Review on the Improvement of Human Settlement Environment Quality from the Perspective of Land Engineering

Siqi Liu 1, 2, 3, 4, 5, *, Junliang Zheng 1
1 Shaanxi Provincial Land Engineering Construction Group Co., Ltd. Xi’an 710075, China
2 Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd. Xi’an 710075, China
3 Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources. Xi’an 710075, China
4 Shaanxi Provincial Land Consolidation Engineering Technology Research Center. Xi’an 710075, China
5 Land Engineering Technology Innovation Center, Ministry of Natural Resources. Xi’an 710075, China

*Corresponding author e-mail: 4102090209@chd.edu.cn

Abstract. Green, healthy and sustainable is the theme of China's current development. The environmental problems caused by rapid urbanization and industrialization need to be solved. Among them, soil pollution is the most significant problem, which is also the most closely related to people's life and work. More and more scholars begin to pay attention to the problem of soil pollution, but there is still a lack of engineering methods to achieve the expected goal. The core of land engineering is the organic reconstruction of soil, through physical, chemical and biological remediation methods to achieve the optimization of soil structure, reduce or eliminate land pollution, to meet the different needs of people. Human settlement environment is a comprehensive study of urban problems. The author thinks that the essence of urban problems is land problems. Land economy, land environment and the social equity and justice decided by them are the main aspects that affect the development of human settlement. Through the remediation of contaminated land, the human settlement will be fundamentally improved. Land engineering has important practical significance for improving the living environment, and provides a feasible path for land ecological construction.

Keywords: Human settlement quality; soil pollution; land engineering; land consolidation.

1. Introduction
Land is an important resource base for human survival and development, and it is the key element of China's new urbanization development [1]. The development of urbanization is often accompanied by...
2. Human Settlement Quality and Land Engineering

2.1. The development and current demand of human settlement

The research on human settlement in foreign countries began in 1950s, and has become mature. It has experienced the early stage with the view of natural ecology as the core, the theoretical development stage of comprehensively quantifying natural ecology and human ecology, and the mature stage with the goal of realizing the sustainable development of society and environment. Since the beginning of the 21st century, the research on human settlement has been from theory to practice, focusing on the livability of cities, evaluation and optimization of human settlement environment, aiming to improve the overall level of human settlement [8-9].

The research on human settlement in China started late, and at present, it mainly focuses on the research on the evaluation and optimization of human settlement environment, and the discussion on the evaluation index system and evaluation method is mature. Some researched on the development of human settlement in China and abroad and the study of the living environment in metropolis and small towns greatly enriched the theory of human settlements environment [10-11]. In addition, domestic scholars mainly focus on the evaluation and theoretical optimization of the regional human settlement environment, aiming to find the problems and solutions to the human settlement [12].

In contrast with the abundant research results of the theory of human settlement environment, the lack of engineering technology methods is obvious. The original purpose of the establishment of human

the change of land use and the improvement of land system [2]. Land urbanization has achieved rapid growth in the scale of urbanization, but at the same time it has led to a highly tense relationship between human and land [3]. Soil erosion, land desertification and all kinds of "poisonous land" events occur frequently. According to the bulletin of national soil pollution survey in 2014, the over standard rate of survey sites reached 16.1%, which posed a serious threat to human health [4]. With the concept of green development put forward, the transformation from land urbanization to human urbanization, its essence is to change the development mode with land economic value as the core into the development mode with land ecological construction as the premise, and take the quality of living environment and people's living satisfaction as the important indicators to measure urban development.

Human settlement environment refers to all kinds of environmental elements of human living together, involving many aspects and levels of nature, economy and society. As an independent science, the science of human settlement originates from the theory of human settlement. Its purpose is to integrate nature and city, and systematically analyze the urban problems caused by rapid urbanization by using the theories of architecture, geography, sociology and ecology [5]. Wu pointed out that the human settlement environment is composed of human, nature, residence, society and supporting system [6]. Combined with the current situation of China's development, this paper puts forward the principles of improving the ecological environment, enhancing ecological awareness, using a variety of related disciplines and paying attention to the overall interests of society. The establishment and development of human settlement environment science is of great significance in the process of urbanization in China. It is constantly changing with the economic and social development and various ecological and environmental problems in China. In view of the different problems in different stages, we need to solve the problems with the help of different subject theories and technological innovation.

