Research on the Measurement of green Development level of Agriculture and Animal Husbandry in Haixi Prefecture

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Abstract. In this paper, the evaluation index system of the green development level of agriculture and animal husbandry in Haixi city was established, and the entropy weight grey correlation TOPSIS model was used to calculate the green development level of agriculture and animal husbandry in Haixi city from 2001 to 2019.The countermeasures and suggestions to promote the green development of agriculture and animal husbandry in Haixi prefecture were put forward.

1 Introduction

The green development of agriculture and animal husbandry is aimed at the sustainable development of economy, society and ecological environment. It is urgent to adjust and optimize the structure of agriculture and animal husbandry industry, improve the output efficiency of agriculture and animal husbandry, and realize the stable income increase of farmers and herdsmen [1].The agriculture and animal husbandry of Haixi autonomous prefecture gave full play to its unique advantages in geography and climate, and vigorously promoted the adjustment of industrial structure and optimized industrial layout.In this context, this paper makes a dynamic measurement and evaluation of the green development level of agriculture and animal husbandry in Haixi prefecture from the aspects of economy, society and ecological environment.

2 Development status of agriculture and animal husbandry in Haixi Prefecture

In 2019, the agriculture and animal husbandry economy of Haixi state made steady progress. According to the statistics of Haixi, the added value of agriculture and animal husbandry reached 3.616 billion yuan, up 2.1%.Grain output reached 78,000 tons, an increase of 2.9 percent over the previous year.The total cultivated land area is 894,600 mu.There are 3.172,500 herbivorous animals in the whole state, and the total output of meat is 35,679 tons.Infrastructure construction in rural areas of the prefecture was strengthened.The total power of agricultural machinery is 425,400 kw.There were 525 hospitals and health centers, 3,771 health workers and 3,307 beds.In general, the rural construction of Shanghai Xi prefecture has been improving, and the infrastructure construction has been increasingly strengthened.The living standards of farmers and herdsmen are also improving. The per capita disposable income of rural residents is 15,052 yuan, up 8.4%.At the end of the year, 3,944 farmers and herdsmen from 1,576 households enjoyed the minimum living allowance, and a total of 18.0589 million yuan was paid.In terms of ecological environment, the forest coverage rate of Haixi city was 3.5%, and the use of pesticide was 19.20 tons, 6.9% less than that of the previous year.

3 measurement and evaluation of the green development level of agriculture and Animal husbandry in Haixi Prefecture

3.1 Construction of evaluation index system of green development level of Agriculture and Animal husbandry in Haixi Prefecture

For accurate assessment of 2001-2019, the dynamic changes of the farming and animal husbandry green development level, when setting the specific evaluation indicators, fully considering the index selection of systemic, scientific and the principle of data availability and draw lessons from the academic circles of the existing research results [3] - [5], and constructs the evaluation index system of farming and animal husbandry, village green development level (table 1).

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Table 1. Evaluation index system of green development level of Agriculture and Animal husbandry in Haixi Prefecture

The target layer	Level indicators	The secondary indicators	Level 3 indicators	Index attribute
Level of green development of agriculture and animal husbandry	Agricultural and animal husbandry economy	Economies of scale	Grain output per capita X1	positive
			Total crop sown area X2	positive
			Agricultural and animal husbandry practitioners X3	positive
		Economic efficiency	Gross output value of agriculture and animal husbandry X4	positive
			Agricultural and animal husbandry labor productivity X5	positive
			Agricultural mechanization degree X6	positive
			Rate per unit animal husbandry product X7	positive
	Rural social development	The standard of living	The engel's coefficient for rural residents X8	negative
			Net income per capita for rural residents X9	positive
			Rural electricity consumption X10	positive
		infrastructure	Number of owned medical institutions X11	positive
			The number of mobile phones per 100 households is X12	positive
	Agricultural and animal husbandry ecological environment	The environmental pollution	Fertilizer intensity X13	negative
			agricultural plastic film application intensity X14	negative
			Intensity of pesticide application X15	negative
		Ecological management	Forest coverage rate X16	positive
			Afforestation area x17	positive

3.2 TOPSIS method of entropy weight grey correlation

(1) Collection and collation of original data

Assuming that there are M evaluation units and N evaluation indexes in the agricultural green development evaluation system, let the evaluation matrix be:

$$X = (x_{ij})_{m\times n}, (0 \ll i \ll m, 0 \ll j \ll n) \quad (1)$$

Xij represents the value of the JTH evaluation index in the I evaluation unit.

