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Management and Protection of Environment and Public Health Safety in Rural Livestock and Poultry Breeding Enterprises

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Abstract: In the context of macro-economy, with the development of social economy and the improvement of people's living standards, it also drives the development of livestock and poultry breeding industry. However, the rapid development of livestock and poultry industry has also brought huge pollution, and the contradiction between industrial development and environmental protection has become increasingly prominent. Therefore, the development of livestock and poultry breeding industry should be coordinated with the development of natural environment in order to realize the sustainable development of livestock and poultry breeding industry. Based on the theory of sustainable development and the characteristics of livestock and poultry industry, this paper puts forward the concept of green sustainable development of Regional Livestock and poultry industry, which means that livestock and poultry breeding industry should not only meet the needs of social and economic life, but also conform to the strategy of environmental protection. On this basis, this paper takes the theory of large-scale system control as the theoretical guidance, combined with historical analysis and causal analysis, analyzes the region According to the system goal of green development of livestock and poultry industry, the evaluation model of livestock and poultry breeding development is established. In this way, compared with other research models, the accuracy of data is improved by 30%, and the practicability and accuracy are higher, which has certain practical value.

1. Introduction

China is one of the countries where animal husbandry originated earlier. About 7000 years ago, the Yellow River and the Yangtze River Basin formed the original form of livestock breeding. After entering the 21st century, China's animal husbandry has made remarkable achievements and

become the pillar industry of China's rural economic development. Its vigorous development not only promotes the development of feed, veterinary medicine, processing, refrigeration, transportation and other related industries, but also becomes an important way to transfer rural labor force. However, this rapid development mainly depends on the traditional livestock and poultry breeding, and its development direction is limited to expand its own breeding scale and increase the number of animals. The development goal is only to improve its own short-term economic benefits, which seriously violates the idea of comprehensive and coordinated development of various industries in rural economy. At the same time, due to the long-term existence of unreasonable factors in traditional breeding methods, animal excreta and feed waste produced by livestock and poultry breeding industry are randomly piled up and discharged into water, air and soil, polluting the surrounding ecological environment, and even inducing the formation of infectious diseases such as viruses and bacteria, which seriously affect the daily life and public health safety of residents. According to the latest data, the economic losses caused by the destruction of China's ecological environment in 2011 exceeded 4% of GDP in that year. In this context, how to reasonably manage the Rural Livestock and poultry breeding enterprises and develop economy while protecting the environment is the main issue of this paper.

With the development of China's rural construction, the continuous adjustment of rural industrial structure and the continuous growth of livestock and poultry products demand, the scale of livestock and poultry breeding has been expanding. A large number of livestock manure has not been treated timely and effectively, which also caused serious water, soil and air pollution. Taking Hebei Province as an example, the environmental pollution caused by livestock and poultry breeding in rural areas was analyzed, and the corresponding control measures were put forward. This paper analyzes the pollution hazards of Rural Livestock and poultry breeding industry, probes into the causes of pollution caused by Rural Livestock and poultry breeding industry, and puts forward the measures to control the pollution of Rural Livestock and poultry breeding industry. The results showed that the pollution caused by livestock and poultry breeding in rural areas can be directly or indirectly reflected through soil, water and air. The main causes of pollution are low utilization of livestock waste, weak awareness of environmental protection, and imperfect livestock and poultry breeding treatment mechanism. This problem can be solved by formulating and improving the laws and regulations on pollution management of livestock and poultry breeding industry, establishing a strict environmental supervision system, improving public awareness of livestock and poultry pollution management, and actively promoting ecological livestock and poultry breeding mode. The research results have important reference value for the systematic analysis of livestock and poultry breeding environmental pollution, analysis of the causes of livestock and poultry breeding pollution, put forward countermeasures to solve the problem, as well as the government to formulate livestock and poultry breeding pollution prevention and control measures. Microbial contamination from livestock farms has aroused public concern for health. Little is known about the level of microorganisms associated with livestock in the air of residential areas. Our aim is to increase our understanding of the problem. In 2014 and 2015, air measurements were carried out in 61 settlements in the Netherlands [1]. DNA concentrations of selected bacteria (E.coli and Staphylococcus; zoonotic pathogen Campylobacter jejuni) and antimicrobial resistance (AMR) gene (tetw, MECA) in air dust were evaluated by quantitative PCR. The hybrid model is used to explore the environmental characteristics of livestock related to spatial linkage (temporal adjustment). DNA from livestock and AMR genes can be detected even at the farthest distance (1200 meters) from the farm, although at low levels. There were significant differences among different sites, which were closely related to the density of surrounding farms, especially poultry and pigs. C. The prevalence of jejunum DNA was low (42% of the samples were positive). The presence of Campylobacter jejuni was only related to poultry (or: 4.7 (95% CI: 1.7-14), and high

poultry density was compared with low-density poultry). Residential exposure to livestock related bacteria and AMR genes. The established associations indicate, in general, the contribution of livestock farms to air microbial pollution and the attribution differences between farm types. This supports the reasonableness of recent studies showing health effects associated with residential areas close to farms [2].

