, China.

Since 2002, Ningxia has strengthened the protection and restoration of wetlands in Yinchuan Plain and implemented measures such as returning farmland to lakes for water storage, returning farmland to lakes, and dredging lakes and waterways. In 2006, the first batch of five wetland restoration demonstration areas and many wetland protection communities transformed and protected the wetland water level, wetland vegetation restoration, and ecological and environmental remediation in Ningxia. In 2008, to protect wetland resources, it listed the establishment of a wetland ecological red line, strengthening planning and construction as key work, and a wetland bird conservation observation station was established. In 2010, the second wetland resource survey organized and mastered the protection and utilization of wetland plant resources, animal resources, and key survey wetlands. Later in 2015, the monitoring and distribution areas of important lakes and wetlands were determined, and wetland water resources and the natural environment were investigated and monitored. Up to now, it has been realized that the Ayi River connects significant lakes, such as the West Lake, and other water system connecting projects have transformed and protected dozens of urban lake wetlands, such as Mingcui Lake, Yuehai Lake, and Xinghai Lake, building more than ten lake and wetland ecotopes in Yinchuan Plain.

2.2. Data Sources

The data required for this study consisted mainly of statistical and remote sensing data. The specific sources were as follows:

(1) Statistical data: Data on average temperature, population density, GDP, total number of tourists received, wetland construction input, and fertilizer use intensity were mainly from the Ningxia Statistical Yearbook of 2001, 2011, and 2021, and related statistical data. Data on the total phosphorus (TP), total nitrogen (TN), chemical oxygen demand (COD), and pH in the waterbodies were sourced from the Ningxia Water Resources Statistical Bulletin for 2000, 2010, and 2020, experimental data, and relevant literature.

(2) Remote sensing data: The land use data of Ningxia in 2000, 2010, and 2020 were obtained from the GlobeLand 30 (Global Geographic Information Public Product) platform, and based on Landsat8 OLI data, the images were preprocessed with ArcGIS software for cropping and projection, and the areas of various land use types were extracted, as applied to the Yinchuan Plain. The landscape diversity index, wetland area, land use intensity, and landscape fragmentation index were calculated [31], as shown in Figure 2.

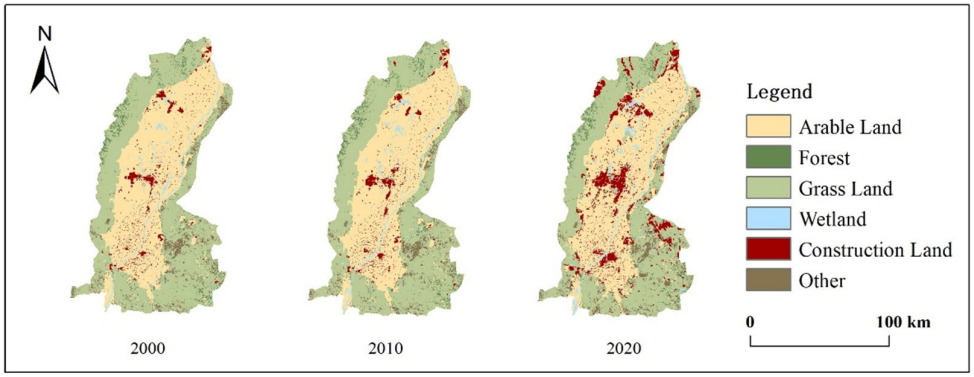

Figure 2. Map of land use types of the Yinchuan Plain, Ningxia, China.

2.3. Construction of Evaluation Model and Index System

2.3.1. Evaluation Model

In the 1990s, OECD (Organization for Economic Cooperation and Development) and UNEP (United Nations Environment Programme) established a causality-based pres-sure–state–response (PSR) model, reflecting the interaction between people and land, in which

humans exert a certain pressure on the environment to cause changes in the environment and take actions and decisions in response to the changes in the environment, thereby preventing environmental degradation or restoring environmental health. However, the model ignores the internal interaction of each subsystem, and the selection of indicators is subjective. The EES multiattribute collaborative model, with natural, economic, and social characteristics, is an environment–economy–society complex system widely used in ecology, psychology, economics, and so on. Nevertheless, this model lacks a causal relationship between systems. Adhering to the perspective of environmental protection and the sustainable development of wetlands in the Yinchuan Plain, Ningxia, and Yellow River Basin, China, this study followed the principles of representativeness and integrity. We integrate the advantages of the PSR and EES models to build the SDG-PSR-EES model and determine the theoretical framework of the wetland ecosystem evaluation indicator system, as shown in Figure 3. Based on the pressure–state–response standard layer, the model selects indicators from the three levels of the environment, economy, and society, effectively controlling the subjectivity of the artificial selection of indicators and reflecting the internal analysis of pressure, state, and response indicators.

