Study on the ecological construction of livestock husbandry at county level

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Abstract: In order to find a balance between livestock husbandry and environmental protection, a feasible, mutually beneficial, inclusive and win-win development system should be established. Taking Longxi County in Gansu Province for instance, the paper demonstrates how to establish livestock husbandry ecosystem in all directions by analyzing and studying the current situation of livestock husbandry development, environmental pollution and the relationship between them. The results show as follows: 1) The dialectical relationship between the total output of pollutants produced by livestock and the carrying capacity of the environment is the basis for formulating relevant macroeconomic policies in county administrative regions. The balance and unification of “water-land-grass-livestock” is the prerequisite for sustainable development of livestock husbandry; 2) Livestock husbandry should adjust the development direction within the safety range of critical points of environmental protection; 3) Livestock husbandry should adjust livestock species, breeding quantity, supporting anti-pollution hardware facilities according to local geographical environment and external carrying capacity, and increase input intensity in soft environment, so as to achieve the aim of reducing emissions. The results of this study can provide a powerful theoretical reference and administrative basis for the coordination of livestock husbandry and environmental protection in county administrative regions.

1. Introduction

With the rapid economic development, China is facing two major pressures - population growth and environmental damage. Therefore, the concept of sustainable development has drawn more and more attention of the whole society [1-2]. As the direction of future agricultural development, ecological agriculture has become an inevitable choice for the sustainable development of agriculture in China. Recently, Livestock husbandry has been developing rapidly, which promotes rural area economic
development and increases farmers’ income. However, large amount of livestock and poultry manure, which cannot be applied to farmland in time, accompanied by the poor operation of the facilities for the disposal and utilization of manure, has become an important source of non-point source pollution [3]. In addition, livestock husbandry has a tremendous negative impact on grassland vegetation, disease transmission, greenhouse gas emissions, land occupation and water resources. At present, a lot of studies have been done in this field in China and the management of scope of sub-item index is strictly demonstrated from different angles of grassland carrying, fecal disposal, gas disposal, gas emissions and so on. This article analyzes and evaluates how the industrial layout and mode of production of livestock husbandry conform to the environmental protection work based on macroeconomic regulation and control. Then establishes the concept of “three determinations” (means water, land and grass determines the development of livestock husbandry), which provides a theoretical reference to policy making and livestock husbandry development.

2. Longxi livestock husbandry development status and sewage discharge

2.1. Longxi livestock husbandry development status

In 2017, the total number of livestock and poultry raised in the county was 4,629,100. Among them, cattle, sheep, pigs and poultry were 71,500; 989,100; 444,100 and 3,124,400 respectively; the total number of livestock and poultry for sale was 2,241,600. Among them, cattle, sheep, pigs and poultry were 21,600; 385,900; 235,700 and 1,598,400 respectively; the total production of meat, eggs and milk was 55,500 tons. Among them, meat, eggs and milk were 39200tons, 10200 tons and 6100 tons respectively; the gross output value of grass and livestock husbandry reached 2.507 billion yuan, and the per capita net income was 2048 yuan [4]. From the above statistics got at Longxi County level, we know that livestock husbandry is ingrained in the county. The county is known as “a hometown of Chinese bacon”, where the processing of livestock products has a long history. There are 7 meat processing enterprises with over 1000 tons of meat products, and 18000 tons of meat products are processed annually. There are 209 livestock husbandry professional communities and 16631 large scale farmers in the county, of which 160 large sheep farmers with more than 100 sheep, 23 large cattle farmers with more than 50 cattle and 36 large chicken farmers with more than 1000 chickens. There are 51 leading companies including Gansu Longyuan Zhongtian Sheep Industry Co., Ltd. etc [5]. In the past two years, the county has vigorously implemented “5532” and “5522” developing models (that is to say, farmers loan 50,000 yuan, plant corn or grass of 5 acres, then raise 3 cattle, they will have annual income of 20,000 yuan or more; or farmers loan 50,000 yuan, plant corn or grass of 5 acres, then raise 20 sheep, they will have annual income of 20,000 yuan or more) among farmers who are identified as precision poverty alleviation filling card households (the local policy aims to alleviate the poverty). It is a good way to increase farmers’ income and becomes indispensable for local economic development. However, it will inevitably become a major target for the eradication of pollution.