Non-point source pollution caused by agricultural production is one of the biggest threats to water resources. In order to achieve the goal of improving surface water quality, the management and control of nuclear power source pollutants has attracted more and more attention in the world. Because of the heterogeneity of the key drivers of nuclear power source pollution, such as topography, precipitation and vegetation types, the management of nuclear power source pollution in mountain areas requires more detailed effort area than that in plain areas. In this study, considering the spatial heterogeneity of natural and man-made factors in mountainous areas, the load of nuclear power source pollutants, such as total nitrogen (TN) and total phosphorus (TP), was evaluated by the export coefficient model and inv EST (integrated assessment and trade-off tool for ecosystem services), which is a water purification model. According to the water environment function, this paper analyzes the non-point source pollutants exceeding the standard. The purpose of the study is to reveal the spatial differences of nuclear power source pollution in mountainous areas, determine the key control areas, and provide the basis for regional pollution control planning and environmental management efficiency improvement in mountainous areas [3].

2. Research Methods

2.1. Large Scale System Analysis

Large scale system theory is a theory that studies the automation and effective control of large-scale engineering and non-engineering systems with large-scale, complex structure, diverse objectives, comprehensive functions and many factors. Large scale system refers to the system with complex structure and size. It has the characteristics of multi-objective, multi-attribute, multi-level and multi variable. Such as economic planning management system, information classification processing system, transportation management control system, ecological environment protection system and water distribution management system. The theory of large-scale system is a new field which has been developed under the condition of enlarging production scale and complex system since 1970s. Its main research topics include large-scale system architecture, scheme, stability, optimization and model simplification [4-6]. Large system theory is based on cybernetics, information theory, microelectronics, socioeconomics, bioecology, operational research and systems engineering. It is based on control technology, information and communication technology and computer technology. There are usually two forms of hierarchical and decentralized control systems: hierarchical and efficient control systems. The method is "large scale system analysis and synthesis [7-8].

In the research of large-scale system, the methods of "decomposition coordination", "decomposition aggregation" and "decomposition combination" can be used to study the relationship between subsystems, and solve the optimization, stability and modeling problems of large-scale systems. In the process of large-scale system research, the integrity of the system and the coordination between subsystems can be considered. This paper introduces the structural models of multi-level large-scale system, multi-level large-scale system and hierarchical large-scale system, as well as the corresponding multi-level state space model. The multi-level state space model consists of a state space model which describes the internal laws of subsystems and a state space model that describes the relationship between different subsystems.The public expression is as follows:

$$\begin{cases} y_{i1} = f_{i1}(Y_i, U, t) \\ y_{i2} = f_{i2}(Y_i, U_i, t) \\ \ldots\ldots \\ y_{in} = f_{in}(Y_i, U_i, t) \end{cases} \tag{1}$$

$$\begin{cases} y_{i1} = F_{i1}(X_i, X_2, \ldots, X_t) \\ y_{i2} = F_{i2}(X_i, X_2, \ldots, X_t) \\ \ldots\ldots \\ y_{in} = F_{in}(X_i, X_2, \ldots, X_t) \end{cases} \tag{2}$$

In the above formula, y is the state variable in F subsystem; y_{i1} is the state space vector of F subsystem, u is the input vector of I subsystem, t is the time variable; F_{in} is the N state function subsystem of I subsystem; it is the generalized relation function between the state variables of F subsystem and other subsystems. The purpose of carrying out the research on livestock and poultry breeding environment system is to promote the "sustainable development" of livestock and poultry breeding industry.