In the process of China's new urbanization construction, the focus of land urbanization reform is land itself. As land has multiple attributes such as nature, ecological environment, society and economy, it is often the place where social system, economic interests and ecological environment problems and contradictions are most prominent [7]. To a certain extent, the land problem is the reflection of human settlement, and the benign development of land is the key to guarantee the quality of human settlement. As a systematic subject to solve land problems, land engineering not only improves and supplements the science of human settlement in theory, but also makes innovation and exploration in engineering practice, which provides a set of feasible paths for land ecological construction and comprehensive improvement of landscape, forest, field, lake and grass.
settlement environmental science is to solve urban problems by using multidisciplinary achievements. On the one hand, it is not possible to make the mature theories and techniques of western scholar’s rigid. The research on human settlement environment science serves the development of urbanization in China. Due to the different social system and the development stage, the urbanization development in China is different from other countries and has distinct characteristics. The development of human settlement environment science should be closely combined with the development of urbanization in China, and research should be carried out in view of the problems existing in the transformation of land urbanization in China; on the other hand, the research on human settlements environment should pay more attention to its practical value and guide urban and rural construction through engineering technology. Therefore, taking land as the research object, it will be the key to improve the quality of human settlement environment to solve the urban problems such as farmland degradation, soil pollution and low efficiency of land use by engineering technology (Fig. 1).

Figure 1. The core and demand of human settlement quality research

2.2. The Connotation and Development of Land Engineering

In view of the lack of engineering technology support for land related disciplines and unable to meet the needs of urbanization construction in the new era, Han first proposed the concept of land engineering in 2013. The essence of the concept is to solve the land problem by engineering means, to change unused land into usable land or to make efficient use of the land, and the core of which is the organic reconstruction of soil mass. Through improving the ability of human beings to repair and control land, improve the efficiency of land use, and ensure the construction of land ecology and sustainable use of land resources [13]. Land engineering is a comprehensive and applied subject, which is of great practical significance to guide urban and rural construction. A complete discipline system has been established in the aspects of land resources survey, big data of land engineering, land regulation and land use and protection, and the optimization mechanism of the whole process of land development and utilization has been formed. Therefore, it is necessary to comprehensively apply land engineering method to solve the problem of regional land use and to realize the efficient and sustainable use of land resources [14]. Combined with the present situation of urbanization in China, land problems mainly involve three aspects: conversion of non-agricultural land, soil pollution and soil quality improvement [15]. In recent years, the innovation of land engineering and technology system has made fruitful achievements in solving land problems and promoting land ecological construction [16]. For example, through the combination of arsenic sandstone and sand to form soil for farmland, ecological treatment and land ecological construction in Mu Us sand area has been carried out to realize the transformation of sand into oasis. In Shichuan river area, Fuping county, Shaanxi Province, the core of soil-water governance to improve the ecological environment of Shichuan river and the quality of human settlement has been significantly improved.
3. Integrated Land Consolidation of Shichuan River in Fuping Section
The integrated land consolidation of Shichuan river in Fuping section is located in the south of Fuping county. Fuping county is located in the middle of Shaanxi province, the transition zone of Guanzhong plain and northern Shaanxi plateau. The project area is located at the gateway of Fuping county in the south, about 50 km away from the provincial capital Xi'an. The total length of the project is about 5 km, which is 1.5 km to the West and 3.5 km to the east of Jinlong bridge. The river course within the project scope is a natural riverbed. Before the implementation of the project, the Shichuan river basin had been cut off, the riverbed was exposed, the rocks were rippled and the weeds were overgrown, and even became a place for garbage stacking in the surrounding area (Fig. 2). Through the use of soil organic and inorganic reconstruction, "water soil" ecological restoration and multi-dimensional configuration of vegetation and other land engineering technologies, the comprehensive treatment of landscape, forest, field, lake and grass in the area of Shichuan river was carried out, which fundamentally solved the problems of farmland degradation, land pollution and inefficient land use, and made the Shichuan river reappear as a green bank with clear water (Fig. 3).

