International Journal of u- and e- Service, Science and Technology
Vol.9, No. 7 (2016), pp.173-186
http://dx.doi.org/10.14257/ijunesst.2016.9.7.18

General Equilibrium Management of Regional Industrial Structure, Ecological Resources and Population Resources: A Case of Henan Province

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Abstract

Considering the imbalance of the economic development, ecological and social resources in the management of economic development, in this study, a general equilibrium is designed to find out the general relationship among those three resources. This research is based on the historical data of Henan Province. And the result will show how social demographics and ecological resources restrain the adjustment of industrial structure reversely. With the view of macroeconomics in general equilibrium theory, this research will dig out the regular existing in variables and draw the diagram explaining how they link with and restrict to each other. In the sample area, the research will give some personal suggestions for economic development management, including, perfecting the planting structure in primary industry, strengthening the resource utilization of the secondary industry, and taking appropriate mitigation measures to the development of the tertiary industry. The results of this study can provide some characteristic thoughts for sustaining economic development.

Keywords: *industrial structure; ecological resources; general equilibrium; coordinated development; sustainable economy*

1. Introduction

Industrial structure and economic growth are highly correlated, and the adjustment of industrial structure has a significant effect on the ecological resources [1]. Whether the change of ecological resources can improve the industrial structure? With the acceleration of the industrialization process, the proportions of the three industries' output value in China from 44.0%, 26.1% and 29.9% in first Five-Years Plan period has been adjusted to 10.2%, 46.8% and 43% in the eleventh Five-Years Plan period. Although the secondary and tertiary industries have been steadily improved, the industrial structure development is still imbalanced. The development of the regional economy in China's Eastern Coastal Regions with developed tertiary industry, the Northeast Regional Industrial Clusters, the Central Plains Economic Zone and West Economic Zone, where the proportion of industrial output structure is similar with the overall development of the country, still suffered varying degrees of obstruction, due to the weaken of other resources, and business and people's ignorance. Similarly, some adjustments of the regional industrial structure have lead to the rapid growth of the economy and the collapse of the biosphere beyond the carrying capacity and ecological environment and system is ultimately broken down. Thus, they caused the collapse of the entire economy. Known from the phenomenon, economy can't be developed without the adjustment of the industrial structure [2]; secondly, the economic growth can affect and depend on its composition environment, demographic factors and ecosystem [3]. Only by searching the coordinated degree of economic development, ecological resources and the development of human society, can we achieve a qualitative leap of the sustainable economic development.

ISSN: 2005-4246 IJUNESST

Herman (1997) considered that people should use qualitative improvement style of economic paradigm (means "development") instead of the amount of extended style of economic paradigm (means " growth") as the future path of progress, he thought that only the growth without development can be achieved sustainable development [4]. This study is committed within the scope of the existing quality population-based society, and to explore the ecological footprint and the industrial structure in the trajectory of economic development. Although the economic development and ecological footprint has been mentioned by many researchers, but most articles just stopped at the economic output, such as the importance of the ecological environment was referred and economic development also need to take into account it, few studies have deepened into the level of the industrial structure in economic development, and have an interaction study to its environment. This exploratory research takes the emerging area of central China as the study range, and takes the region with a typical representative of Henan Province as the research object , combined with its total population characteristics, to dig out the potential link among the area of economy, ecological resources and social demographic, to analyze the equilibrium process in the economic development process of the industrial structure, social demographic and ecological footprint more deeply, to provide the reference for the coordinated development of the similar region.

Taking Henan as the case, the characteristic of this sample is that natural resources are not abundant, as our country's the first largest agricultural and populous province. Henan's total GDP has been ranked the top five in the whole country and the first place in the rise of central China area for several years. The primary industry has been the pillar industry of Henan for a long time [5]. With the promotion of agricultural modernization and the regional industrial structure adjustment, there is a large number of the idle labors appeared in the area [6]. While the proportion of the secondary industry being more than 45% and the serious lagging tertiary industry are unable to absorb the surplus labor[7-8]. Therefore, the province showed the slow development and imbalance economic development. This paper is based on ecological footprint system, and divides units to butt joint our three industries precisely, and use the physical indicators of structure to replace the broad concept of the economic development. Then by extracting the consecutive 11 years' GDP statistics of the sample area, the research calculated and analyzed changes of the province's industrial structure in ecological perspective, as well as the extent of the usage in nature and social resources, and put forward targeted solutions and suggestions.