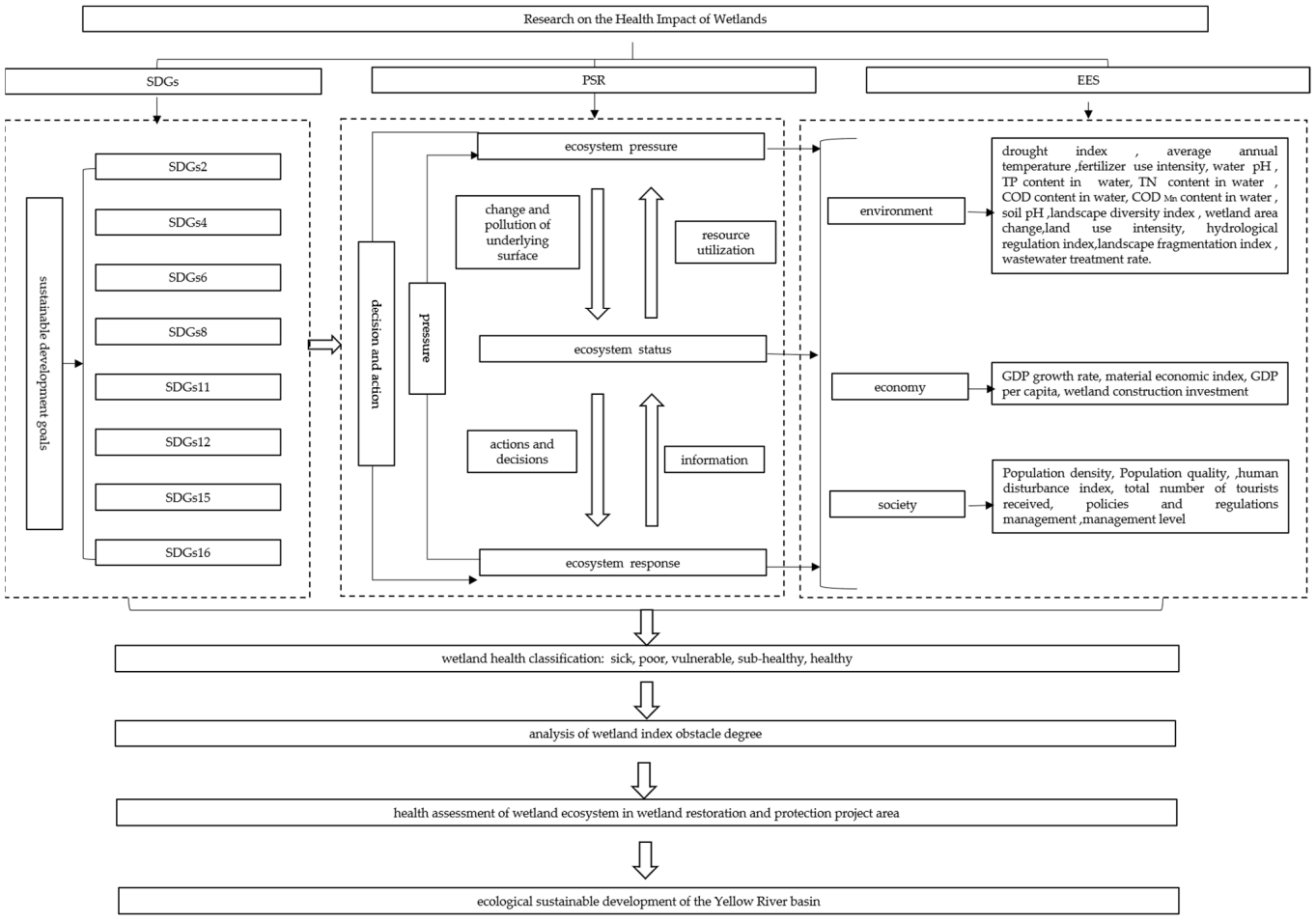

Figure 3. SDG-PSR-EES framework model. Note: SDG 2 ensures the elimination of hunger, food security, balanced nutrition, and sustained and successful agricultural development. SDG 4 ensures equitable education and inclusive opportunities for lifelong learning. SDG 6 ensures safe drinking water and sanitation. SDG 8 ensures a sustainable economy and employment. SDG 11 builds harmonious development of people and cities. SDG 12 ensures sustainable consumption and production patterns. SDG 15 protects terrestrial ecosystems, prevents desertification, curbs soil degradation, and protects biodiversity. SDG 16 builds inclusive, harmonious, and sustainable social environments.

2.3.2. Construction of Evaluation Index System

According to the SDG-PSR-EES model that was established, with 17 targets and 169 subtargets contained in the SDGs as the core, 25 indicators were selected based on the integrality, systematicity, and representativeness of the health impact factors of the wetland ecosystem in the Yinchuan Plain of Ningxia in the Yellow River Basin, and the accessibility and operability of the indicator data. The indicators are shown in Table 1.

Table 1. The theoretical framework of urban wetland ecosystem health assessment.

