Analysis on Spatial Pattern Changes of Land Resources Utilization and Soil Pollution Sources in the New Period

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Abstract. Land use change is an important part of global change, and land use research has also become the focus of global change research. With the growth of population and the economic development of society, the relationship between human beings and land is getting closer and closer, and the interaction is getting stronger and stronger. The resources and environmental problems brought by it have also received strong attention from all walks of life. The use of change has become a major factor in environmental change. At present, environmental problems have become the key link in ecological problems, and in environmental problems, soil pollution is one of the major sources of pollution. Soil pollution can affect crop yields and even contaminate groundwater, so soil pollution has always been a key link in pollution prevention. This paper introduces the connotation and related theories of land resource utilization change, and analyzes the formation and classification of soil pollution sources and the problems of land resource space utilization in the new era. On the basis of reviewing the status quo of soil pollution in China, this paper analyzes the risk analysis and damage of soil pollution, and studies the spatial and temporal pattern change of land use and soil pollution control countermeasures in the new period. In recent years, China's environmental problems have become increasingly prominent, including soil pollution is relatively serious, soil pollution has a certain uniqueness, relatively hidden, lagging and long-lasting, it will cause pollution to crops and food, which in turn affect people's health and soil pollution. Not only does it affect humans through crops, but it can also enter the human body through direct contact or breathing, causing harm to the human body. The research and analysis in this paper is to achieve the sustainable use of land resources in the new era and to ensure that people have access to adequate and safe food and living environment.

Keywords: Land use change; Temporal and spatial changes; Spatial pattern; Soil environment; Source of pollution.

1. Introduction
Land is the basis for human survival and the material security of social development. With the growth of population and the economic development of society, the relationship between human beings and land is getting closer and closer, and the interaction is getting stronger and stronger[1]. The resources and environmental issues have also received strong attention from all walks of life. Land use change has become a major factor in environmental change[2]. Research on the spatial pattern change of land
resource utilization has become a hot topic in recent years. Land use is essentially the economic activity of human beings to obtain material products and services through the combination of land, that is, the process of exchange and transformation of matter, energy and value between humans and land, and thus has the characteristics of simultaneous evolution with economic society[3]. The land itself has the “dual” attribute of resources and assets. Other economic and social factors can only enter the production process if they are combined with land use[4]. Land use change is mainly affected by the dual factors of nature and society. Natural factors include climate, hydrology, soil, geological landforms, etc. Social factors include investment in land, demand for land products, and degree of urbanization[5]. At the same time, land use change also affects the natural basis of human survival and development, such as climate, ecological processes, biochemical cycles and other global changes, as well as environmental quality issues such as regional food security and regional socio-economic stability. Soil is the material basis for sustainable economic and social development and an important part of human survival and development[6]. At the same time, with the rapid population growth and the rapid advancement of the social economy, the scope and intensity of land use by humans has also grown at an unprecedented rate, resulting in a series of major global environmental pollution problems such as various sources of pollution[7]. How to solve the spatial pattern change of land resource utilization caused by soil pollution problems and achieve sustainable strategic development has become an urgent problem to be solved today[8]. Therefore, studying land use change in the new era has far-reaching significance for studying global environmental changes and realizing long-term human development.

2. An Overview of the Relevant Theories of Spatial Pattern Changes of Land Resources Utilization and Soil Pollution Sources

2.1. The concept of land use change
Throughout the research results of land use change by many scholars at home and abroad, the land use change is summarized as follows: it is a most active and universal material and energy exchange that can occur at any time and space scale. The complicated process, it not only affects the production capacity and spatial distribution pattern of terrestrial ecosystems, but also mirrors the process of adaptation, utilization and transformation of nature and the temporal and spatial processes of the earth's land surface.

2.2. Relevant theoretical analysis
The theory of sustainable use of land resources stems from the theory of sustainable development. As a material carrier of social and economic development, land is one of the indispensable resource conditions for achieving sustainable development goals[9]. In the process of land use, the non-renewability of land resources determines the limited supply, which constitutes a special contradiction with the growing demand for land. Sustainable use of land resources from the perspective of resources, we must base on the sustainable use of resources; from a social point of view, we must use fairness as a basis.