Generally speaking, large-scale system has complex structure and large scale, so it is necessary to study whether large-scale system can be decomposed into several smaller systems on a regular basis [9]. In this way, the smaller system after decomposition can be studied separately, thus simplifying the analysis of the whole system. The decomposition of large-scale system is only related to the topological structure of the system, and has nothing to do with the specific parameters. The concept of strong correlation plays a key role in decomposition.The related system [10-11] is given. Consider the expression of the decentralized control system as follows:

$$x(t) = Ax(t)\sum_{i=1}^{v} B_i u_i(t) \tag{3}$$

$$y_t = C_i x(t) + \sum_{j=i}^{v} D_{IJ} u_j(t), i \in v \equiv \{1,2,\ldots,V\} \tag{4}$$

Environmental system is the basis of the development of livestock and poultry breeding activities. It is also the restrictive factor of resources, environment and society. It is not difficult to realize that the integrity of livestock and poultry breeding environment system is determined by the nature of the complex large-scale system of "breeding resources, environment and social environment". The change of any link in a large-scale system can become the driving force of the change of the whole system. At the level of temporal and spatial distribution, the relationship between various factors in the system will be more complex [12]. Therefore, only on the basis of a unified understanding of the various factors of the system and their relationship can we have a comprehensive understanding of the whole system.

2.2. Historical Analysis

Based on the historical data of 25 years since 1995, including products, output value, employment and decline, the basic process, current situation and future trend of China's animal

husbandry development are drawn in terms of cost, scale and layout.

With the method of historical analysis, the research is carried out with the structure of "data and literature → environment and conditions → course and current situation → problem discovery, restrictive factors and key projects → countermeasures and suggestions → accelerating the healthy and sustainable development of animal husbandry", as shown in Figure 1.

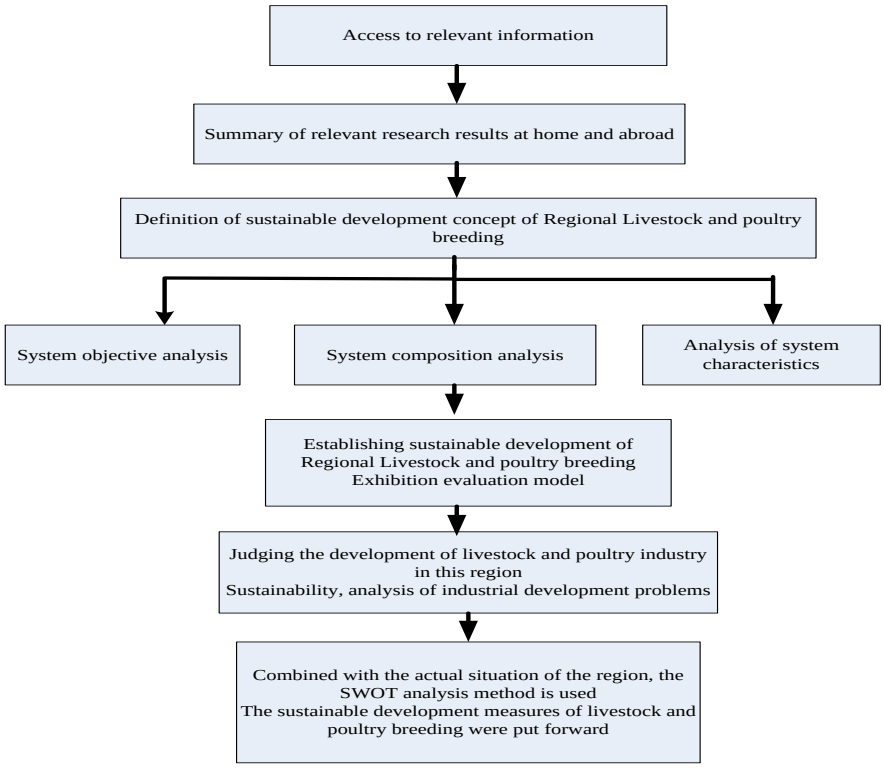

Figure 1. Research structure

2.3. Causality Analysis

The focus of causal analysis is to analyze the causes and results of past occurrences. Causal analysis is commonly used in quality control. What is a quality problem? It is based on the causal relationship between the development and change of things, and seeks reference through possible results. The reason for this result. Investment control at the decision stage is essentially active control. Since the investment activity has not yet begun, the causal analysis method is used to guide the increase in investment in the past project implementation phase. What are the factors leading to increased investment and the reasons for these factors, and then determine the decision plan. According to the reasons for increasing investment, we can make a scientific score and choose a reasonable decision plan.

Causality in system dynamics is the most basic interaction between system elements. The causal chain is represented by the relationship of the loss line. As shown in Figure 2, there are three factors: rural livestock and poultry production, pollutant emissions and resources. If the increase in rural livestock and poultry production can lead to an increase in pollutant emissions, or the reduction in

rural livestock and poultry production also leads to a reduction in pollutant emissions, that is, between rural livestock and poultry production and pollutant emissions The change is the same, which is called a positive causal chain; if the increase in the number of reproduction leads to a decrease in resources, or the decrease in the number of reproduction leads to an increase in resources, it can be said that there is a negative causal relationship between the amount of rural livestock and poultry breeding and the amount of resources .