2. Literature Review

Regional industrial structure is the key factor to affect the regional economic growth and an important sign of a regional economic development [9], each region's suitable proportions of industrial structure are still in dispute state. Denison (1976) analyzed the historical economic data in the United States from 1929 to 1957 and derived that 12% of economic growth is caused by the changes of industrial structure [10].Similarly, Kuznets (1985) thought that 10% of economic growth is caused by the changes in the industrial structure after analyzing the economic data in the United States from 1948 to 1966 [11]. And Chenery (1960) proposed the most extensive model of industrialized economic growth which support that the rapid growth of the secondary industry can get the optimal allocation of resources and this has been widely recognized (Sacks, 1972; Ueno, 1972; Lee, 1981; Beason & Weinstein, 1996). But Gregory & Griffin (1974) denied industrialized model by solid evidence and pointed out that if there is in a high per capita income levels, the rapid growth of the tertiary sector will reduce the scale elasticity of the tertiary industry. Liuwei (2002) found that although China's economic growth is mainly driven by the tertiary industry, the expansion of the tertiary industry structure will reduce the positive effect of the economic scale which comes from the primary and secondary industries. And he pointed out that simply relying on the expansion of the tertiary

industrial structure will ultimately put the economy into a recession situation [12]. Through researching and analyzing the basic situation and variation trend and evaluating each industrial competitiveness as well as the proportional strength of the existing situations to identify industries with relatively competitive advantage as a regional leading industries, and then to determine the reasonable direction of the regional development of the future industries.

Although there are a few researches between ecological resources and economic growth, but there are some limitations and indirections. Ree (1992) divided ecological footprint into three categories, the land for providing natural resources for human society and economic development, and the land to be used for human emissions of pollutants, and the land required directly for human habitation and life [13]. Base on these researches, the existing research problems are to be summarized as follows. Firstly, it is a little bit one-sided that using of a single assessment of regional ecological footprint, ignoring the impact from demographic factors and other aspects of the industry structure. Monfreda *et al.*(2004) through literature review found a large number of ecological footprint evaluation results are too pessimistic, and the results showed that except for a small number of countries and regions, most of the conclusions were ecological deficit, the results could not make an objective and comprehensive evaluation combining local economic development and natural resources [14].Secondly, environment and economy is a pair of contradiction to affect the sustainable development. Numerous studies have confirmed that the level of economic development and the ecological footprint come to a negative correlation, that is to say, the more undeveloped regions are, the lower the living standards of the people have, the stronger economic sustainability is. Zhang *et al.* (2001) researches on China's 12 provinces showed that underdevelopment of Yunnan and Tibet is ecological surplus and to arrive at the sustainability of its development is the strongest [15]. This is just not consistent with the theory of sustainable development, and the theory puts out that poverty is the biggest non-sustainable and the primary task of sustainable development is economic development, and only through the development of the economy can we eliminate or reduce the mismatch between the subsystems. The difference of the two perspectives which need to find a development point which is not only good for economic development but also the minimal impact on environment urgently is also one important part this research.

There are many researches in the ecological resources and industrial structure; most of them adopt to analysis the relationship with the methods of STIRPAT, EKC, VAR, Decoupling, and IRF, which employed in the ecological footprint as a norm in these researches (Helmut Habel *etc.*,2001; Karl Heinz Erb., 2004; MathisW. *etc.*, 2004; Yangyan, 2009; Zhang Lifeng, 2010; Zhao Xingguo, 2011). Because of the importance of the norm of the ecological environment, the reviews find some query in research: Firstly, because the division standards between the ecological footprint and three main industries are different, the research of the combination of ecology and industry is misery. If the researches just adopt the standard of division of the ecological footprint to divide the industry into the primary industry and the secondary industry, the results may miss the tertiary industry [16-17]. Secondly, scholars just adjust the industrial structures in one side and hope it can have influence on the economic, what's more, scholars want to realize the goal of the partial equilibrium of economic through the partial adjustment of ecological environment, but they have little research on general equilibrium theory, which describes that the stability of macro economy and the coordination degree are direct ratio, and the ignorance of ecological resources and the population make the changes indifference (Walras,1873; Van Kooten *etc.*, 2000; Hossein Razavi, 2002; Xu Chuanyang, 2006; LuChao, 2008; Wang Jianjun, 2010). That is to say, existing research does not realize the actual general equilibrium.

3. Research Methods

3.1. Ecological Resources Calculation Methods

The research used the synthesis to measure the area of ecological footprint [18-19], and also took the method of Van(1999) [20]which refers to the conversion of production area and the method of Erb(2004) [21] which put up with the concept of Actual Land Demand. In this concept, the research used the average production in the world to replace the production of creatures in district, and used the related figures in the district research to replace the equal factors and coefficient of productivity. The system of research calculation includes the production of the ecological footprint [22] and ecological capacity [23].