2.2. Livestock husbandry pollution investigation
2.2.1. *Livestock waste discharge pollution*. The rapid development of aquaculture plays an important role in the economic development of rural areas and the increase of farmers' income. However, with the intensification of livestock and poultry farming, the shift of agricultural labor force and the application of fertilizers which has changed from organic fertilizer to chemical fertilizer, livestock and poultry feces changed from treasure to waste, which brought about the problem of environmental pollution [6]. Pigs, cattle, sheep and chickens are the four big livestock and poultry breeding according to the data of the county by the end of 2017. According to the yield and discharge coefficient of individual livestock and poultry, the amount of excrement, chemical oxygen demand (COD) production and total nitrogen are showed as follows [7] (see Table 1, because of the geographical relationship of the object of the argument, this paper only extracts the data of "Northwest region").

| Table 1. Pollution production coefficient of livestock and poultry. |
|---------------------------------------------------------------|
| **Amount of excrement/Kg·d^{−1}** | **COD production/g·d^{−1}** | **Total nitrogen production (TN)/g·d^{−1}** |
| Pig | 3.54 | 334.55 | 31.73 |
| Cattle | 20.42 | 2235.21 | 104.10 |
| Sheep | 0.87 | 0.46 | 2.15 |
| Chicken | 0.18 | 0.18 | 1.85 |

In Table 1, the livestock and poultry breeding period is calculated according to the data published by the State Environmental Protection Administration when necessary [8]. That is to say, the breeding period of the pig is 199 days, the cow is 365 days, the sheep is 365 days, and the chicken is 210 days. The formula for calculating the total fecal amount, COD, total nitrogen (phosphorus) is as follows [7].

\[ Q = \sum_{i=1}^{4} N_i \times T_i \times P_i \]  

(1)

In the formula, \( Q \) is feces, COD, total nitrogen (phosphorus) production components (ten thousand tons), \( N_i \) is the breeding quantity of \( i \) species of livestock and poultry. \( T_i \) is the feeding period (d); \( P_i \) is the coefficient of pollutant production (kg/d or g/d), and \( i \) is the \( i \)-th kind of livestock. Taking pigs as an example, the annual total amount of sewage discharged from this type of livestock in this county is (due to the almost uninterrupted livestock and poultry farming in large-scale farms, the calculation result is converted into the annual output of sewage):

\[ Q=44.41\times199\times(3.54+334.55\times1000^{−1}+31.73\times1000^{−1})\times365/199/1000 = 633200 \ t \]  

(2)

In the same way, the total amount of sewage discharged from cattle, sheep and chickens was 553,900 tons, 315,000 tons and 205,700 tons respectively. The annual discharge of livestock in the county was 1,707,800 tons, of which the total nitrogen and phosphorus emissions were 63,800 tons, the excrement and urine is about 1,644,000 tons, the latter accounting for 96.26% of the total amount of discharged pollutants, which is the largest source of pollution.
2.2.2. Evaluation of the external environment capacity. The external environment includes land, forage grass and water resources. As a consumptive resource, they are the basis for the development and growth of livestock husbandry. From the perspective of environmental protection, the carrying capacity of various items must be kept within the bearing range.

i) Land carrying capacity

In accordance with the “Survey on Pollution and Countermeasures of Large Scale Livestock Farming in China”, it is suggested that the livestock manure per hectare of cultivated land can carry about 30 tons [9]. The county has an area of 134,040 mu (≈0.0667 hectares) of cultivated land [10], and it can be seen that the peak value of the livestock manure in the county is about 4,021,200 tons, and the total amount of the actual discharge pollution is about 40.88% of the bearing capacity. In the case of this data, it seems to be within a reasonable range. However, according to the latest study “Technical Guide for Estimating Carrying Capacity of Livestock Contaminated Land” [11] released by the Office of Ministry of Agriculture, the total nitrogen and phosphorus nutrient demand of all kinds of plants in this county is much smaller than the total amount of nitrogen and phosphorus emission which exceeds the carrying capacity by 52.63%. In Longxi County, there are 200,000 mu (≈0.0667 hectares) of cultivated land. Among them, about 150,000 mu is planted with wheat, 650,000 mu of corn, 50,000 mu of alfalfa, 450,000 mu of potatoes and 100,000 mu of vegetables, 350,000 mu of all kinds of Chinese herbal medicines and 250,000 mu of fruit trees. The yield per mu of above crops are wheat 400Kg/ mu, corn 750Kg/ mu, alfalfa 1500Kg/ mu, potato 3200Kg/ mu, vegetable 1500Kg/ mu, Chinese herbal medicine 800Kg/ mu, forest and fruit 2500Kg/ mu. According to the above index, 100Kg yields in different plants need recommended value amount of nitrogen and phosphorus as shown in Table 2.