![Figure 2. The condition before land consolidation in Shichuan river](image1)

![Figure 3. The condition after land consolidation in Shichuan river](image2)

4. The Interaction between Human Settlement Quality and Land Engineering
Currently, in the key stage of China's urbanization transformation, the scientific research of human settlement environment needs to start from the nature of land problems, with the help of land engineering technology and methods to coordinate the relationship between man and land. From the strategic needs of human settlement and the research content of land engineering, the two have a high degree of agreement. This is mainly due to the multiple attributes of land, land environment can often reflect the regional human settlement environment, and the contradiction of human settlement environment construction is often concentrated on the land problem. Through soil organic reconstruction technology, soil improvement and pollution control are carried out, and land problems are rectified from the source, so as to realize land ecological construction. Based on the characteristics of multiple elements and levels
of human settlement environment, the comprehensive management of landscape, forest, field, lake and grass was carried out by means of land engineering technology, and the intensive and economical utilization and sustainable development of land were realized. In terms of content, land engineering is the supplement and improvement of human settlement environment and an important way to coordinate the relationship between human and land in the new era. The ultimate goal of land engineering is to improve the quality of living environment and people's living satisfaction.

4.1. Remediation of Soil Pollution
Soil pollution will cause direct harm to human health, and human activities are the main causes of defaced land, including industrial waste pollution, domestic waste pollution, construction waste pollution, agricultural non-point source pollution, soil erosion and other issues, which makes the land completely or partially lose its original use value and construction value. To prevent and control soil pollution and ensure the quality and safety of agricultural products, the safety of human settlements and ecological environment are the major strategic needs of rural revitalization and ecological civilization construction in China. By analysing the process and effect of soil pollution, the ecological health risk was evaluated, and the pollution type, degree and formation mechanism were found out. The organic reconstruction technology of soil is used to construct a good soil structure by means of replacement, compounding and increasing or decreasing. Change the existing form of pollutants in the land or the way of combining with the land, and reduce their transportability in the environment. In order to reduce the concentration of harmful substances in the contaminated land, physical, chemical and plant reconstruction techniques were used. Through the land purification, ecological environment can be systematically remediated including land resources, water resources, biological resources and climate resources. It put forward a practical path to improve the quality of living environment as a result.

![Figure 4. The practical method to realize human settlement quality improvement from the view of remediation of land pollution](image)

4.2. Multi Ecological Elements Land Consolidation
Multi ecological elements is an entirety. It is a spatial combination formed by the interaction of different types of ecosystems in a certain range under specific conditions. Land is the common carrier of these ecosystems. Taking the comprehensive management of land elements as a bridge, the various natural resource elements of mountains, rivers, forests, fields, lakes and grasses will be closely linked to enhance the regional ecological function, production function and living function. Land degradation, soil pollution control and land ecological protection should be managed in a unified way to effectively balance the relationship between utilization and protection of multiple factors. The near natural method
and ecological technology should be adopted as far as possible to reduce the disturbance to the environment. According to the different objects of land bearing, different degrees of damage and different stages, the land consolidation projects of various elements should be connected in a certain scale space to form an independent, interrelated and interdependent whole, so as to promote the gradual recovery of ecosystem service function and promote the regional ecological construction.