3.1.1. Production of the Ecological Footprint: The definition of production of the ecological footprint:

$$EF_P = EF_{PB} + EF_{PC} \tag{1}$$

In the formula of (1), EF_P stands for Production of the ecological footprint; EF_{PB} stands for the needs of acreage for producing district materials and it expressed by:

$$EF_{PB} = \frac{P_B}{Y} \times EQF \tag{2}$$

In the formula of (2), P_B means the harvest of the production of materials; EQF means the equivalence factors of the using of all kinds of lands in current year; Y means the average production of the world materials in current year; EF_{PC} means the acreage for taking in carbon dioxide that produced by the activities and it expressed by:

$$EF_{PC} = \frac{P_C \times (1 - S_{ocean})}{Y_C} \times EQF_C \tag{3}$$

In the formula of (3), P_C stands for the amount of carbon dioxide in a certain district; Y_c stands for the average absorptive capacity of the carbon dioxide in the world; EQF_C stands for balanced factors of lands used by absorbing carbon dioxide (it equals to the equivalence factors of woodland). S_{ocean} stands for the amount of carbon dioxide that absorbed by ocean, Monfread's 1/3 coefficient is employed in this research.

3.1.2. Ecological Capacity: Ecological capacity means the total amount of ecologically productive area that a district can afford for human beings, it includes farmland, grassland, woodland, and fishery land (including inland waters and ocean) and construction land (such as the land for water construction and the land for infrastructure).

$$EC = a \times YF_L \times EQF = N \times \sum a_j \times EQF \times YF_L \quad (j=1, 2, 3,\cdots, 6) \tag{4}$$

In the formula of (4), a means acreage of the using land in a district; N means the population; j means the types of biological productive land; a_j means the average acreage of the biological productive land; YF_L means the yield factors of land use, production factors is the ratio between the average biological productivity of land in nation or region and the average biological productivity of similar land in the world.

3.1.3. Ecological Deficit: When the ecological footprint deducts ecological capacity, it will be the difference, if the difference is positive value, then we can know the natural resources which is hold by human is more than the resources that can be afforded by the ecological system, it calls Ecological Deficit; on the contrary, if we use the trade or the future resources to make up for the human, the difference will be negative value , and the

negative value means the natural resources that hold by human are allowed in the ecological system , that is the state of sustainable development , in other words , it calls Ecological Surplus.

$$ED = EF - EC \quad (5)$$

3.1.4. Evaluation of the Equivalence Factor and the Yield Factor: The equivalence factor is related to the accuracy of the results directly. Because of the different countries and regions have different types of land, the equivalence factor is different. In China, the south and north, the east and west, have big differences in industrial structures, weather and topographic features. So, when calculating the ecological footprint in Henan, the research should not adopt the standard of equivalence factor that used by the international countries or China, and should find the proper equivalence factor for Henan province under the condition of NNP and the features of natural resources. Liu Mocheng's research about the equivalence factors in Henan is employed in this text [24], the research is expressed in the following chart:

Table 1. Evaluation of the Equivalence Factor in the World

Types of Land	Wackernagel	WWF	Wackernagel	WWF	Liu Mocheng(2010)	
	2001	2002	2004	2005	China	Henan
Farmland	2.17	2.11	2.19	2.39	1.74	1.81
Woodland	1.35	1.35	1.38	1.25	1.41	1.05
Grassland	0.47	0.47	0.48	0.51	0.44	0.64
Water Area	0.35	0.35	0.36	0.41	0.35	0.5
Building Land	2.19	2.11	2.19	2.39	1.74	1.81
Energy Land	1.38	1.35	1.38		1.41	1.05

Source of Data: WWF and the Arrangement of Related Articles [25-26]

This research adopts the static quantity factor which is received by comparing the yearly production of food and fruits in Henan and the world. So the authors know the yield factor of farmland and garden land is 1.66, and for being changed from the farmland, the yield factor of construction land decides the yield factor of the farmland [27]. The yield factor of other types of land is [28-29]: grassland is 0.19, woodland is 0.91, water area is 1.

3.2. General Equilibrium Theory

General equilibrium theory (Walras, 1874) regarded it as a regular that a general equilibrium of the whole economic system showed that all the commodities in the markets had reached equilibrium at the same time. Through the analysis of the numerical simulation on the general equilibrium of economic system, the theory could reflect the fundamental mechanisms of elements deciding the allocation of resources and income distribution in a market. After that, many economists threw themselves into the general equilibrium theory applied to the actual economic analysis. Varian (1990) had proposed Pareto Efficiency in the framework of general equilibrium theory, which had made a significant contribution to the research in path analysis of efficiency equilibrium and equity. The general equilibrium theory has transformed the description of the economy from an abstract theory into the image of the real economy, which can truly evaluate the comprehensive influence of all kinds of shocks facing to the economy by using the theory for numerical analysis to the real problem (Shoven&Whally, 1984).