(2) Dimensionless treatment of indicators

The extreme value method is adopted in the dimensionless treatment of indicators, and the treatment methods for forward type indicators and reverse type indicators are shown in Equation (2) respectively.

$$x_{ij}^{'} = \frac{x_{ij}-x_{min}}{x_{max}-x_{min}}, x_{ij}^{'} = \frac{x_{max}-x_{ij}}{x_{max}-x_{min}} \quad (2)$$

Where xj is the JTH index value, Xmax is the maximum value of the JTH index, and Xmin is the minimum value of the JTH index, and is its standardized value.In order to eliminate the influence of standardized index value on logarithmic calculation, coordinate translation should be carried out. The formula is as follows:

$$y_{ij} = x_{ij}^{'} + A, \text{ In this paper, A is 0.0001} \quad (3)$$

（3）Calculate the proportion of the index value in the year I of the JTH index p_{ij}

$$p_{ij} = \frac{y_{ij}}{\sum_{i=1}^{m} y_{ij}}, (0 \ll p_{ij} \ll 1) \quad (4)$$

（4）Calculate the information entropy of the JTH index e_j:

$$e_j = -K\sum_{i=1}^{m} p_{ij}\ln p_{ij}, (K \text{ is constant}, K = \frac{1}{\ln m}, m = 11) \quad (5)$$

（5）Calculate the information utility value of the JTH index d_j:

$$d_j = 1 - e_j \quad (6)$$

（6）Calculate the weight of evaluation index

$$w_j = \frac{d_j}{\sum_{i=1}^{m} d_j} \quad (7)$$

$$w_j^{'} = \frac{w_j}{\sum_{i=1}^{e} w_j} \quad (8)$$

Where, is the total ranking weight of the JTH index, is the single ranking weight of the JTH index in each subsystem (criterion layer), and E is the number of evaluation indexes in each criterion layer.

（7）Calculate the weighted normalized matrix:

$$A = (a_{ij})_{m\times n} \quad (9)$$

（8）Determine the positive ideal solution A+ and the negative ideal solutionA^-:

$$A^+ = \{\max a_{ij} | i = 1,2,\cdots,m\} = \{a_1^+, a_2^+, \cdots, a_n^+\} \quad (10)$$

$$A^- = \{\min a_{ij} | i = 1,2,\cdots,m\} = \{a_1^-, a_2^-, \cdots, a_n^-\} \quad (11)$$

（9）Calculate the Euclidean distance from each evaluation unit to the positive and negative ideal solution $l_i^+$and l_i^-:

$$l_i^+ = \sqrt{\sum_{j=1}^{n}(a_{ij} - a_j^+)^2} (i = 1,2,\cdots m) \quad (12)$$

$$l_i^- = \sqrt{\sum_{j=1}^{n}(a_{ij} - a_j^-)^2} (i = 1,2,\cdots m) \quad (13)$$

（10）The grey correlation coefficient between each evaluation unit and the positive and negative ideal solution is calculated $f_{ij}^+$and f_{ij}^-:

$$f_{ij}^+ = \frac{\min|a_j^+ - a_{ij}| + \beta \max|a_j^+ - a_{ij}|}{|a_j^+ - a_{ij}| + \beta \max|a_j^+ - a_{ij}|} \quad (14)$$

$$f_{ij}^{-}=\frac{\min\left|a_j^{-}-a_{ij}\right|+\beta\max\left|a_j^{-}-a_{ij}\right|}{\left|a_j^{-}-a_{ij}\right|+\beta\max\left|a_j^{-}-a_{ij}\right|} \quad (15)$$

(11) The grey relational degree between each evaluation unit and the positive and negative ideal solution is calculated $r_j^{+}$and r_i^{-}:

$$r_i^{+}=\frac{1}{n}\sum_{j=1}^{n}f_{ij}^{+},\ r_i^{-}=\frac{1}{n}\sum_{j=1}^{n}f_{ij}^{-} \quad (16)$$