From the economic point of view, it is necessary to take the rational development of the economy as the core; through scientific, efficient and optimal allocation of land resources, aim to obtain the best structure of social, economic and ecological benefits and realize the comprehensive benefits of land use. Maximize.

The theory of spatial dynamics is usually a description of the evolution process of the spatial pattern of a regional system and its system interaction and its feedback mechanism[10]. Specifically, it reveals spatial cognition and its behavior, spatial processes and structures. Through spatial cognition, it affects behavior, through spatial behavior to create spatial processes, and then through spatial processes to reshape spatial structure. Finally, spatial structure generates spatial cognition and individual spatial behavior through information feedback. influences.
2.3. Formation and classification of soil pollution sources
Soil pollution refers to the pollutants produced by human activities. It passes through various ways to lose soil. The quantity and speed exceed the speed of soil purification, destroying the natural dynamic balance, and gradually accumulating the accumulation process of pollutants. As a result, the soil is naturally dysfunctional, soil quality is degraded, and the growth and development of the crop is affected, as well as the decline in yield and quality.

The soil environment is an open system. The exchange of matter and energy between the soil and other environmental factors causes the source of soil pollution to be extremely extensive. There are natural sources of pollution and some are sources of pollution. Natural pollution sources refer to places where nature emits harmful substances or influences to the environment, such as active volcanoes; anthropogenic sources of pollution refer to sources of pollution caused by human activities. The latter is the main target of soil pollution research, and among these pollution sources, the pollution of chemical substances to the soil is the most concerned. The way in which pollutants enter the soil can be divided into sewage irrigation, solid waste utilization, application of pesticides and fertilizers, and atmospheric deposition according to the classified soil pollution sources.

2.4. Problems in the spatial utilization of land resources in the new era
In recent years, with the rapid development of social economy, large-scale construction and development of various regions, and the emergence of a large number of township and village enterprises, industrial and mining land has risen sharply, resulting in rapid growth of construction land, and most of them are from cultivated land near towns and villages. At the same time, with the continuous increase of the total population, the demand for land for residential use and transportation has been expanding, resulting in the conversion of part of cultivated land into non-agricultural land such as residence and transportation. Per capita arable land showed a trend of decreasing linearity, and the contradiction between people and land was more prominent (see in Figure 1).

According to the soil census data, more and more land resources are poorly grounded, land use is reuse lightly, heavy fertilizers are light organic fertilizers, lack of maintenance of land, imbalance of nitrogen, phosphorus and potassium in soil, and soil organic matter and total nitrogen The content is insufficient, and the soil fertility is declining. At the same time, with the rapid development of township enterprises and the changes in agricultural industrial structure, the industrial “three wastes” emissions and the use of chemical pollutants such as chemical fertilizers and pesticides are increasing, and the ecological environment quality of agricultural cultivated land is also Continuous decline. Moreover, the basic farmland protection indicators in some areas are too high and are seriously divorced from reality, which is much higher than the national standards (85%), and it is actually difficult to guarantee implementation. Non-agricultural construction land, especially urban and rural residential land, has soared, and the land use structure has not been adjusted in time, which has intensified the extensive use of land for rural residential areas.
3. China's soil pollution status and harm

3.1. Status of soil pollution in China
At present, China's cultivated land contaminated by heavy metals such as tin, arsenic, chromium and
lead is nearly 20 million, accounting for about one-fifth of the total cultivated land area; among them,
industrial “three wastes” pollutes 10 million hectares of cultivated land, and the area of sewage irrigation
has reached more than 330. Ten thousand hectares For example, a province has surveyed 2.59 million
hectares of cultivated land in 47 counties and suburbs (accounting for 2/5 of the province's cultivated
land area). The results show that 75% of the counties have been threatened by varying degrees of heavy
metal pollution. And the pollution trend is still increasing. Wastes such as sewage irrigation have caused
soil pollution in large areas of farmland. For example, after more than 20 years of sewage irrigation in
the Zhangshou Irrigation District of Shenyang, more than 2,500 hectares of contaminated cultivated land
have caused serious pot pollution, and the paddy field contains 57 mg of alfalfa. In the suburbs of Tianli,
23,000 hectares of farmland were polluted due to the quasi-irrigation of sewage. In the suburbs of X
area, 2,700 hectares of farmland were polluted by sewage irrigation. The soil was polluted by the
application of sediment containing sediment, and the contaminated area accounted for 46% of the
cultivated land area of the suburbs. A sample survey of a sewage irrigation area in the mid-1980s showed
that about 60% of the soil and 36% of the brown rice were contaminated (See in Table 1). On the other
hand, there are 13,013 million hectares of cultivated land in the country that are contaminated with
pesticides. In addition to the pollution of cultivated land, there are also soil pollution problems in
industrial and mining areas and cities in China.