But it had posed challenges for equilibrium theory that it had been ruled out by general equilibrium theory that economic resources had not gotten a sufficient utilization which was the core content in the Keynesian macroeconomic theory. A branch inspired by Location Theory in later research, Losch(1939) published Spatial System Economics

(named The E-economics of The Location in the United States in 1954), which made the researches of the structure of the region no longer as established by applying the general equilibrium theory to space description in the most general description, from local equilibrium to general equilibrium. Since then, general equilibrium theory can be used to evaluate the regional economic sustainable development at this stage including the economic targets and natural resources, and the activity of human closely activities, analysis the partial equilibrium by damaging the interests of the other industries, and even the economic behavior exceeding expected. And that is the reason why these researches choose the general equilibrium theory to explain the relationship between the economy, the natural and the related industry of human being.

3.3. Resources of Data

By arranging Statistical Yearbook of Henan Province in 2000-2011, every year data of FAO, the Living Planet Report and National Natural Capital Accounting with the Ecological Footprint Concept, the research gets those data. And through the analysis of Wackermagel's standard about the conversion between the land of fossil fuel and the land of energy, this research learn about the condition of the amount of creatures and per capita consumption.

4. Finding

The Central Plains Economic Zone (CPEZ), as a centralized of Henan, is developed into the 12th Five-Years Plan in China. The strategy is that Henan is the foundation of food and modern farm; it will create a way that will not sacrifice farm, food and ecology, environment, so that it can set a good example for the development of industrialization, urbanization and agricultural modernization. But under the condition of large population and limited natural resources, it is the only way to find the balanced point through the ecological resources, the development of economic and the industrial restructuring.

4.1. Variation Tend of Ecological Footprint during the Development

The researches make the units of ecological footprint system, which are farmland, woodland, grassland, waters, building land and energy land [30], corresponding with the division standard of Chinese companies. The primary industry includes plough, woodland, meadow and waters, and the secondary industry includes industry and construction business, in addition, the tertiary industry includes transportation realty industry and so on. These three parts cross-occupy the building land and energy land of ecological footprint system. Consulting the figure of the Ministry of Land and Resources of PRC and national economic census, this text divided the land for construction and energy land based on the proportion of resident and mine land and transportation construction land. After getting rid of the ecological footprint consumption, the researches decompose kinds of ecological resources into three major industries according to different proportions. So the time table of three major industrial ecological footprints after transformation is born. As shown in Table 2.

Table 2. Time Table of Three Major Industrial Ecological Footprint units: hm^2/cap

Project/year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
The first industry	0.91438	0.9275	0.95271	0.99363	0.95423	1.05745	1.14496	1.25398	1.13466	1.19805	1.21983	1.23966
The second industry	0.36658	0.40365	0.44081	0.65757	0.74197	0.91673	1.05926	1.27605	1.51787	1.61036	1.75299	1.83305
The third industry	0.00623	0.00639	0.00679	0.00735	0.00869	0.01364	0.01477	0.01794	0.02123	0.0229	0.02379	0.02541
Annual total ecological footprint	1.2872	1.3375	1.4003	1.6586	1.7049	1.9878	2.219	2.548	2.6738	2.8313	2.9966	3.0981
Annul ecological carrying capacity	0.2859	0.2846	0.2837	0.2936	0.29	0.3181	0.3175	0.3136	0.3153	0.3219	0.3191	0.3226

It is consistent with the recent studies from the proportion of industrial structure. LuChao [31] adopt the shift share analysis method to calculate the five regions of Henan, and Xu Chuangyang [32] adopt the methods of comparing the labor productivity to calculate the industrial efficiency of Henan. They concluded that the primary industry is too large in the overall development of Henan, the second industry has been developed and the tertiary industry is the serious lag actually.

As shown in Table 2, the industrial structure of Henan from 2000 to 2011, the GDP of the primary industry has tripled, but it has dropped from 23% to 14% in the total GDP, the ecological footprint occupation has dropped from 71% to 40%, which means the availability factor of the primary industry remarkably improve. This prove that in the past 12 years, even through Henan's primary industry is no more the biggest industry, and the total amount of the use of resources has dramatic decline, its total still preserve its dominant position in our country depending on the increase of energy usage. This is in accord with the policies，which are advocated by CPEZ, "Concentrate on building the core area of food production，consolidate and improve the importance in nation's commissariat safety." And "Develop high-yield, high-quality, efficient, ecological, safety of agricultural." The province is changing into the agricultural strong province with the steady increase of agricultural output from the original big labor-intensive agricultural province [33].