(12) The Euclidean distancel_i^{+}、l_i^{-}And greyr_j^{+}、r_i^{-}Dimensionless treatment:

$$R_i^{+}=\frac{r_i^{+}}{\max r_i^{+}},R_i^{-}=\frac{r_i^{-}}{\max r_i^{-}} \quad (17)$$

$$L_i^{+}=\frac{l_i^{+}}{\max l_i^{+}},L_i^{-}=\frac{l_i^{-}}{\max l_i^{-}} \quad (18)$$

(13) The dimensionless Euclidean distance and the grey relational degree were combined:

$$k_i^{+}=\alpha_1R_i^{+}+\alpha_2L_i^{-},k_i^{-}=\alpha_1R_i^{-}+\alpha_2L_i^{+} \quad (19)$$

$\alpha_1+\alpha_2=1$，α_1、$\alpha_2\in[0,1]$ ， Respectively represent the proportion of proximity of position and similarity of shape. k_i^{+} comprehensively reflects the proximity between the evaluation unit and the ideal program， The greater the value, the better the scheme; k_i^{-} comprehensively reflects the proximity between the evaluation unit and the ideal program, and the greater the value, the worse the program.

(14) Relative closeness degree of the calculation scheme:

$$Y_i=\frac{k_i^{+}}{k_i^{+}+k_i^{-}} \quad (20)$$

This value represents the relative closeness between the ith evaluation unit and the optimal ideal solution. The greater the closeness, the better the scheme.On the contrary, the smaller the closeness, the worse the scheme .

3.3 Dynamic evaluation of green development level of Agriculture and Animal husbandry in Haixi Prefecture

On the basis of constructing the evaluation index of the green development level of Agriculture and animal husbandry in Haixi, the original data of Haixi from 2001 to 2019 were sorted out by consulting the Statistical Yearbook of Qinghai Province and The Statistical Yearbook of Haixi prefecture. The data were standardized, and the index weights were determined by entropy weight method (Table 2).

Table 2. Weight of evaluation index of green development level of Agriculture and Animal husbandry in Haixi Prefecture

The target layer	Level indicators	The secondary indicators	Level 3 indicators	Total sort weight	Single sort weight
Level of green development of agriculture and animal husbandry	Agricultural and animal husbandry economy	Economies of scale	Grain output per capita X1	0.0219	0.048
			Total crop sown area X2	0.0756	0.1664
			Agricultural and animal husbandry practitioners X3	0.0916	0.2014
			Gross output value of agriculture and animal husbandry X4	0.0862	0.1895
		Economic efficiency	Agricultural and animal husbandry labor productivity X5	0.0793	0.1745
			Agricultural mechanization degree X6	0.0364	0.0801
	Rural social development	The standard of living	Rate per unit animal husbandry product X7	0.0636	0.1410
			The engel's coefficient for rural residents X8	0.0152	0.0573
			Net income per capita for rural residents X9	0.0844	0.3181
		infrastructure	Rural electricity consumption X10	0.0466	0.1755
			Number of owned medical institutions X11	0.0654	0.2464
			The number of mobile phones per 100 households is X12	0.0538	0.2429
	Agricultural and animal husbandry ecological environment	The environmental pollution	Fertilizer intensity X13	0.1142	0.4083
			agricultural plastic film application intensity X14	0.0425	0.1519
			Intensity of pesticide application X15	0.0165	0.0589
		Ecological management	Forest coverage rate X16	0.0610	0.2010
			Afforestation area x18	0.0504	0.1801

From the level of development of farming and animal husbandry, village green evaluation index weight distribution, the weight index of greater than 0.06 have eight, five of the economic development of the farming and animal husbandry, rural social development has two, one of farming and animal husbandry ecological environment, therefore, in the form of farming and animal husbandry, village green development system of the subsystem, farming and animal husbandry subsystems of economic development is relatively important.At present, the first condition for realizing the green development of agriculture and animal husbandry in Haixi is to increase the financial support for agriculture and animal husbandry and to develop the productive forces.We will raise and improve farmers' living standards, strengthen infrastructure and improve the quality of the population.At the same time, we should pay attention to the ecological environment of agriculture and animal husbandry, reduce pollution and strengthen ecological management.