Table 2. 100kg of yield formation in different plants need recommended value amount of nitrogen and phosphorus.

| Plant                        | Nitrogen N/Kg | Phosphorus P/Kg |
|-----------------------------|---------------|-----------------|
| Wheat                       | 3.0           | 1.0             |
| Corn                        | 2.3           | 0.3             |
| Alfalfa                     | 0.2           | 0.2             |
| Potato                      | 0.5           | 0.088           |
| Vegetables                  | 0.36          | 0.088           |
| Chinese herbal medicine     | 2.32          | 0.323           |
| Fruit trees                 | 0.3           | 0.08            |

Note: Because the vegetables are widely planted, they are calculated by the average value of 8 kinds of vegetables, the Chinese herbal medicine is calculated by astragalus, and the fruit tree is calculated by the apple trees which are widely planted.

$$Q = \sum_{i=1}^{7} P_i \times 100 \times A_i \times a_i$$

(3)
In the formula, \( Q \) is the demand of regional plant nitrogen and phosphorus (10,000 Kg), \( P_i \) is the yield per mu of \( i \) crop (Kg/mu), \( A_i \) is the total area (mu) of planting \( i \) crop, \( a_i \) is the recommended value of nitrogen and phosphorus for \( i \) crop to form 100Kg yield (kg). It can be obtained that the total nitrogen and phosphorus nutrient demand of all kinds of plants in Longxi County is about 41,849.6 tons, of which the total nitrogen nutrient demand is 36,833.5 tons, and the total phosphorus nutrient demand is 5,016.1 tons. It can be seen that the total nitrogen and phosphorus nutrient demand of all kinds of plants in this county is 41,800 tons, which is much smaller than the total amount of 63,800 tons of nitrogen and phosphorus emission, and the nitrogen and phosphorus emission exceeds the carrying capacity by 52.63%.

According to the results of (1) and (2), combined with the concept of pig equivalent, 100 pigs are equivalent to 15 cows, 30 beef cattle, 250 sheep and 2500 poultry [11]. The number of livestock raised in the county is as follows: the pig equivalent is 444,100 pigs equivalent, cattle 238,300 pig equivalent, sheep 395,600 pig equivalent, poultry 125,000 pig equivalent, and the total discharge of pig, cattle, sheep and poultry is 633,200 tons, 553,900 tons, 315,000 tons, and 205,700 tons respectively. The gross pollution and pig equivalent table is as follows (Table 3).

| Pig/ten thousand | cattle/ten thousand | sheep/ten thousand | chickens/ten thousand |
|------------------|---------------------|-------------------|-----------------------|
| Total output of  | 63.32               | 55.39             | 31.50                 | 20.57                 |
| Sewage/ million t|                     |                   |                       |                       |
| Equivalent to pig| 44.41               | 3.83              | 39.56                 | 12.5                  |
| equivalents/ million |
| Sewage yield rate of per pig equivalents | 1.42 | 2.32 | 0.79 | 1.64 |

As can be seen from the above table, the discharge capacity of pigs is the largest, accounting for 37.08% of the total discharge amount; followed by cattle and sheep, chickens with the least amount of 205,700 tons, accounting for 12.04% of the total. It can be seen that livestock and poultry farming in the county is mainly concentrated on pig farming and cattle breeding.

ii) Grassland carrying capacity

As a result of global warming and the influence of natural and human factors such as grassland reclamation, overgrazing, and increasing range of human activities, grassland vegetation has been seriously destroyed, resulting in grassland degradation, desertification, salinization, etc. The area of rocky desertification continues to expand and the carrying capacity of grassland decreases seriously. At present, 90% of the available natural grassland in the country has been degraded to some different degrees. According to statistics, the livestock overloading rate of grassland in deserted areas is from 50% to 120%, and in some areas it is as high as 300%. [12]. Longxi County is located in southeastern Gansu Province and in the central part of Dingxi City, with a total area of 2,408 square kilometers and a total population of 519,200. Among them, the agricultural population is 433,000. The county is from 1612 meters to 2762 meters above sea level, the average annual temperature is 8.1 °C, the sunshine
hours are 2,210 hours, and the rainfall is 415mm. The frost-free period is 160 days, which belongs to the Loess Plateau area [13]. The county has natural grassland of 630,000 mu, among which 578,100 mu can be used as grassland. It is the largest terrestrial ecosystem and also a water conservation area [14].