In 2011, the total GDP of the secondary industry is five times that of 2000 in Henan. The proportion of GDP was increased significantly from 45% to 57%. During the process of economic development, the second industry has greatly improved in quantity. But resource use efficiency does not increase, the second industry ecological footprint was increased from 28% to 59%, while the ecological footprint promoted from 0.36658 hm^2/cap to 1.83305 hm^2/cap, which has been five times of the past. The change shows that the high speed development at this stage is to get through a large amount of waste of resources in secondary industry.

Although the tertiary industry reached 2.4446 trillion Yuan in Henan in 2011, which is 4.14 times that of 2000, the proportion of GDP in Henan province was from 31% down to 29%, the ecological footprint is increased from 0.48% in 2000 to 0.82% in 2011, while the total ecological footprint is increased by 4.08 times. This fully shows that the development speed of the tertiary industry is lower than the overall speed in Henan, and it lose its advantage in GDP total of Henan province, in addition, its eco efficiency does not have a corresponding increase, so there is still large room for the tertiary industry to improve.

4.2. Variation Trend of Natural Resources During the Development

Relative to the expansibility of the industrial structural adjustment, natural resources are limited [34]. The size of ecological footprint is positively associated with the development degree and total resources, and is negatively related to the utilization rate of resource and eco efficiency, it's also subject to the total resources (Senbel M *etc.*, 2007Dietz Thomas *etc.*, 2007; Shi Haixia *etc.*, 2013; Zhang Chuanke, 2013). The results show that the ecological capacity considerably less than the ecological footprint of Henan

Province, the natural environment is in the state of ecological deficit. In Table 3, the amplification of ecological footprint reached 241.82%, while the amplification of ecological carrying capacity is only 112.84%, consistent with the findings of other scholars, the demand to the natural environment exceeds the supply natural can provide. Congregated various types of ecologically productive land in Henan Province, and quantify the production and living needs of the natural ecological system from the macro, the researcher can calculate the average value of ecological footprint and its proportion in Henan, shown in Figure 1.

(1) Farmland: the ecological footprint of farmland is positive value which variation range is from 0.58 hm^2/cap to 0.77 hm^2/cap. But it ratio is declined in the state that the proportion is from 45% down to 24%. It is not difficult to find that the annual production is in a state of positive growth, and compared with 2000, it increased to 157.90% in 2011. This proves that the farmland is in weak sustainability during this period of time, there are some remaining biological capacities to support future growth of the ecological footprint.

Table 3. Ecological Footprint Per Capita Time Series Change Table
units:hm^2/cap

Project/year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
farmland	0.58217	0.59242	0.60017	0.62603	0.57827	0.65843	0.70895	0.76539	0.71222	0.74299	0.75436	0.76663
woodland	0.01908	0.01782	0.0187	0.01814	0.00402	0.00444	0.00389	0.01168	0.00827	0.00959	0.00751	0.00982
grassland	0.2559	0.25427	0.27219	0.27918	0.29619	0.31487	0.33645	0.36371	0.27739	0.28994	0.28857	0.28441
waters	0.05296	0.05845	0.05677	0.06496	0.06947	0.07576	0.09122	0.10786	0.13057	0.14895	0.1625	0.1714
Building land	0.00811	0.00873	0.00983	0.01093	0.01341	0.01663	0.01899	0.02114	0.02691	0.0292	0.03029	0.0337
Energy land	0.3805	0.4183	0.456	0.674	0.7609	0.9402	1.0851	1.3088	1.5537	1.6478	1.7926	1.8745
Total ecological footprint	1.2987	1.35	1.4137	1.6732	1.7222	2.0103	2.2446	2.5786	2.7091	2.8684	3.0358	3.1405