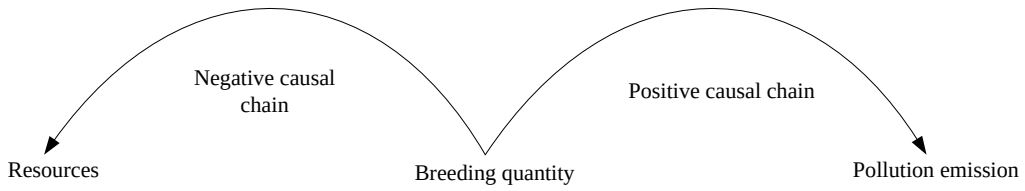

Figure 2. Schematic diagram of causality

Feedback is the relationship between the external input of the system and the internal output of the system. It is mainly formed by a series of causal chains which is called "feedback cycle". The feedback loop can be divided into a positive feedback loop and a negative feedback loop "feedback loop".

3. Research Design

The livestock and poultry breeding environment system is composed of livestock and poultry breeding subsystem (LRs), natural environment subsystem (lifi) and community. LRSE is a complex structure with many factors and complex action patterns. This system is not only a composite system of natural system and artificial system, but also includes human consciousness and human consciousness activities. Livestock and poultry breeding environment system is the basis of Regional Livestock and poultry breeding sustainable development, which needs the support of livestock and poultry breeding resources and environment. The key to realize the sustainable development of Regional Livestock and poultry breeding industry is to reasonably allocate livestock and poultry breeding resources and environment. Reasonable development and protection of livestock and poultry breeding environmental resources is the premise of realizing the sustainable development of animal husbandry. Regional Livestock and poultry breeding. The unreasonable development and utilization of livestock and poultry breeding environmental resources will become the basis of livestock and poultry breeding resources and environment. The weakening of the foundation, especially the regeneration mechanism, may lead to the destruction of resources and environment, thus limiting the development of regional animal husbandry. Livestock and poultry breeding is the core subsystem of the livestock and poultry breeding environment system, is an important part of the livestock and poultry breeding environment system, and is the basis of the whole system. It is not only the connection between livestock breeding system and natural environment subsystem, but also the channel to regulate the relationship between them. LRE is a whole composed of three interrelated parts P (1), P (2) and P (3). The records are as follows:

$$W(n)=\{E(n),R_n\} \tag{5}$$

$$E(n)=\{e(i),i=1,2,3\} \tag{6}$$

$$S_N=(S_1,...S_2,...S_n) \tag{7}$$

$$S_1 \in A_i(i = 1,2,...,n) \tag{8}$$

Where e (I) is the subsystem LRS, LRSE and lrne, and is the association set between E (1),..., e (I),..., e (n). The internal state of LRE consists of LRS, LRSE, lrne States and state space. Under different system states and system inputs, LRE of livestock and poultry breeding environment system shows different behaviors.

The dynamic hypothesis is based on the existing theory to explain the behavior of existing problems, and proposes the dynamic change hypothesis caused by the internal feedback structure of the system. Variables, reference patterns and other available data graphs (CLD) and inventory flow charts are used to establish causal structure diagrams of the system. Causal loop diagrams are used to express the dynamic assumptions of the system. As shown in Figure 3:

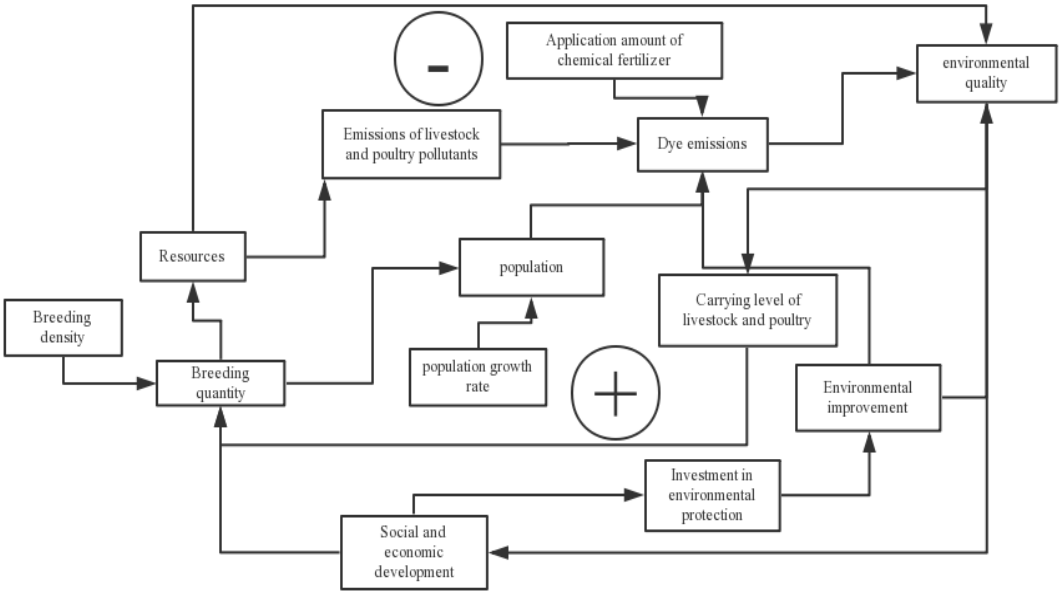

Figure 3. Causality diagram of livestock and poultry breeding simulation

Causal loop analysis: there are three main loops in the simulation of livestock breeding resource carrying capacity, which are named resource environment loop, social environment loop and livestock and poultry breeding environment loop.

4. Analysis of Research Results

According to the investigation results and the analysis ability of environmental management system, the environmental problems of large farms were analyzed, and the corresponding management countermeasures and suggestions were put forward.

In the traditional domestic livestock and poultry breeding, animal manure can be used as organic fertilizer in time, which will not cause serious environmental pollution. However, the situation of large-scale livestock breeding is completely different. Due to the serious disconnection between agriculture and animal husbandry, the output of livestock manure is too large and concentrated, and the local cultivated land is insufficient, so it is impossible to completely realize the reasonable direct return to the field. Therefore, although the industrial proportion of large-scale livestock farms is

very small, from the perspective of environmental risk, large-scale breeding is the main aspect of environmental pollution caused by livestock and poultry breeding. In order to evaluate large-scale pollution load farms, the conservative estimation parameters of production process and pollution emission of large-scale livestock and poultry farms are calculated by using the Environmental Protection Institute of the Ministry of agriculture. If the dry manure cleaning method is used to estimate livestock and poultry, the impact on the environment is small and the treatment cost is low, then the fecal clearance rate of the farm is 60%, while the chicken farm has the advantages of small impact on the environment and low treatment cost. The concentration of COD discharged from piggery is 1060mg / L, that of chicken farm is 1200mg / L and that of cattle farm is 350mg / L. The pollution load of different scale farms is shown in Table 1:

Table 1. Pollution emissions from large scale livestock and poultry farms

Experimental project / Number of animals	Pig farm		chicken farm		cattle farm	
	500	500	3000	10000	200	500
COD concentration in wastewater (kg / L)	162	9.8	12	15	4.2	5.6
Daily solid waste volume (T)	0.27	0.8	0.125	0.5	04	2.0
Daily wastewater load (T)	5.0	6.7	1.2	7	6.8	15
Cod load of rotating water per day (kg)	33.9	75.24	13,2	49	33.25	68.4

The determination of parameters is the most important link, which determines the accuracy of the model operation results. Because the system studied by system dynamics is relatively complex, and the internal elements of the system are interrelated and influence each other, it is impossible to obtain very accurate system dynamics parameters. Therefore, it is only necessary to meet the requirements and purposes of modeling when determining the parameter value. The model parameters include constants, table functions and initial values. The table function is represented by the historical data of variables in the statistical data, and the initial value is also selected from the statistical data. The constant parameters are determined according to the average value of the parameters and the values selected by experts and relevant departments. Through the model test, the relative error of the parameters is less than 10%. The specific parameters are shown in Table 2:

Table 2. Initial values of model state variables

constant	dimension	Parameter estimates	state variable	dimension	Initial value
Change rate of grain sown area	1	0.0002	Grain sown area	hectare	37256
population growth rate	1	0.0037	population	people	3.3026*1
Change rate of cultivated land area	1	-0.00446	Cultivated land area	hectare	263758
Change rate of fertilizer application rate	1	0.0304	Application amount of chemical fertilizer	ton	104338
GDP growth rate	1	0.128	GDP	Ten thousand yuan	1.4582*134
Change rate of aquaculture	1	0.06	Breeding quantity	head	4.432551