Table 1. Effect of applying waste fertilizer on heavy metals content (mg / kg) in soil and rice

| Deal with                        | Cd  | Hg  | Cr  | Pb  | Ni | Cu | Zn |
|----------------------------------|-----|-----|-----|-----|----|----|----|
| Application of waste fertilizer soil | 1.5 | 0.07 | 12.0 | 82  |    |    | 92 |
| Control soil                      | 0.6 | 0.05 | 12.0 | 24  |    |    | 20 |
| Application of waste fertilizer rice | 0.033 | <0.008 | < 0.01 | 0.027 | 6.27 | 3.0 | 16.2 |
| Control rice                      | 0.007 | <0.008 | < 0.001 | 0.18 | 0.18 | 2.7 | 19.0 |
3.2. Soil pollution risk analysis and hazard

With the increasingly serious problems of soil and environmental safety at home and abroad, the soil area of different degrees of pollution has been expanding, and soil pollution has become a serious hidden danger to the quality and safety of agricultural products in China and even the world. In this context, in order to comprehensively and deeply study the impact of external pollutants on environmental quality and the degree of harm to humans, and to control and repair soil pollution, many countries at home and abroad have launched research on soil pollution at different levels. Many researches on pollution status investigation, risk assessment and macro-decision management have been carried out successively, and some research progress has been made. In general, various soil pollution studies focus on policies, regulations, economic and technical means, and microscopically focus on the internal mechanisms of soil pollution characteristics and sources, migration and transformation, and analytical techniques. Among them, the micro-scale soil pollution risk assessment of soil pollution health risk assessment and ecological risk assessment research as an important measure to effectively assess the degree of soil pollution and its suitability to human health, more and more cause the industry and the country and The local decision-making bodies are widely recognized and highly valued.

4. Analysis on the Change of Time-Space Pattern of Land Use in the New Period and the Countermeasures of Soil Pollution Control

4.1. Dynamic analysis of land use change

The land use dynamics index is a quantification of the dynamic changes in land use types, including single land use dynamics and integrated land use dynamics, which reflects the extent of local land use change, which simplifies the complex land use process. Comparing the differences in land use change in different regions and the prediction of future land use change trends in the region have a positive effect.

4.2. Dynamic simulation of land use spatial pattern

4.2.1. Land use demand model parameter setting. According to the characteristics of land resources in the new period, set decision variables: cultivated land \( x_1 \), garden \( x_2 \), forest land \( x_3 \), pasture \( x_4 \), other agricultural land \( x_4 \), formed town land \( x_6 \), rural residential land \( x_7 \), industrial and mining land \( x_8 \), special land \( x_9 \), traffic land \( x_{10} \), water conservancy facility land \( x_{11} \), unused land \( x_{12} \).