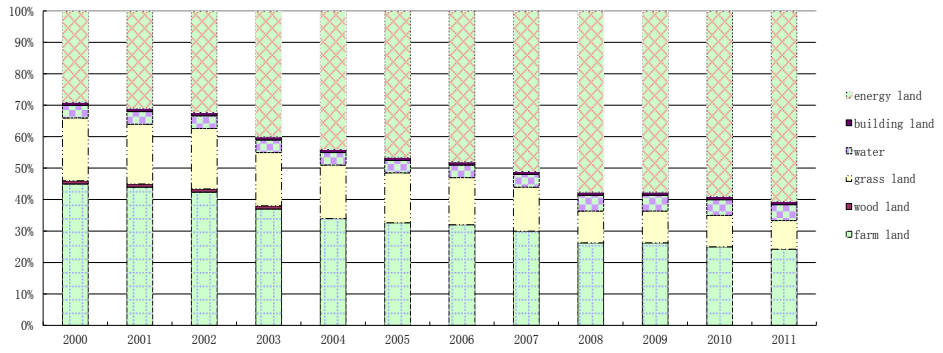

Figure1. Proportion of the Ecological Footprint Per Capita Units: %

(2)Woodland: In recent years, associated with the forest plating and urban greening in Henan, the forestry resources construction had twice increases in 2005 and 2009. The per capita forest ecological footprint declined from 0.0190 hm^2/cap in 2000 to 0.0098 hm^2/cap in 2011, but forestry ecological carrying capacity increased from 0.0049 hm^2/cap in 2000 to 0.0072 hm^2/cap in 2011. Indirectly prove that Henan is non forestry province, and support a larger space for future ecological carrying capacity growth in the area.

(3)Energy land: the proportion of energy land in ecological economy from 0.38 hm^2/cap in 2000 up to 1.87 hm^2/cap in 2011, its increase reached 60%, and the total is up to 498.11%, it's the largest increase in the accounting. It suggests that the change of Henan's production structure has a direct connection with the amount use of raw coal, steel products and cement, in addition, it prove the fact that Henan Province develop rapidly in the construction industry in recent years. Then this case can prove that the part of the ecological occupation has exceeded the limit of ecological carrying capacity.

(4)Building land: building land per capita ecological footprint has increased from 0.008 hm^2/cap to 0.337 hm^2/cap, the increase reached 42 times, but the total ecological footprint proportion has been maintained at about 1%. It's in the state of relatively stable, which shows that building land has strong sustainability and the certain development potential.

Relating to the rapid increase of ecological footprint, the change of ecological carrying capacity per capita is too moderate. As shown in Table 4, the two types of lands, waters and land, the variation tendency of them are both unclear, since the water area increased from 388,300 hectares to 473,300 hectares in 2006, it keep no change for many years; the proportion of grassland is lower, and its ecological carrying capacity is almost zero. While the change of farmland, woodland, building land and energy land in the past 12 years is very clear. Although the carrying capacity is increasing year and year, which mainly come from the woodland and building land, but its increase is much lower than ecological footprint.

Table 4. Time Change of Per Capita Ecological in Henan Province
units:hm^2/cap

Program/Year	2000年	2001年	2002年	2003年	2004年	2005年	2006年	2007年	2008年	2009年	2010年	2011年
Farmland	0.2185	0.2177	0.2172	0.227	0.2234	0.2451	0.2438	0.2425	0.2413	0.2413	0.2389	0.2413
Grassland	0	0	0	0	0		0	0	0	0	0	0
Woodland	0.0049	0.005	0.0047	0.005	0.0053	0.0056	0.0061	0.0038	0.0066	0.0067	0.0069	0.0072
Energy land	0.0213	0.021	0.0209	0.0208	0.0207	0.0266	0.0264	0.0263	0.0262	0.0326	0.0323	0.0326
Water Area	0.0021	0.002	0.002	0.002	0.002	0.002	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024
Building land	0.0013	0.0012	0.0016	0.0019	0.0018	0.0021	0.0023	0.0022	0.0027	0.0027	0.0029	0.003
Land	0.038	0.0375	0.0373	0.0371	0.0369	0.0367	0.0365	0.0363	0.0361	0.0361	0.0357	0.0361
Ecological capacity	0.2859	0.2846	0.2837	0.2936	0.29	0.3181	0.3175	0.3136	0.3153	0.3219	0.3191	0.3226

4.3. Population Resources Trends in Development

The adjustment of industrial structure can be extended, but the population resources are infinite [35]. So the researcher should improve the efficiency and the coordination of factors in the condition of the limited resources and existing population, the improvement can make a good foundation for the economic and the sustainable development of environment in Henan. What's more, it makes the resources of population helpful to the economy and natural environment. Henan has a large population, which has reached 9.967 millions of people and growth rate of population reached 106.18% in 2010. Although far lower than the 241.82% growth in the ecological footprint, and the large population, the high difficulty in the adjustment of population structure and Henan is not rich in natural resources. And it is not feasible to get the foundation of the development of economic only depending on ultimate resources and import. By calculating the correlation coefficient of Henan province population and the ecological footprint, we get that the correlation coefficient of Henan's population and ecological footprint is 0.9785, and the correlation coefficient of Henan's population and ecological carrying capacity is 0.9000, which is a highly positive correlation, so the total quantity control of population is still the future focus of the work in Henan province.