Target Layer	Criterion Layer	Factor Layer	Indicator Layer	Indicator Source	Indicator Attribute	Indicator Explanation
Health assessment of urban wetlands ecosystem in Yinchuan Plain	Pressure A1	Environment B1	Drought index C1	SDG 15.1	Negative	The index of drought degree refers to the region's rainfall to evaporation ratio.
			Average annual temperature C2	SDG 15.2	Negative	The arithmetic mean of the average daily temperature for the whole year.
			Fertilizer application intensity C3	SDG 2.3	Negative	The degree of non-point source pollution caused by human activities to lakes and wetlands.
		Economy B2	GDP increase rate C4	SDG 8.1	Positive	The economic development level of the region.
		Society B3	Population density C5	SDG 11.3	Negative	Refers to the number of people living per unit land area, indicating the population density in Yinchuan Plain. Calculation formula: $P = N/A$ (P: Population density, N: Population of Yinchuan Plain, A: Yinchuan Plain wetland area)
			Population quality C6	SDG 4.1	Positive	The stress level of lakes and wetlands was reflected by the population's quality around Yinchuan Plain, which was measured by the percentage of the social population with a high school education or above in the total population around the plain.
			Human disturbance index C7	SDG 11.2	Negative	Refers to the impact of human production, living, and other activities on the environment and ecosystem. Calculation formula: $R = (E + F)/A \times 100\%$ (R: Human disturbance index, E: Dry land area, F: Urban residential land area, A: Total study area.)

Table 1. *Cont.*

Target Layer	Criterion Layer	Factor Layer	Indicator Layer	Indicator Source	Indicator Attribute	Indicator Explanation
Health assessment of urban wetlands ecosystem in Yinchuan Plain	State A2	Environment B1	Water pH C8	SDG 12.1	—	The waterbody pH, as shown in Table 2 in the national Surface Water Environmental Quality Standards.
			TP content in water C9	SDG 12.1	Negative	The total phosphorus content of wetland water.
			TN content in water C10	SDG 12.1	Negative	The total nitrogen content of wetland water.
			COD content in water C11	SDG 12.1	Negative	The water oxygen demand of wetland.
			COD_{Mn} content in water C12	SDG 12.1	Negative	The permanganate index of wetland water.
			Soil pH C13	SDG 12.1	—	The pH of the soil.
			Landscape diversity index C14	SDG 15.2	Positive	Represents an index used to measure the complexity of an ecosystem's structural composition. Calculation formula: $H = -\sum_{i=1}^{m}(P_i \times log_2 P_i)$ (P_i: The proportion of area occupied by Class i landscape types, m: The number of landscape types.)
			Wetland area change C15	SDG 15.2	Positive	The pattern of wetland area change.
			Land use intensity C16	SDG 8.2	Negative	The intensity index of land use of wetlands, forest land, cropland, grassland, and construction land in Yinchuan Plain. Calculation formula: $P = ((N + J))/N$(N: agricultural land area, J: construction land area, N: total area of wetlands in Yinchuan).
		Economy B2	Material economy index C17	SDG 8.1	Positive	Evaluates the level of wetland's economic production function and the degree of socioeconomic development.
		Society B3	Total number of visitors C18	SDG 8.4	Negative	Measures the change in the number of tourists in the Yinchuan Plain.

Table 1. *Cont.*

Target Layer	Criterion Layer	Factor Layer	Indicator Layer	Indicator Source	Indicator Attribute	Indicator Explanation
Health assessment of urban wetlands ecosystem in Yinchuan Plain	Response A3	Environment B1	Hydrological regulation index C19	SDG 6.5	Positive	One of the important functions of the wetland ecosystem, Hydrological regulation index = (river area + beach area)/total wetland area.
			Landscape fragmentation index C20	SDG 15.2	Negative	Expresses the number of landscape patches as an index of the degree of disturbance to that ecosystem. Calculation formula: $PD = \frac{\sum N_i}{\sum A_i}$ (PD: Patch density, $\sum N_i$: Total number of landscape patches in Yinchuan Plain or total number of patches of a landscape element patch type, $\sum A_i$: Total area of wetlands in the Yinchuan Plain.)
			Wastewater treatment rate C21	SDG 6.2	Positive	Represents the attainment of wastewater treatment standards in the Yinchuan Plain Wetland.
		Economy B2	GDP per capita C22	SDG 8.1	Positive	The ratio of the gross product achieved in the Yinchuan Plain to the resident population belongs to the accounting period.
			Wetland construction input C23	SDG 15.1	Positive	Represents the government's investment in wetland restoration and protection.
		Society B3	Management of policies and regulations C24	SDG 16.3	Positive	Represents the development and implementation of regulations for wetlands in the Yinchuan Plain.
			Management level C25	SDG 16.3	Positive	Indicates the level of management for the wetlands of the Yinchuan Plain.

Table 2. Surface Water Environmental Quality Standard Basic Item Standard Limit (in mg/L) [44].

Number	Evaluation Factors	Grading Standards				
		I	II	III	IV	V
1	Chemical oxygen demand (COD)	≤15	15	20	30	40
2	Total nitrogen (TN)	≤0.2	0.5	1.0	1.5	2.0
3	Total phosphorus (TP)	≤0.01	0.025	0.05	0.1	0.2
4	Permanganate index (COD_{Mn})	≤2	4	6	10	15

2.3.3. Determination of Index Weights

This study determined each weight using the Information Entropy (IE) weight method, as shown in Figure 4. The entropy weight method is an objective assignment method that reflects the information implied by indicator data. The smaller the entropy, the greater the

entropy weight, indicating a more significant variability of the indicators. Conversely, the greater the entropy of the indicator, the smaller the entropy weight. The calculation steps are as follows. Construct n samples of m evaluation indicators with a judgment matrix of $R = (x_{ji})_{n \times m}$.