4.2.2. Determination of the objective function. From the current level, gross domestic product is generally used to reflect the value of the final product and service created in a region within one year. Therefore, here we seek to maximize the total output value, that is, the objective function is:

\[
f(x) = \sum_{j=1}^{n} c_j x_j \rightarrow \max
\]

When the spatial pattern of land use changes in a region, the relationship between land types will also change.

\[
c_j = \sum \min(D_k \times R_3) - (x_4 + x_5) (i = 1, 2, \ldots, n; k = 1, 2, \ldots, m)
\]

Among them, \( c_j \) is the land use type benefit coefficient, that is, the gross domestic product per unit area calculated according to the current year's price. The value is mainly determined according to the
land use status and natural economic characteristics. Finally, the land use structure optimization objective function is:

\[
\max f(x) = 1.8x_1 + 4.35x_2 + 2.99x_3 + 0.8x_4 + 0.002x_5 + 13.44x_6 + \\
1.18x_7 + 152.5x_8 + 0.001x_9 + 40.21x_10 + 0.42x_11 + 0.001x_12
\]

(3)

4.2.3. Results and analysis. The process of land use change is long-term, dynamic, and complex, and the causes of land use change are also diverse. After systematic analysis of the temporal and spatial patterns of land use, it can be found that although natural factors have certain restrictions on land use patterns, with the development of social economy, the interference of human activities on land use changes is gradually increasing. Especially for the study of shorter time scales, regional demographic changes, socio-economic development status, infrastructure construction and layout have become the main factors affecting land use change.

4.3. Prevention and control measures for soil pollution sources in the new era

4.3.1. Strictly control each pollution source. Controlling and eliminating sources of soil pollution is a fundamental measure to prevent pollution. That is to control the amount and speed of pollutants entering the soil, so that it slowly degrades naturally in the soil, and does not quickly enter the soil in large quantities, causing soil pollution.

1) Control corporate pollution and strengthen the control of harmful substances in products of heavily polluting enterprises. For industries such as chemical, paper, electroplating, and tanning, new or dismantling production facilities and pollution control facilities, it is necessary to formulate a plan for the cleaning and disposal of residual pollutants in advance, and report to the relevant local authorities for the record. Strengthen the treatment and comprehensive utilization of industrial waste, determine the list of key environmentally-regulated enterprises, and implement dynamic updates.

2) Control agricultural pollution and monitor the quality of irrigation water to meet the irrigation water quality standards. The sewage biological treatment system is established at the entrance of the irrigation water, and the purpose of controlling the agricultural soil pollution source is achieved through harmless and resource treatment. Reform the farming system to regulate the bioavailability of heavy metal elements such as chromium, lead and zinc by adjusting soil pH and Eh values. Rational application of various organic fertilizers can not only increase the soil organic matter content, improve soil properties, but also increase the adsorption capacity of soil colloids for heavy metals. Research on the manufacture and application of slow-acting fertilizers, reduce the use of plastic film and study recycling methods to reduce soil pollution. Techniques such as plant fixation, extraction and root filtration can also be applied to soil remediation, and plants can be screened to increase soil fertility, improve soil properties, and reduce pollutant content.

3) Reduce living pollution. Promote resource recycling and harmlessness through waste sorting and recycling; implement domestic sewage treatment, rectify informal landfills; strengthen safe disposal of heavy metal wastes such as used batteries, lamps, thermometers, etc.; reduce excessive packaging. Strengthen the science and technology and capital investment in soil pollution control, set up a group of specialized real-time monitoring institutions, develop a number of model bases with typical and exemplary significance, accelerate the transformation of scientific and technological achievements, and establish an administrative system for investigation, monitoring, prevention and treatment, and results supervision.
4.3.2. Establish and improve the pollution prevention standard system in the region. On the basis of complying with the relevant national legal standards, the rules and regulations applicable to soil pollution control in the region shall be formulated according to local conditions. Standards such as recycling of pesticide packaging waste, soil environmental management of plant land, and wastewater discharge standards have been issued. Establish and improve the determination of harmful substances in the soil, the inquiry of pollution sources and the division of key pollution areas. Pay attention to the principle of prevention, fines of polluters, principles of business closure, and principles of sustainable development, in order to achieve healthy and orderly development of agricultural soils in the region. The solution to soil pollution requires not only a tough attitude from the government, but also a public concern about soil pollution (see in Figure 2). In order to improve the environmental awareness of the masses, local governments should open up agricultural soil protection columns, explain the hazards of soil pollution, and expose pollution violations in a timely manner, so that information is transparent and open, accelerate the governance of polluting enterprises, and give full play to the public opinion supervision role of the news media.