After the index weights were calculated, the nearness of each evaluation unit was calculated according to Equations (9) to (20) (Table 3). In order to reflect the dynamic changes in the green development level of agriculture and animal husbandry in Haixi prefecture, figure 1 was made according to the comprehensive evaluation data in Table 3.

Table 3. Green development level of agriculture and Animal husbandry in Haixi Prefecture

	Comprehensive evaluation of		Evaluation of economic development		Social development evaluation		Ecological environmental assessment	
year	Close to the degree of	Level of development	Close to the degree of	Level of development	Close to the degree of	Level of development	Close to the degree of	Level of development
2001	0.4494	intermediate	0.3753	intermediate	0.3245	intermediate	0.6783	fine
2002	0.4407	intermediate	0.3981	intermediate	0.3213	intermediate	0.6197	fine
2003	0.4275	intermediate	0.3709	intermediate	0.3542	intermediate	0.5800	intermediate
2004	0.4479	intermediate	0.3797	intermediate	0.3349	intermediate	0.6561	fine
2005	0.4612	intermediate	0.4121	intermediate	0.2935	poor	0.6977	fine
2006	0.4392	intermediate	0.4482	intermediate	0.3454	intermediate	0.5206	intermediate
2007	0.4259	intermediate	0.4736	intermediate	0.3121	intermediate	0.4729	intermediate
2008	0.4337	intermediate	0.4504	intermediate	0.4697	intermediate	0.3743	intermediate
2009	0.4888	intermediate	0.4248	intermediate	0.4693	intermediate	0.5980	intermediate
2010	0.4970	intermediate	0.4570	intermediate	0.5016	intermediate	0.5483	intermediate
2011	0.4888	intermediate	0.4588	intermediate	0.5151	intermediate	0.5786	intermediate
2012	0.5247	intermediate	0.4526	intermediate	0.5205	intermediate	0.6298	fine
2013	0.4966	intermediate	0.4751	intermediate	0.5244	intermediate	0.4988	intermediate
2014	0.5168	intermediate	0.5348	intermediate	0.6348	fine	0.3736	intermediate
2015	0.4957	intermediate	0.5179	intermediate	0.6729	fine	0.2873	poor
2016	0.5237	intermediate	0.5322	intermediate	0.7180	intermediate	0.3175	intermediate
2017	0.5361	intermediate	0.5284	intermediate	0.7513	fine	0.3315	intermediate
2018	0.5952	intermediate	0.5394	intermediate	0.7876	fine	0.4809	intermediate
2019	0.5816	intermediate	0.5543	intermediate	0.7616	fine	0.4770	intermediate

Note:Closeness level 0-0.3 is poor,0.3-0.6 is intermediate level0.6-0.8 is good,0.8-1 is high quality.

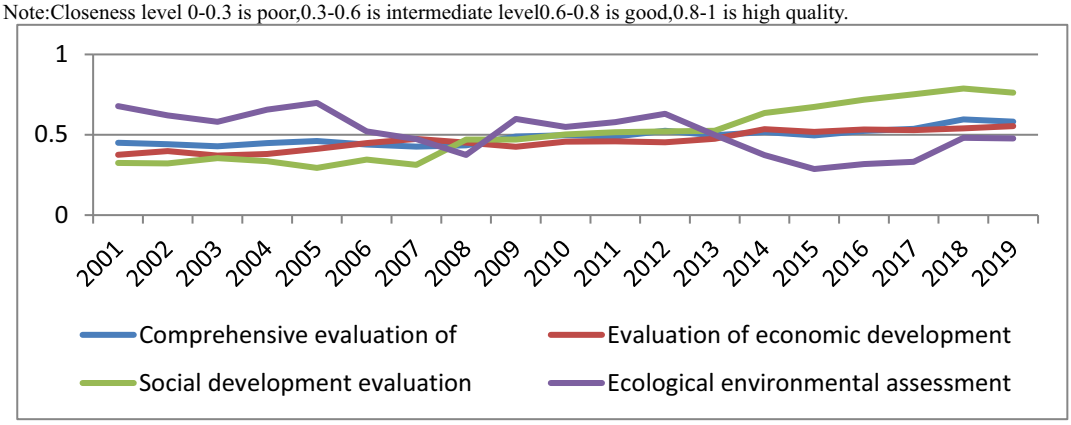

Figure 1. Green development level of Agriculture and Animal husbandry in Haixi prefecture from 2001 to 2019

From Figure 1, it can be clearly seen that the green development level of agriculture and animal husbandry in Haixi was on the rise from 2001 to 2019, and the overall development status was good, and the green development level was constantly improved.The green development index of agriculture and animal husbandry in Haixi autonomous prefecture was 0.4494 in 2001 and 0.5816 in 2019, indicating that the green development level of agriculture and animal husbandry had been improved, but it still did not break the intermediate level.