The change of the structure or equation of the model may lead to the change of the policy conclusion simulated by the model. If the model shows high policy sensitivity, the model is not suitable for countermeasure analysis. Sensitivity test is mainly used to test the sensitivity of some policy parameters. In this paper, six parameters were changed from - 3% to 3% to observe the range of environmental carrying capacity of livestock and poultry breeding resources. With the rapid development of large-scale livestock and poultry breeding industry in China, the disconnection between agriculture and animal husbandry in the whole agricultural production system has gradually intensified. It is mainly manifested in the following two aspects:

On the one hand, the isolation of the construction of large-scale livestock and poultry farms aggravates the disconnection between agriculture and animal husbandry. In China, due to the restriction of land system, the vast majority of large-scale livestock and poultry farms do not have corresponding supporting farmland, resulting in a relatively serious phenomenon of agricultural and pastoral disconnection. According to the investigation of large-scale livestock and poultry farms in China, cities and rural areas, it can be concluded that the pollution problem of livestock and poultry breeding is deepening year by year. As shown in Figure 4, the relationship between the polluter index and the region is as follows:

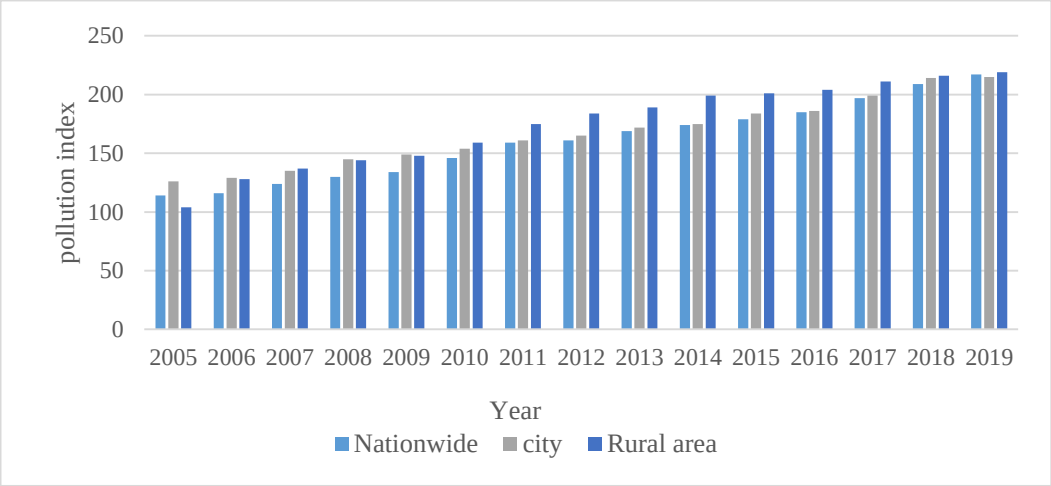

Figure 4. Pollution of livestock and poultry farming

As shown in Figure 5, in recent 15 years, in order to solve the problems of meat, eggs and milk of urban residents and grasp the "vegetable basket" project, governments at all levels have attached great importance to the development of livestock and poultry breeding industry. Considering the reasons of transportation and other aspects, in order to reduce the cost, the initial construction sites were mostly in the suburbs and counties of cities with convenient transportation, thus many large-scale livestock and poultry farms were built in the suburbs of cities. With the development of the city and the increase of population, some farms have become more and more close to the surrounding towns and rural residents, and even become a part of the urban area, forming the current situation that large-scale livestock and poultry farms are relatively concentrated around large and medium-sized cities, accelerating the ecological environment pollution in large and medium-sized rural areas.