Prevention and control measures of soil pollution sources in the new era

Control corporate pollution and strengthen control of harmful substances in heavy polluting enterprises
Control agricultural pollution and monitor the quality of irrigation water
Reduce living pollution, promote its resource and harmlessness, and recycle
Strengthening technology and capital investment in soil pollution control

Figure 2. Prevention and control measures for soil pollution sources in the new era

5. Conclusion

In summary, the rapid development of the economy, the rapid advancement of urbanization, and the unreasonable land use planning. The main manifestation is that the area of cultivated land has decreased sharply, the land for urban construction has increased rapidly, the use of land in the region has become more plaque and fragmentation, and the contradiction between people and land has become increasingly acute, directly threatening the sustainable development of the regional social economy and ecological security. Due to the large driving factors of land use change and the complex structure of land use change, the research on the mechanism, process and development trend of land use change, and determining the scientific and rational land use spatial pattern will be conducive to regional sustainable development. Development can enable decision makers to have a deeper understanding of the process of land use change, which is conducive to better integration with current land management work, and also provides a theoretical reference for the preparation of land use planning and the formulation of land use policies. However, in areas where population density is concentrated and the economy is more developed, soil pollution is becoming more and more serious. In order to predict and prevent the generation of soil pollution sources, especially the pollutants that directly or potentially threaten environmental pollution,
the migration process and its harmful mechanism in the soil system are studied. If the source and proportion of pollutants can be accurately determined, it is of great practical significance to carry out macroeconomic regulation and control of decision-making departments.

Acknowledgments
Project: 1: Shandong Province Higher Vocational Education Master Studio; 2: Shandong Vocational College Young Skills Teacher Training Program; 3: Shandong Vocational Education Teaching Reform Research Project Research on the Construction and Implementation of the Course Quality Assurance System of “Standard Leading, Classification Advanced, Diagnostic Reform” (2019029).

References
[1] Jun Du, Peiling Yang, Yunkai Li, et al. An Analysis on the Inter-annual Spatial and Temporal Variation of the Water Table Depth and Salinity in Hetao Irrigation District, Inner Mongolia, China. 2017, 344(3):155-177.
[2] Dimitris Dermatas. Waste management and research and the sustainable development goals: Focus on soil and groundwater pollution[J]. Waste Management & Research, 2017, 35(5):453-455.
[3] XU Kaipeng, WANG Jingjing, CHI Yanyan, et al. Spatial optimization and sustainable use of land based on an integrated ecological risk in the Yun-Gui plateau region. 2016, 36(3):821-827.
[4] E.I. Atuanya, W.T. Aborisade. Pesticide pollution status in cocoa plantation soil. Global Journal of Environmental Science & Management, 2017, 3(3):287-298.
[5] P. Liu, K. Wu, M. Luo. Evaluation of agricultural land soil heavy metal elements exceed standards and safe utilization zones. Nongye Gongcheng Xuebao/Transactions of the Chinese Society of Agricultural Engineering, 2016, 32(23):254-262.
[6] Kwadwo Owusu, Paul W. K. Yankson, Alex B. Asiedu, Resource utilization conflict in downstream non-resettled communities of the Bui Dam in Ghana. Natural Resources Forum, 2017, 41(2):243.
[7] Terekhova V A, Shitikov V K, Ivanova A E, et al. Assessment of the Ecological Risk of Technogenic Soil Pollution on the Basis of the Statistical Distribution of the Occurrence of Micromycete Species. 2017, 48(5):417-424.
[8] Nasrin Ansari, Mehdi Hassanshahian, Hadi Ravan. Study the Microbial Communities’ Changes in Desert and Farmland Soil After Crude Oil Pollution. International Journal of Environmental Research, 2018, 12(1):391-398.
[9] Virendra Singh. Energy Dispersive X-Ray Fluorescent Analysis of Soil in the Vicinity of Industrial Areas and Heavy Metal Pollution Assessment. Journal of Applied Spectroscopy, 2017, 84(2):289-294.
[10] Xu Jing, Jiali Yang, Tengfei Wang. Effects of Salinity on Herbicide Lactofen Residues in Soil. Water Air and Soil Pollution, 2018, 229(1):13-17.