Excepting the stabilize scale, the population structure and the concepts are also needed to adjust. It is proved that the scale of population is proportional to the labor and the population structure has main effect on the quality of labor [12-36]. The change of industrial structure has effect on the unemployment rate and employment structure, which will affect the adjustment of the labor structure and the scale of the population. Since the adjustment of industrial structure in Henan in 2000, the primary industry has a large number of idle labors, which flows to the coastal areas of our country or some big cities in Henan. Due to the non-synchronous of the secondary industry and tertiary industry, the

emergence of the frictional unemployment happens. Vocational education becomes a necessary industry to improve urban competitiveness, social stability and people living. And residents have a weak awareness in the production, life and resource conservation and green consumption. So for all these reasons, it is a big struggle for the large population and ecological resources shortage areas. Therefore, cultivating and affect residents' subconscious level education, green production and green consumption are the necessary basic work.

4.4. Correlation Analysis Between the Marketing

Through the analysis, we can know that the six big resources and industrial structure are respectively connected with the ecological footprint and ecological capacity, see Table 5. In the table shows that energy ecological footprint of farmland, water, building land and energy land are always more than 0.9, so do the ecological capacity of them, this is a positive correlation. Only the woodland ecological footprint is negatively related to the total ecological footprint and the total ecological capacity.

Table 5. Correlation of Henan Ecological Footprint and Industry

Types	Single ecological footprint		the correlation with Single EF and total EC
	the correlation with Total EF	the correlation with Total EC	
Farmland	0.950565	0.912319	0.972483
Woodland	-0.55454	-0.68549	N/A
Grassland	0.380426	0.538246	0.654303
Water Area	0.973472	0.827561	0.801209
Building Land	0.988847	0.885698	0.904879
Energy Land	0.99749	0.8989	0.904856
The first industry	0.9699	0.8433	
The second industry	0.9857	0.8561	
The third industry	0.989	0.8577	

EF means ecological footprint, EC means ecological capacity

Thus, it can be seen that increasing the farmland, grassland and water area, strengthening the construction of public energy facilities of concentration. Increasing forest products plays a positive role on the improvement of ecological environment. The main three industries and the ecological footprint and ecological capacity are also present a positive correlation. That is to say, the economy development and resource usage are directly related to the size. In the sustainable development of the environment, improve the efficient use of resources on the condition that reducing the ecological footprint and does not affect the pace of economic development has become a key.

4.5. General Equilibrium Proposals of Economic Structure

Above all, there is a positive correlation between the each two factors in view of Henan region of each economic development, the use of natural resources and population. The managers should taking the advantage of characteristics of the large population to the basic extensive publicity, and make full use of resources from the micro infiltration consciousness to popularize green concept step by step, see Figure 2.

Using the currency market as the region economy, so does the commodity market, the researches worked out the general equilibrium management structure of natural resources and the labor market representing the production and the life of people's equilibrium

sufficiently. The primary target of economy is the GDP of region in China (see top left corner of Figure 2), the balance of currency market is the point of i0. Crossing the 45° balance line (see top right corner of Figure 2), the balance point intersects with the labor market (the bottom right corner of Figure 2). Predicated on the assumption that the labor market and the currency market were balanced, the lines of current situation of natural resources in Henan (the bottom left corner of Figure 2) are adjusted dynamically. The balance point from currency market makes the ecological deficit. And the balance point from labor market makes the ecological surplus. On the balance intersected point in the natural resources in Henan, something must be done to enhance the ecological capability or reduce the ecological footprint, which means the general equilibrium management in three markets in sustainable way. Specific recommendations are as follows:

Firstly, pay attention to the adjustment of industrial structure in Henan Province. The fact that the primary industrial base and the large population indicate that reducing the proportion of primary industry is not an option. If we just improve the proportion of the tertiary industries, it will lead to intensified competition in the industry and more frictional unemployment [12]. Therefore, Henan's main industry adjustments supplement each other and there are different policies for different kind of industries and the orientation put forward in the basic of social employment stability and the premise of the most use of ecological resources. The managers should continue to maintain the stable development of the primary industry, at the same time, the government should also ensure the food supply and the survival ability, change the proportion of appropriate planting structure, strengthen forest construction, develop the second industry at a constant speed and improve the resource utilization, strengthen the wastes treatment ability, encourage the recycling economy and provide guidance to related processing and manufacturing enterprise construction economy, offer benign development space for the third industry, urge the third industry to develop in green ecological all-round development, which can form the benign economic development and recycling.