Normalize R to obtain the normalized judgment matrix B with the following expression:

$$b_{ji} = \frac{x_{ji} - x_{min}}{x_{max} - x_{min}} \quad (1)$$

For n samples of m evaluation indicators, the entropy of each indicator can be determined as follows:

$$H_i = \frac{1}{lnn}\left(\sum_{j=1}^{n} f_{ji} ln f_{ji}\right) \quad (2)$$

The degree of dispersion of the evaluation data of the ith indicator can be expressed as $1 - H_i$. The greater the difference between the original indicators x_i, x_{ji} the greater the $1 - H_i$ value; therefore, the greater the amount of information transmitted by the indicator, the higher its importance and vice versa. If the samples are equal, the indicator evaluation value is concentrated, and its role in the comprehensive evaluation is small. f is the degree of satisfaction in different samples under the same indicator (the smaller or larger its degree is too high), and the formula for calculating f is as follows:

$$f_{ji} = \frac{1 + b_{ji}}{\sum_{j=1}^{n}(1 + b_{ji})} \quad (3)$$

The entropy weight of the evaluation index was calculated as follows:

$$w_i = \frac{1 - H_i}{m - \sum_{i=1}^{m} H_i} \quad (4)$$

where $\sum_{i=1}^{m} w_i = 1$.

2.3.4. Evaluation Index Classification Standards

Based on the relevant content of the evaluation of urban wetland ecosystem health study and references [45], the Comprehensive Evaluation Index (CEI) was used to quantitatively evaluate the indicators and characterize the health status of the urban wetland ecosystem in the Yinchuan Plain, taking values between 0 and 1, with a value of 0 reflecting the worst health status and 1 indicating the best health status. It is divided into five grades (healthy, sub-healthy, vulnerable, poor, and sick), and the grading standards of each evaluation index are determined as shown in Table 3. The formula is as follows:

$$CEI = \sum(I_i \times W_i) \quad (5)$$

where CEI is the comprehensive evaluation index, I_i is the normalized value of the individual indices, and W_i is the normalized weight of the evaluation index.