Due to the local corn silage, the balance of grass and livestock is used to characterize the grassland carrying capacity [15].

\[
\begin{align*}
Fr &= Fp \\
Fr &= Ns \times CSN \times T \times a \\
Fp &= Fng + Fs + Fig
\end{align*}
\]

F_r is the forage requirement, F_p is the total forage yield, CSN is quantitative for livestock and poultry daily needs, N_s is the number of raised sheep, T is the number of breeding days, F_ng is the grassland grass yield, F_s is the straw available amount, F_ig is yield grass for irrigated artificial grass.

Combined with the local conditions in Longxi, the sum of \( F_{ng} \) is 48,000 tons, \( F_{ig} \) and \( F_s \) is 1,426,000 tons, and \( F_p \) is 1,474,000 tons.

According to the conversion relationship of "1 cow = 5 sheep units, 1 pig = 1.5 sheep units and 20 chickens = 1 sheep unit", the total number of livestock breeding in this county is 2,169,000 sheep units. Due to the county feeding level, the value of CSN is 2.5 Kg, and the coefficient of livestock age is 0.8, so the formula (2) is calculated:

\[
F_r = 2.5 \text{Kg} \times 365 \times 2,169,000 \text{ sheep units} \times 0.8 = 1,583,400 \text{ t}
\]

\[
F_r - F_p = 109,400 \text{ t}
\]

It can be seen from the above that the carrying capacity of artificial and natural grasslands in this county is seriously "overloaded", exceeding 5% of the basic group. Reasons for this are as follows: 1) In recent years, the rapid development of livestock husbandry has led to the over-expansion of basic mother livestock without policy guidance; 2) Less annual precipitation (see Table 4 [16]), is restricted for forage growth. In addition, the "warm winter" climate reduces the snow cover in winter and prevents the grass from turning green and growing fast in spring. 3). The appearance of idle farmland in rural areas led to the further expansion of straw crops. At the same time, because livestock demand is greater than supply in the market, many farmers sell off the livestock when they don’t grow the best condition. What’s more, the benefit of livestock farmers has not been maximized simply because of the shortage of forage.

| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|
| Precipitation/ mm | 4 | 5 | 11 | 23 | 40 | 48 | 67 | 58 | 38 | 26 | 5 | 2 |

iii) Water resources carrying capacity

Water resources are basic and strategic resources and one of the basic conditions for maintaining the steady development of the national economy and the sustainable development of cities [17]. The total
amount of water resources in Longxi County is 1,707,620,000 cubic meters, of which available water resource is about 71,800,000 cubic meters. The annual water consumption of industry, agriculture and residents is about 61,100,000 cubic meters. Meantime, the branch canal and supporting projects of the first phase of Taohe River have water supply and irrigation projects in the county. It is planned that by 2020, 66,400,000 cubic meters of water will be transferred [18]. According to the fact that “the sheep need 2 to 3 kilograms of drinking water for per kilogram of forage in an environment of minus 17 degrees Celsius to 27 degrees Celsius” [19], when the peak value of 3Kg for per kilogram of forage water is taken, combined with the formula CSN=2.5Kg, the daily water requirement of a sheep is 7.5 kg. Then total Water requirement of livestock Q is as follows:

\[ Q = a \times b \times 7.5 \times 356 = 0.8 \times 2,169,000 \times 7.5 \times 365 \times 365 = 4,750,000 \text{ t} \]  

In the formula: the coefficient of adult livestock a is 0.8, the sheep units b is 2,169,000.

It can be seen that the livestock water demand in Longxi accounts for 6.62% of the available water resources (this result does not include the wasteful water resources, the increase of drinking water due to seasonal factors and the water for forage irrigation). Therefore, we can make a preliminary conclusion that the water resources in this county can carry the development of livestock husbandry.