The development index of agriculture and animal husbandry economy in Haixi state fluctuates and generally rises.Combined with Table 3, it can be seen that the development level index of agriculture and animal husbandry economy in Haixi state increased from 0.3753 in 2001 to 0.5543 in 2019, with an increase of only 0.18%.The rural social development index showed a relatively stable upward trend. Table 3 shows that the rural social development index of Haixi rose from 0.3245 in 2001 to 0.7616 in 2019.The development level of agriculture and animal husbandry ecological environment fluctuates. In Table 3, the development level index of ecological environment decreased from 0.6783 in 2001 to 0.4770 in 2019. In recent years, with the development of economy, the environment in Haixi city has been polluted to a certain extent.

4 Conclusions and countermeasures

By constructing the evaluation index system of the green development level of agriculture and animal husbandry, the entropy weight grey correlation TOPSIS model was used to calculate the green development level of Agriculture and animal husbandry in Haixi autonomous prefecture. The results showed that the green development index of Agriculture and animal husbandry in Haixi autonomous prefecture rose from 0.4494 in 2001 to 0.5816 in 2019, but still failed to break the intermediate level.The development level of agriculture and animal husbandry economy in Haixi state showed a

steady rising trend and kept at the intermediate level.The level of social development in rural areas is on the rise, rising from the intermediate level to a good level.The level of agricultural and animal husbandry ecological environment fluctuates, and the level of development in 2015 is poor. In other years, the level of rural social development fluctuates, but remains at the intermediate level.In order to further improve the green development level of agriculture and animal husbandry in Haixi, and promote regional economic and social development and farmers' life improvement, this paper proposes the following countermeasures and suggestions from the three subsystems of green development of agriculture and animal husbandry.

We will improve the structure of the agriculture and animal husbandry industry and promote the healthy development of the agriculture and animal husbandry economy.In order to promote the development of agriculture and animal husbandry economy, we should constantly optimize the industrial structure, deal with the degree of correlation between industries, achieve recycling, avoid waste of resources.While ensuring the supply of agricultural and livestock products, it highlights the non-productive functions of agriculture, such as ecological protection, sightseeing, leisure tourism and cultural inheritance, and attracts capital, talents, technology and other high-quality factors with rich connotations of featured agriculture and animal husbandry, so as to accelerate the transformation and upgrading of the industry.

We will strengthen infrastructure and promote social sustainability.The development of agriculture and animal husbandry economy needs multi-factor input, and farmers and herdsmen need to know more about technology. Therefore, it is necessary to attach importance to the training of farmers and herdsmen's cultural knowledge and skills.It is also necessary to accelerate the construction of transport infrastructure integrating urban and rural areas and strengthen the connectivity between urban and rural areas.We will strengthen the construction of supporting infrastructure such as communications and electric power in farming and pastoral areas.Good infrastructure is the guarantee for efficient organization of production and improvement of people's quality of life. It is also the basis for the green development of agriculture and animal husbandry.

We will promote the development of ecological agriculture and animal husbandry, and improve the ecology and environment of agriculture and animal husbandry.Around the provincial party committee proposed "from farmers and herdsmen single planting, breeding, ecological care to ecological virtuous circle of production and life of" new concept, accelerating the development of farming and animal husbandry, on the basis of carrying out ecological comprehensive treatment engineering, and actively build green ecological, zero growth action actively developing chemical fertilizers and agricultural pollution source management, promote green production mode [6].The cultivation of farmers and herdsmen's awareness of environmental protection and ecology can achieve the new goals of tidiness of the countryside, recycling of manure, reduction of fertilizer and medicine, improvement of product quality, reduction of resource dependence, and beauty of ecological environment, so as to realize the virtuous cycle of ecology and life.

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