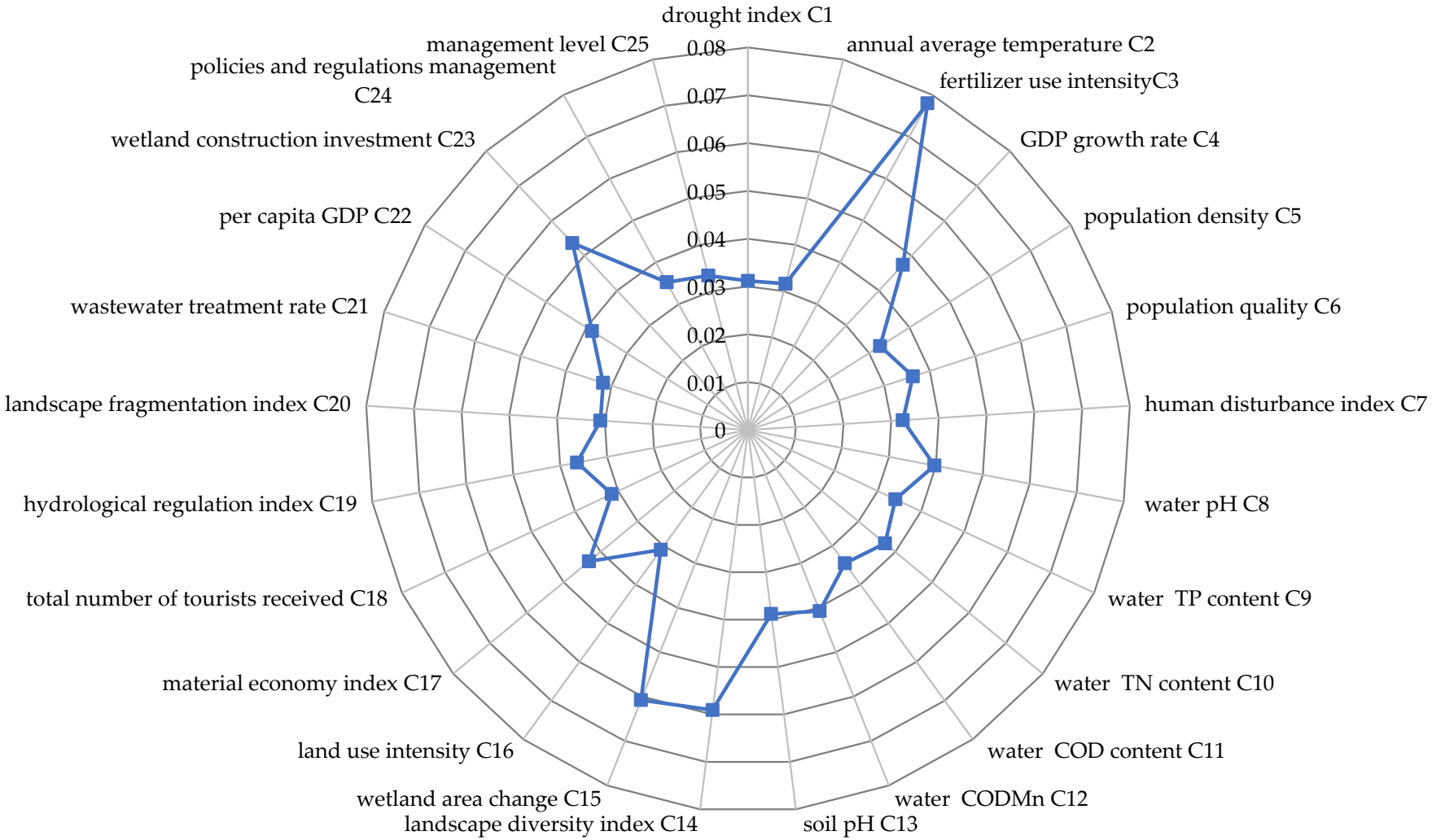

Figure 4. Radar map of index weights for evaluating urban wetland ecosystem health in Yinchuan Plain, Ningxia, China.

Table 3. Wetland ecological health grade classification and evaluation standards.

Comprehensive Health Index (CHI)	Health Status	Status Description
I [0~0.2)	Sick	Wetland ecosystem health is relatively feeble, wetland pressure is high, wetland area is highly variable, lake wetland panels are severely fragmented, and wetland ecosystems have seriously deteriorated.
II [0.2~0.4)	Poor	Wetland ecosystem health is relatively poor, external pressures are high, and wetland changes are relatively high.
III [0.4~0.6)	Vulnerable	Wetland ecosystem health is relatively average, external pressures are high, a few ecological anomalies occur, and the lake ecosystem is maintainable.
IV [0.6~0.8)	Sub-healthy	Wetland ecosystem health is relatively good, external pressure is relatively small, wetland changes are relatively small, the system is relatively stable, and the lake wetland ecosystem is sustainable.
V [0.8~1.0)	Healthy	Wetland ecosystem is in good health, no ecological abnormalities occur, external pressure is shallow, the lake wetland area changes little, and the system is stable and sustainable.

The integrated health index formula for the stress, state, and response of the Yinchuan Plain wetland ecosystem is as follows:

$$PEI = \sum(I_i \times W_i)/W_p \quad (6)$$

$$SEI = \sum(I_i \times W_i)/W_s \quad (7)$$

$$REI = \sum(I_i \times W_i)/W_R \quad (8)$$

where PEI, SEI, and REI are the health indices of pressure, state, and response, respectively. i is the number of evaluation indicators for each system. W_i is the normalized weight of indicator i. I_i is the normalized value of evaluation indicator i. W_p, W_s, W_r are the weights of the pressure, state, and response indicators, respectively.

2.3.5. Construction of Obstacle Degree Model

The obstacle degree of each evaluation index in the evaluation of the ecological health of the Yinchuan Plain wetlands was calculated using the obstacle degree model, which enables an analysis of the determinants limiting the healthy development of the Yinchuan Plain wetlands and is calculated as follows:

$$Q_{ij} = \frac{(1 - P_{ij}) * W_j}{\sum_{j=1}^{n}(1 - P_{ij}) * W_j} * 100 \quad (9)$$

$$Q_i = \sum Q_{ij} \quad (10)$$

where Q_{ij} denotes the obstacle degree of a single indicator for ecological safety, P_{ij} is the standardized value of the jth indicator in the ith year, n is the number of indicators, W_j is the combined weight, and Q_i is the obstacle degree of the jth standard layer for ecological safety.

3. Results and Analysis

3.1. Overall Evaluation of the Ecosystem Health of Urban Wetlands in Yinchuan Plain

From 2000 to 2020, urban wetlands' overall ecological health index showed a steady upward trend in the Yinchuan Plain, as shown in Figure 5. Its health level increased from sick to sub-healthy, indicating that the ecological health of urban wetlands in the Yinchuan

Plain has improved significantly over the past two decades, and wetland restoration, protection, and repair efforts have been practical.