3. Livestock husbandry and the relationship between the environment

3.1. Effects of livestock husbandry on the environment

“Long Shadow Environment Problems and Solutions of Livestock Husbandry” [20] issued by the UN Food and Agriculture Organization of the United Nations in 2006 pointed out that if the changes in land use caused by land occupation in livestock husbandry and livestock farms are taken into account, the global livestock industry accounts for 9%, 65%, 37% and 64% of the total emissions of CO₂, N₂O, CH₄ and NH₃ from human activities respectively. Greenhouse gas emissions of livestock husbandry account for 18% of the total emissions from human activities, thus livestock husbandry has become a great threat to climate change. According to the data released by China's initial national communications on climate change, in 2004, the CH₄ emissions from livestock enteric fermentation and livestock manure management system accounted for 59.21% and 5.04% respectively of the agricultural emissions, and the two accounted for 29.70% and 2.53% respectively of nationwide emissions. Livestock husbandry has become the source of the largest CH₄ emissions in the field of agriculture in China [21]. At the same time, most livestock farms are built in rural areas because of land prices, grass sources and other reasons. The excrement discharge from livestock husbandry has not had a small impact on the surrounding residents, which is contrary to the construction of a new socialist beautiful countryside. In addition, the harmful gas in the enclosure can seriously harm the livestock.

3.2. The environmental impact on livestock husbandry

In recent years, environmental protection, guided by sustainable development strategies and new development concepts, has become a vane for the development of various industries. Only on the premise of not violating the relevant laws and regulations of environmental protection and only by
opening up and innovating boldly, can we walk out of an industrial road that conforms to the county’s conditions. As far as environmental protection is concerned, the promulgation of various policies has forced the livestock husbandry to reshuffle and prepare for new start. The major impacts on livestock husbandry include: Firstly, breaking the existing pattern of breeding, it is mainly manifested in the delineation of prohibited areas and restricted areas. According to "Longxi County Livestock and Poultry Farming Area Division Program" [22], 18 farms in this county are in the prohibited area and have to be converted or relocated, and the prospects of the farms in the restricted area are also not optimistic. The restriction of the amount of breeding has undoubtedly blocked the way to expand the reproduction of livestock industry. Secondly, it is urgent to replan the layout of the industry. The county administer 17 townships, each of which has different competitive power of livestock husbandry, and the corresponding pollution degree is different, which weakens the government's macro-control to a certain extent. Lastly, the new policy of environmental protection puts forward new requirements for industry development. As far as the livestock is concerned, it is necessary to change from pursuing the greatest economic benefits in the past to set up the green production system under the new normal condition by supporting the related environmental protection facilities.

4. Conception of unified and coordinated development
At present, agricultural environment in China is under the double pressure of exogenous and endogenous pollution, which has increasingly become the bottleneck of agricultural sustainable development. What’s more, agricultural non-point source pollution is becoming more and more serious due to over-exploitation of agricultural resources [23-24]. As an important part of agriculture, livestock husbandry is also facing innovation. In the paper the author makes a tentative plan on how to coordinate the development of livestock husbandry and environmental protection based on Longxi County, Gansu Province.

4.1. Adjust the layout for environmental protection management
In order to adjust the layout of livestock husbandry industry, the following facts should be followed:

First, consider the bearing capacity carefully. Take Longxi County for instance, Wenfeng Town has a total area of 257.6 square kilometers and an area of 110,400 mu of cultivated land, while Shuangquan Town has a total area of 75 square kilometers and the area of 32,300 mu of cultivated land. On the basis of actual situation ascertained in March 2017, there are 1,379 farmers in Wenfeng Town and 1,318 households in Shuangquan Town. As far as the carrying capacity of cultivated land is concerned, these two towns are not equal. Therefore, the indicator is an important reference for the overall layout of the industry.

Second, consider the altitude and monsoon factors. Viewed the map of Longxi County, Mahe Town has an average elevation of 1,800m in the north, Wenfeng Town 1,682m at the southernmost end, Shuangquan Town 2,116m at the westernmost end, Weiyang Town 1,850m at the easternmost end, and Yuntian Town 1,976m in the central part. As we all know, the molecular weight of air is about 29, and the proportion of harmful gases in livestock is relatively large. In addition, the humidity of livestock enclosure is high, and there are more dust and microorganisms. Therefore, it is generally considered that the proportion of air in the enclosure is larger than that of air, and the mobility is
relatively slow. Because Longxi is a temperate continental monsoon climate, the breeding population should be in the lower tuyere at low altitude, and the air pollution treatment of the livestock enclosure is mainly "upper ventilation, lower adsorption", which is also an important basis for adjusting the layout.