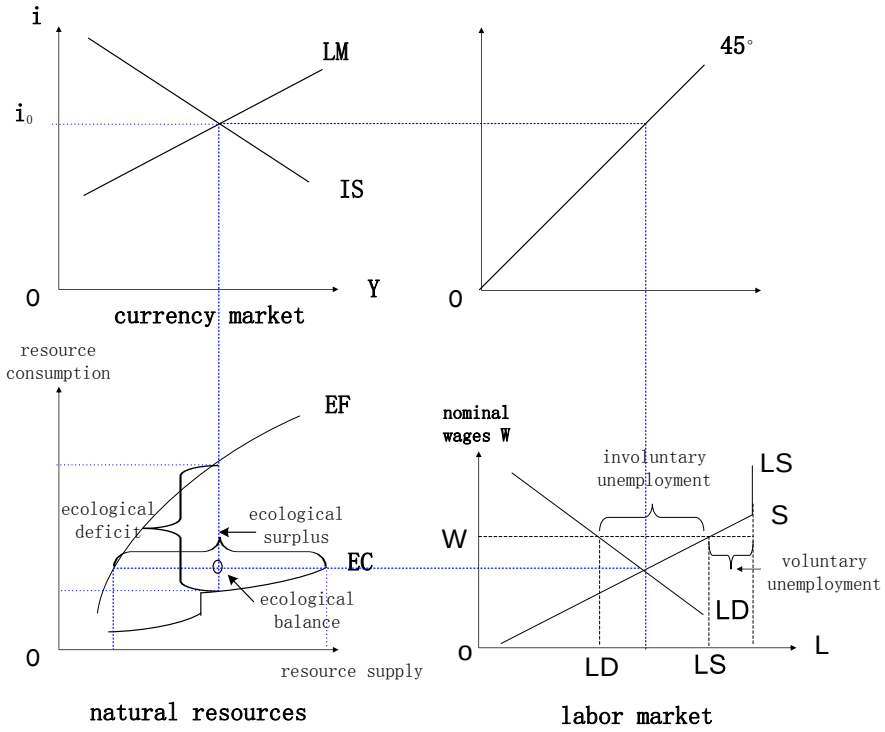

Figure 2. General Equilibrium Management of Regional Industrial Structure and Ecological Resources and Labor Market

Secondly, the managers should make full use of the large population base in Henan to popularize the sustainable industrial adjustment and enterprise sustainable idea. And the green concept should be strong, broad, and persistent in grassroots promotion and popularization. First of all, the government should encourage the construction of green ecological forest land and increase the forest product development, which bases on the effects of forest on ecological capacity. The green economy is the basic condition of the regional ecological environment, which can strengthen local ecological capacity. Secondly, the government should also improve the use of production and life of various resources based on the fact that the limited resources, study the domestic and foreign advanced recycling system and recycle mechanism, and make the best use of the existing resources. Finally, the government promotes and strengthens the green concept of enterprises and public, encourage green production, life and consumption. The concept of popularization of green economy and ecological protection can keep up for a long time on popularization; which will make full use of resources and all aspects of the implementation of sustainable development to the personnel training .This is the key to solve the balance between population and limited resources.

5. Discussion and Conclusions

During the period, the researches take Henan province as the research object, and find that there was a strong positive correlation relationship between industrial structure and ecological resources, in addition, the factor of ecological resource also affect and bound the adjustment of industrial structure.

The theoretical significance of this study is that the ecological resources and social resources will be bring to the index of economic development, and they and industrial structure adjustment will be both seen as the inner motive power of economic development. We will find that ecological resources can not only promote the development of economy, but also can become the shackles of economic development, which will turn focus on the general equilibrium and sustainable development of the industrial structure.

Its practical significance is that providing specific ideas and suggestions for the balanced development of the regional industrial structure, from a macro point of view, we make the policies should base on the local district of the existing ecological and social resources, in order to make the policy of industrial structure adjustment which will promote economic which can also lay the foundation for sustainable development. From the microscopic point of view, it can correct the one-sided understanding of enterprise and individuals to economic development and construct the ecological resource, society, population and the industrial structure adjustment’s comprehensive dynamic development.

6. Limitations and Future Research

Because of the limited time, the differences of the basic data and the standard, we have some mistakes because of the replacement of missing data and our speculation. The following studies can base on the idea of this text, combine with the specific application background to investigate and study the optimum collocation proportion of the three major industries.

Acknowledgments

This research was funded by Soft Science Project supported by Henan Science and Technology Agency (Grant No.162400410570, Named: Research on Tourism Big Data Development Strategy of Henan Based on E-government Cloud), and Innovation Team of

Philosophy and Social Science of Henan Colleges and Universities (Grant No.2012-CXTD-12).

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