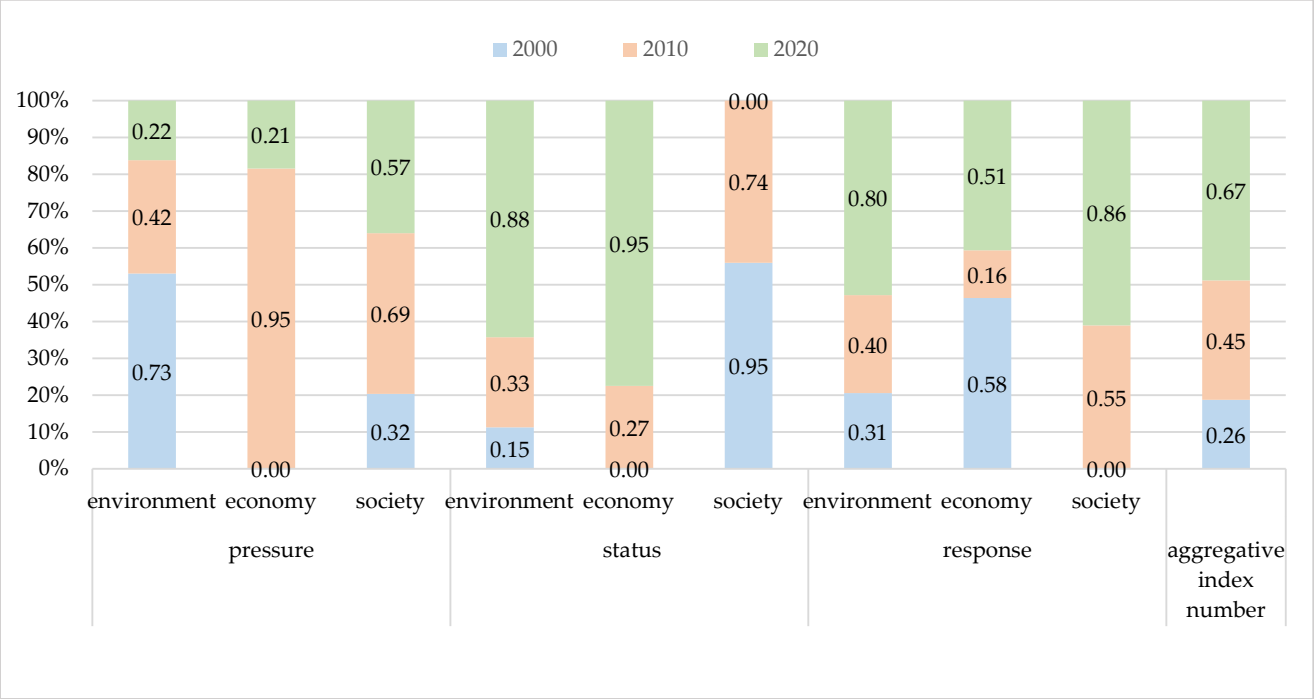

Figure 5. Changes in the composite health index of urban wetlands in Yinchuan Plain.

From 2000 to 2010, the stress index level increased from vulnerable to sub-healthy, the status index increased from sick to poor, and the response index maintained a pathological level. From 2010 to 2020, the stress index decreased from sub-healthy to pathological, and the status and response indices increased to healthy levels.

(1) Stress analysis

From 2000 to 2020, the pressure index showed a trend of first rising and then falling, the health index increased from 0.31 to 0.44 and then fell to 0.35, and the health level rose to vulnerable in 2010. The environmental pressure health grade decreased, whereas the social health index increased from 0.33 to 0.58. Among the indicator layers, fertilizer use intensity and population density accounted for the tremendous weight. During 2000–2010, fertilizer use intensity increased significantly, and human interference decreased continuously. During 2010–2020, the total agricultural pollution emission of nitrogen decreased from 14,700 tons to 5400 tons per year, and the total amount of fertilizer use increased by only 0.93 kg/hm^2. However, increasing population density increased the human interference index in the Yinchuan Plain. The GDP growth rate decreased in 2020 owing to the complex and severe domestic and foreign environments and the profound impact of the COVID-19 pandemic. Article 11 of the SDGs states that the coordinated development of human beings and cities should be constructed. Sustainable development goals should be established for urban development, considering economic development and ecological protection. To move toward the goal of sustainable development for the wetlands in the Yinchuan Plain, we should vigorously strengthen the restoration and reconstruction of wetlands, strengthen the establishment of wetland protection laws and regulations, clarify the responsibilities and obligations that come with wetland protection, strive for a social consensus on the best ways to achieve sustainable and enhanced wetland protection, and improve the public's awareness of wetland protection and sustainable development.

(2) State analysis

From 2000 to 2020, the state index increased significantly, the health index increased from 0.13 to 0.83, and the health grade increased from sick to healthy. The environmental health index increased from 0.15 to 0.88. The economic index increased from 0 to 0.95, the health grade changed from sick to healthy, and the social index decreased significantly from 0.95 to 0. Among the index layers, the changes in urban wetlands area and landscape diversity index have the greatest weight. The material economy index increased significantly, the number of tourists received gradually increased, the wetland area increased from 586.18 km^2 to 1407.4 km^2, and there has been an overall decrease in the concentration of pollutants in waterbodies. It shows that, in recent years, the authorities governing Yinchuan Plain in Ningxia have strived to adhere to the ideal of ecological civilization and harmonious coexistence between man and nature in implementing wetland restoration and protection projects. They have continued implementing major projects for protecting and restoring important wetland ecosystems, including precise and scientific pollution control methods, acting within the law, and have achieved remarkable results.