Third, adjust the composition of livestock species; the main way is to advocate the raising of low sewage livestock. According to the Table 3 in this paper, "pollution rate for per unit pig", the amount of sewage discharged by one head of four major livestock breeds is from large to small, which is cattle > pig > chicken > sheep, and the livestock species are also affected by market price, dietary habits, breeding habits and so on. But as far as county environmental protection is concerned, it is also an important reference for macro-control.

4.2. Reduce the environmental load balance capacity
As far as Longxi County is concerned, livestock husbandry has a large amount of fecal waste and excessive carrying capacity of cultivated land, which is due to the fact that the quantity of aquaculture is too large and leads to the status quo of environmental overloading, so it is imperative to reduce emissions by reducing the amount of manure.

First, the elimination of lower feed utilization rate and the promotion of livestock and poultry with high rates of return have always been the source power for the sustainable development of livestock husbandry, which is particularly important today when the environmental protection problem is increasingly prominent. It is also a necessary means of reducing basic groups.

Second, popularize high quality forage planting. The productivity of grassland per hectare in China is only 7 livestock production units, and the meat yield per hectare of grassland is only 30% of the world average [25]. This method is a necessary way to increase the total amount of forage grass. Increasing yield within a fixed unit area can not only guarantee the basic needs of livestock husbandry development, but also an important means to increase farmers' income.

Third, upgrade downstream processing production capacity. This mainly refers to the meat processing industry. As the "intermediate" in the docking market, the greater the production capacity of this link, the shorter the "stagnation" time of adult livestock and poultry in the enclosure, one is to reduce the raising cost of breeding owners, the other is to reduce the discharge of livestock and poultry manure, and the third is to effectively revitalize the entire industry chain of livestock husbandry, which can be described as "kill three birds with one stone".

4.3. Strengthen configuration and Advocate green production
At the county level, it is necessary to establish livestock carcasses innocuous treatment sites, organic fertilizer production line, and so on. At the same time, livestock farmers, as the most advanced individuals, should take their own improvement as their own responsibility. Livestock husbandry authorities at the county level should inculcate breeding owners through on-the-spot teaching, observation, etc. Let the farmers truly realize that ecosystem farming technique is a great event that benefits other people as well as themselves and it is the critical point of improving quality and increasing efficiency [26]. At the same time, the finance branch at the county-level should actively take care of the project and finance, starting with leading enterprises and setting up ecological
circulation operation system which take "self-discharge and self-elimination" as the appeal to reduce the amount of external discharge in the region. What’s more, farming and livestock husbandry can cooperate with each other through "forest culture" models, and then bring the farmers around to fully participate.

5. Conclusion
The livestock husbandry in China is at the crossroads and is changing from the traditional livestock husbandry to the modern livestock husbandry. With regard to the general direction of the transformation of Chinese livestock husbandry, the CPC Central Committee has pointed out that it is to build a resource-saving, environment-friendly livestock husbandry, to build harmony between man and nature and human-oriented healthy livestock husbandry and to build circular and sustainable development livestock husbandry in accordance with the scientific development concept and the requirements of building ecological civilization [27]. Based on the analysis of the development of livestock husbandry in Longxi County, Gansu Province, the author draws the following conclusions on how to establish livestock husbandry ecosystem in an all-round way:

First, the total amount of sewage and environmental carrying capacity of livestock are prerequisite for the harmonious development of livestock husbandry and environmental protection and it is also the basis for the formulation of relevant macro policies in county administrative regions. "Water-land-grass-livestock" is the main line of balance and the basis for coordinated development. The cultivated land and grass resources in this county meet the carrying capacity requirements of the existing livestock and poultry quantity.

Second, it is necessary to grasp the relationship between livestock husbandry and environmental protection, and adjust the development direction within the safety range of the critical point.

Third, the development of livestock husbandry should be based on the local geographical environment, external bearing capacity, timely adjustment of livestock species, feeding quantity, and supporting anti-pollution hardware facilities. It is also indispensable to increase input in soft environment to achieve the purpose of emission reduction.

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