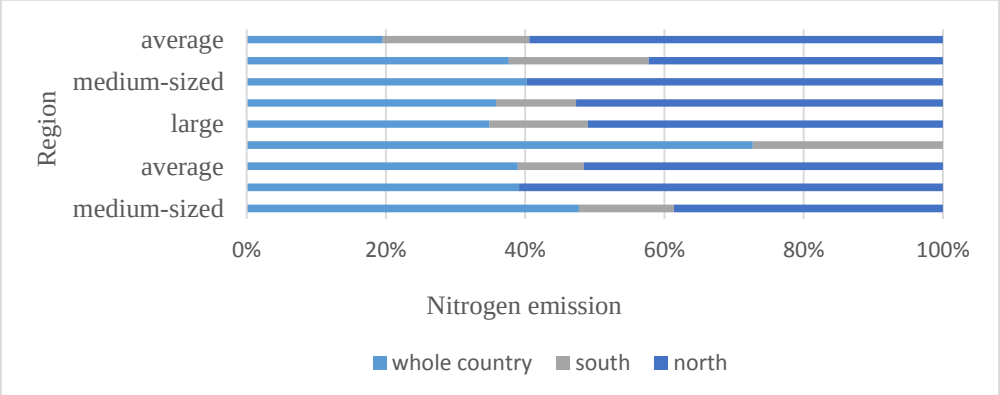

Figure 5. Nitrogen emission from large scale livestock and poultry farms

Although there is no obvious rule for the minimum distance between different areas, different breeding scale and breeding types from residential houses and nearby water sources, it can be seen that livestock farms in southern China are close to residential houses and water sources, which may cause environmental impact on nearby residents and water sources. Moreover, it can be seen from the table that there is no obvious difference between different scales. On the one hand, it shows that the corresponding environmental management of livestock and poultry breeding industry in China is not in place; on the other hand, it also shows that many large-scale livestock and poultry farms will have obvious impact on the surrounding environment. According to the relevant standards of Canada, small and medium-sized livestock and poultry farms will be within 2-3 km of the surrounding area, and large and medium-sized livestock and poultry farms will be 4-6 km away from the surrounding areas Residents and water sources within km have environmental impact. Therefore, the opinions of residents must be sought for new farms in Canada within this range. However, livestock and poultry farms in China are basically built in the area 2 which will have environmental impact on residents, and some large-scale livestock and poultry farms in some places are even in residential areas. In this survey, 1476 livestock and poultry farms are not more than 50m away from the water source, accounting for 4.3% of the total number of livestock and poultry farms in this survey, accounting for about 8% - 10% of the total number of large-scale livestock and poultry farms in China; the survey also found that 5834 livestock and poultry farms are not more than 150m away from the surrounding residential areas or civil water sources, accounting for about 25% of the total number of large-scale livestock farms in China. Due to improper site selection and lack of management, livestock farms not only threaten the surrounding ecological environment, but also lead to serious environmental disputes between livestock farms and surrounding residents in many places.

On the basis of the above research, due to the externality of environmental pollution, through the discussion of external environmental cost management, incentive economic measures are adopted to control the risk areas and counties. Based on the external environment cost theory and game model, this chapter analyzes the cost-benefit of the government, organic fertilizer enterprises and farmers respectively, and proposes that the government can investigate five enterprises A, B, C, D, E and F based on the organic fertilizer mode of livestock and poultry manure. The specific data are shown in Figure 6:

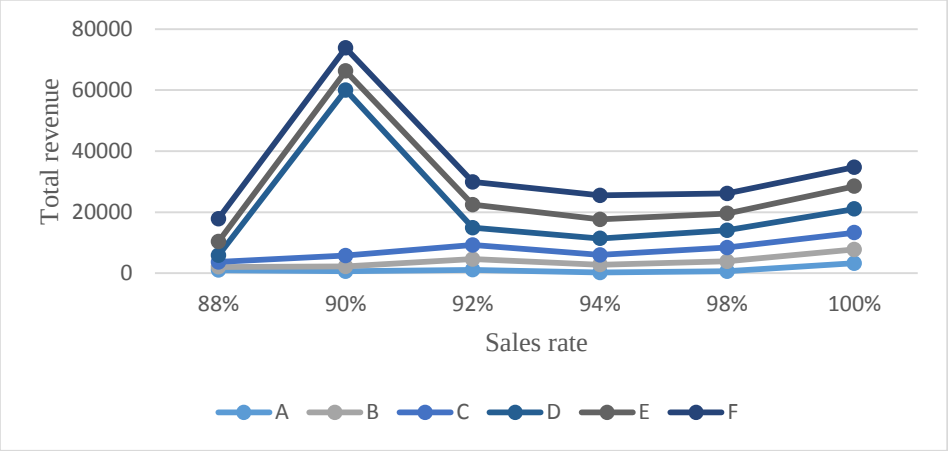

Figure 6. Relationship between fertilizer sales rate and revenue

Organic fertilizer enterprises and farmers should be subsidized to get the upper and lower limits of subsidy amount. It can be concluded that the soil of some districts and counties (Party A) has the risk of pollution by livestock and poultry breeding, resulting in crop yield reduction and quality degradation, thus causing the public (Party B) to be affected in varying degrees, but Party A has not implemented compensation to Party B, which forms the external environmental cost of livestock and poultry breeding pollution. In this study, the incentive environmental economic law subsidy policy is selected to scientifically dispose livestock manure and produce organic fertilizer to reduce the risk of pollution, so as to control the external environmental costs. At the same time, for the subsidy support policy, we must pay attention to the subsidy object and subsidy amount. The survey data of the relationship between sales rate and subsidy of seven enterprises are shown in Figure 7:

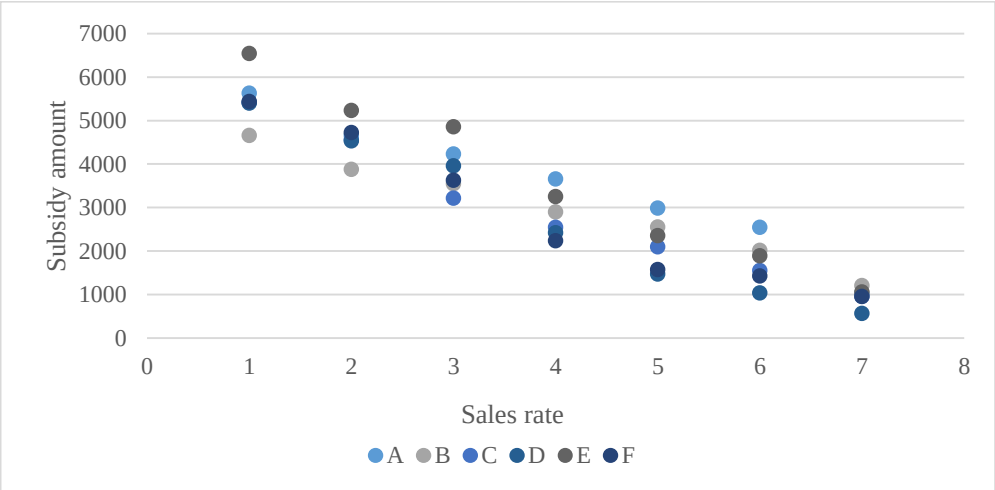

Figure 7. Diagram of relationship between fertilizer sales rate and subsidy amount

Through the investigation of 7 organic fertilizer enterprises, this study selects the organic fertilizer enterprises with an average annual production scale of 50000t as the research object to conduct cost-benefit analysis. According to the survey data, the sales rates of organic fertilizer enterprises are 100%, 99%, 98% respectively 91%, 90% revenue, sales tax, net income and present value of net income. When the sales rate is 90%, the total income is negative, and the next analysis is terminated. Through the data of sales rate and total revenue, the corresponding function graph is established. From the functional relationship, it can be concluded that when the sales rate is 90.03%,

the total revenue of the enterprise in 20 years is 0. In other words, when the annual sales rate of organic fertilizer enterprises is less than or equal to 90.03%, the organic fertilizer enterprises are in a negative level, and government subsidies are needed.

5. Conclusion

Based on the theory of large-scale system control, combined with historical analysis and causality analysis, this paper analyzes various factors affecting the development of Regional Livestock and poultry breeding industry, studies various indicators, establishes the evaluation model of livestock and poultry breeding development, and carries out prediction, early warning and scenario analysis on the development of livestock and poultry breeding resources and environment. The following conclusions are drawn

According to the spatial division planning of livestock and poultry industry, it is necessary to formulate relevant policies to support and promote the optimization of industrial spatial layout. The first is to formulate fiscal policies to make subsidies "market-oriented", and encourage farms to actively cooperate with "production suspension and transfer". Secondly, relying on standard breeding subsidies and "combination of breeding and breeding" subsidies can ensure the cooperation of breeding farms after spatial transfer, and realize the gradual transformation of livestock and poultry breeding industry from environmental pollution industry to ecological conservation industry. Secondly, it is necessary to formulate a clear land use policy to incorporate the land demand for animal husbandry into the overall urban planning; secondly, to formulate land use support policies to create a good policy environment for livestock and poultry breeding industry to lease and transfer land; land supervision policy to ensure the standardization of livestock and poultry breeding land, and promote the transformation of animal husbandry from extensive to intensive through land policy. The third is to formulate germplasm resources protection policies, strengthen the guidance of local livestock and poultry genetics on industrial layout, improve the support of improved seed resources for industrial development, and feedback the healthy development of improved variety protection industry.

Animal husbandry development research is a complex project. Although the relevant statistical data and field survey data are collected and sorted out in this paper, due to the limitation of time, theoretical level, personal experience and other factors, only the number of large farms is calculated in this paper, but the environmental pressure caused by scattered breeders and other livestock and poultry species (sheep, horses, rabbits, etc.) is ignored, Therefore, the research results are very small and there are some estimation errors. In the follow-up study, long-term and location-based sampling analysis is recommended to make the data more accurate. At the same time, it is necessary to carry out environmental risk research on heavy metals, antibiotics and pathogens in livestock manure.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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