(3) Response analysis

From 2000 to 2020, the response index increased, and the health index rose from 0.33 to 0.83. The health grade changed from sick to healthy, indicating that the government's investment in urban wetland construction and comprehensive management was significant. Environmental indicators had the highest weighting in the Yinchuan Plain over the past ten years. The health index of environmental indicators increased from 0.31 to 0.80, and the health level changed from sick to healthy, with the highest weight of the hydrological regulation index in the past 20 years. During 2000–2010, the health index of economic indicators showed a decreasing trend from 0.58 to 0.16, and the health status changed from vulnerable to sick. From 2010 to 2020, it showed an increasing trend from 0.16 to 0.51, and the health status changed from sick to vulnerable, with the highest weight for constructing wetland inputs. The social indicator health index increased the most from 0 to 0.86 during the two decades, and its health status changed from sick to healthy. The factor with the highest weight in the response index was the wetland construction input weight of 0.0536, which had the greatest impact on the health evaluation results of the response index. The response indicators were ranked in the following order of weight: C23 > C22 > C19 > C24 > C25 > C21 > C20. These findings show that the Ningxia government has strengthened its awareness of wetland construction, increased investment in wetland construction, and improved the ecological function of wetlands in the past two decades. The annual increase in the hydrological regulation index and wastewater treatment rate shows that the relevant departments attach great importance to the protection and restoration of wetlands, have increased wetland areas while protecting them, and have responded positively to the sustainable development of wetlands.

3.2. Obstacle Degree Analysis of Yinchuan Plain Indicator Layers

The obstacle degree model was used to calculate the obstacle degrees of each indicator and element layer in the Yinchuan Plain from 2000 to 2020, as shown in Table 4.

From 2000 to 2020, the obstacle degree change in each index layer was analyzed concerning time in Table 4. The obstacle degree of fertilizer use intensity obstacle degree, the total number of tourists received, and wetland construction input gradually increased, among which the obstacle degree of fertilizer use intensity changed the most, from 0.001 to 24.942 in 2000–2020, which had a more significant impact on the ecological health of urban wetlands. However, the drought index, population quality, waterbody TN content, waterbody COD content, waterbody permanganate index, material economy index, hydrological regulation index, wastewater treatment rate, per capita GDP, policy and regulation management efforts, and management level obstacle degrees have decreased significantly over the past two decades.

Table 4. Analysis of the obstacle degree of urban wetland in Yinchuan Plain ecological health evaluation index layer.

Target Layer	Guideline Layer	Indicator Layer	2000	2010	2020
Evaluation of wetland ecosystem health in Yinchuan Plain	A1	C1	4.512	0.835	0.001
		C2	1.063	0.001	10.107
		C3	0.001	13.526	24.942
		C4	6.850	0.001	11.726
		C5	0.000	2.058	10.475
		C6	5.249	3.454	0.001
		C7	4.696	0.001	3.461
	A2	C8	3.677	6.995	0.001
		C9	4.931	0.001	4.846
		C10	5.387	3.755	0.001
		C11	4.990	2.827	0.001
		C12	5.897	4.764	0.001
		C13	3.463	6.832	0.001
		C14	8.546	9.253	0.002
		C15	8.792	9.649	0.002
		C16	0.337	0.001	9.915
		C17	6.240	5.391	0.001
		C18	0.000	1.178	10.069
	A3	C19	5.263	3.486	0.001
		C20	0.000	5.448	0.001
		C21	4.606	1.498	0.001
		C22	5.583	4.158	0.001
		C23	0.001	9.444	14.479
		C24	5.099	3.104	0.001
		C25	4.823	2.348	0.001

In 2000, the obstacle factors that had less impact on the health of wetlands mainly included C3 fertilizer use intensity in the Yinchuan Plain, the total number of tourists received, and the landscape fragmentation index. More obstacle factors had a greater impact on the health of wetlands, including GDP growth rate, landscape diversity index, and C15 wetland area change. Before wetland restoration and protection measures were implemented, more factors affected the wetlands' health. Greater obstacle factors exist at the social, environmental, and economic levels. By 2010, fertilizer use intensity had become one of the main obstacle factors affecting wetlands after being one of the least influential factors in 2000. Its obstacle degree reached 13.526, while the GDP growth rate, human disturbance index, and waterbody TP content gradually decreased in ranking obstacle factors. In 2020, based on the obstacle degree indicators, there were 16 indicators with an obstacle degree of less than 1. However, fertilizer use intensity is still the main obstacle degree factor, and its obstacle degree has significantly increased compared to 2010. In addition, the obstacles included the average annual temperature, the GDP growth rate in 2020, the total number of tourists received, land use intensity, population density, and wetland construction input.

4. Discussion

The health assessment of urban wetland ecosystems is to assess the wetland ecosystem as a whole [46,47]. It reflects the integrity of the wetland ecosystem's physical, chemical, and ecological functions, the health of the urban wetland ecosystem, and its impact on human well-being [48,49]. This study systematically evaluated the ecological health from the three aspects of economic development, ecological environment, and social security of wetlands from the perspective of sustainable development goals in the Yinchuan Plain, regarding wetlands as an organic whole. It has comprehensively analyzed the interrelation-

ships of various indicators of the ecosystem in the Yinchuan Plain. This system avoided the one-sided nature of a single factor. The index model of this study was developed based on previous studies [33,35,49–51], and an SDG–PSR–EES coupling model was established. This model set three elements within the pressure, state, and response indicators: the environment, economy, and society. This model establishes three element layers of environment, economy, and society within the pressure, state, and response indicators, and the indicators are derived from the sustainable development goals. Thus, the evaluation system combines measured data, statistical data, and previous research results to establish a more comprehensive evaluation index system for urban wetlands in the Yinchuan Plain. In this study, the entropy weight method was used to determine the index weight, the comprehensive evaluation index model was used to calculate the ecological health index of Yinchuan Plain, and the ecological health of the study area from 2000 to 2020 was graded. Finally, the obstacle degree model was used to calculate the obstacle degree of each evaluation index in the ecological health assessment of the Yinchuan Plain. In the research process, it was found that the entropy weight method [26], comprehensive evaluation index model [52,53], and obstacle degree model [54,55] were widely used in international wetland ecological health assessment and other related fields [56–58], indicating that the data processing and application methods of are reliable and effective and can systematically reflect wetland ecological health status, which is suitable for the health assessment of wetland ecological restoration and protection in the world's major river basins and also applicable to the related fields of ecological health assessment.

The results showed that the wetland protection project had achieved remarkable results in the Yinchuan Plain over the past two decades. From 2000 to 2020, the health index increased from 0.26 to 0.67, and the health level increased from poor (II) to sub-healthy (IV). The main factors restricting the healthy development of wetland ecology in the Yinchuan Plain are wetland construction, investment in restoration and protection, population density, the number of tourists, and fertilizer use. The results of other studies on the Yinchuan Plain wetland health evaluation were cross-validated to verify the accuracy and validity of the results of the Yinchuan Plain. Mingcui Lake National Wetland Park and Yuehai National Wetland Park reflect the health status of the Yinchuan Plain to a certain extent. LifangYang et al. [25] determined the health level of the Mingcui Lake wetland ecosystem by calculating a comprehensive index of ecosystem health and using a five-point grading system (diseased, unhealthy, sub-healthy, healthy, and very healthy). The results showed that the Mingcui Lake ecosystem was sub-healthy. Lifang et al.'s research results are consistent with the results of this study. Mingye Zhang et al. [24] extracted 13 evaluation indices from five aspects of the water environment, soil, biology, landscape, and society to construct a health evaluation system for wetland ecosystems and evaluated the health status of the Yuehai National Wetland Park ecosystem. The results showed that the comprehensive health index of the Yuehai National Wetland Park ecosystem was 3.893, showing a moderate health level, which supports the authenticity and effectiveness of the results of this study. Relevant departments should continue to implement major projects for the restoration and protection of important wetland ecosystems, continuously promote the ecological protection and high-quality development of the Yellow River Basin, adhere to scientific planning, adjust measures to local conditions, strictly implement the "Wetland Protection Regulations" of the autonomous region, and constantly accelerate the legal process of wetland protection and management. Together, these measures will contribute to the ecological management and high-quality, sustainable development of the Yinchuan Plain Basin wetlands in one of the world's major rivers. Therefore, the SDGs PSR-EES coupling model, evaluation index system, and research methods based on the sustainable development goals and comprehensive economic development, ecological environment, and social security are universal. It is suitable for the health assessment of wetland ecological restoration and protection in the world's major river basins, and also applicable to the related fields of ecological health assessment.

This study does not consider the health assessment of heavy money indicators. In the future, we should comprehensively consider all factors affecting the ecological health of wetlands, build a more scientific and reasonable evaluation index system, and evaluate the ecological health of wetlands.

5. Conclusions

(1) Based on development goals, the SDG-PSR-EES coupling model and evaluation index system constructed from the three aspects of economic development, ecological environment, and social security offers universal utility. It is suitable for the health assessment of wetland ecological restoration and protection in large river basins worldwide. It is also applicable to fields related to ecological health assessment.

(2) In the past two decades, the ecological health index of urban wetlands has increased significantly in the Yinchuan Plain of the Yellow River Basin in China. The health level has risen from poor (II) to sub-healthy (IV), indicating that the wetland restoration and protection project has achieved remarkable results. Restoration and protection projects play important roles in promoting the ecological health of urban wetlands.

(3) The main factors restricting the healthy development of wetland ecology in the Yinchuan Plain are wetland construction restoration, investment in protection, population density, the number of tourists, and fertilizer use. Therefore, major ecological restoration projects, increased investment, reasonable control of population density and tourism, rational use of wetland resources, and comprehensive management of wetlands in the Yellow River Basin should continue to be implemented to promote the healthy development of wetland ecology, ecological protection, and high-quality development of the Yellow River Basin.

(4) To carry out wetland ecological restoration and protection in the world's major river basins, we must strive to adhere to the ideal of ecological civilization and harmony between humans and nature, continue to implement major projects for the restoration and protection of important wetland ecosystems, promote the health of wetland ecosystems, promote the coordinated development of the environment and society, and unswervingly take the road of green sustainable development.

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