4.3. Big Data Application in Land Engineering

Obtaining the dynamic evolution data of human settlements is one of the important tasks in human settlements research [17]. The analysis of land environment evolution is an important part of the study of human settlement environment evolution. On the one hand, the development of remote sensing satellite image technology enables people to monitor the impact of human activities on the earth and the urbanization of the earth surface based on different spatial resolutions, and analyse the change trend of land use patterns and landscape patterns; On the other hand, through the establishment of a unified land engineering big data resource system, improve the ability of data support. Through systematic and comprehensive combing, we can find out the current situation of land resources, establish data resource catalogue, construct various land basic databases and special achievement databases, improve the construction and update mechanism, and realize long-term and dynamic monitoring of land environment.

4.4. Land Ecological Civilization

Land ecological civilization emphasizes the harmonious coexistence of human and land resources. Land is not only the carrier of natural environment, but also the carrier of social system and economic activities. Since ancient times, land civilization is an important part of ecological civilization. It is the process and history of the evolution and development of the Chinese nation on the land. Fertile land breeds the Chinese nation, which is the foundation of China's splendid culture. When the land lost its original carrying capacity, the ecological environment was destroyed, and the culture also declined. This is repeatedly proved by history. Human settlement environment is not only the sum of tangible environment, but also the sum of all kinds of non-material things, such as culture and art, residents' satisfaction and sense of belonging. In the high-quality transformation stage of China's urbanization, the non-material ecological elements can measure the good and bad of human settlement environment construction from the perspective of human feelings. The optimization process of human settlement environment is actually the collaborative development process of human settlement hard environment and soft environment. This coupling relationship has a high degree of fit with the development of land civilization. By improving the land environment, we can better protect the land civilization, which is reflected in the comprehensive improvement of nature, economy, society and culture.

5. Conclusion

This research analysed the connotation of China's new urbanization construction, starting from the transformation of land urbanization and land problems, analysed the significance of human settlement environment science to China's urbanization development, summarizes the development and practical needs of human settlement environment, and pointed out the current situation that the theoretical research results were rich, however, the engineering technology methods were lack. In view of this problem, this paper proposed to solve the urban problems such as farmland degradation, soil pollution and low efficiency of land use through land engineering, so as to improve the scientific system of human settlement environment. Taking the comprehensive treatment project area of Shichuan river (Fuping section) as an example, this paper expounded that the land engineering had carried out the integrated improvement of mountains, rivers, forests, fields, lakes and grasses as a whole. The treatment benefits based on soil environment are remarkable, and the quality of human settlements has been greatly improved. Land engineering is an important supplement to human settlement science and an important way to coordinate the relationship between human and land in the new era. The relationship between land engineering and human settlements can be summarized as follows:
(1) Based on the soil organic reconstruction technology, through the prevention and control of land pollution, the improvement of soil quality and the restoration of soil surface vegetation, the safe use of land and the safety of human settlements can be realized.

(2) Taking land consolidation as a bridge, the natural resource elements of mountains, rivers, forests, fields, lakes and grasses should be closely linked, and multi-objective trade-offs and coordination should be made to enhance the regional ecological function, production function and living function.

(3) The analysis of land environment evolution is an important part of the study of human settlement environment evolution. Through the construction of all kinds of land basic database and special achievement database, the construction and updating mechanism is improved, and the long-term and dynamic monitoring of land environment is realized.

(4) The coordinated development process of human settlement hard environment and soft environment has a high degree of agreement with the development of land civilization. By improving the land environment, we can better protect the land civilization, which is reflected in the comprehensive improvement of nature, economy, society and culture.

Acknowledgements
This work is funded by 2021 Shaanxi provincial innovation capacity support plan project - Spatial distribution characteristics and health risk assessment of soil heavy metals in urban fringe of southern Shaanxi province (2021KRM079).

References
[1] Yuan Fangcheng, Jin Yongguang. Current situation and future of land urbanization in the context of new urbanization [J]. Journal of Wuhan University (PHILOSOPHY AND SOCIAL SCIENCES), 2017, 70 (6): 120-131.
[2] Liu Jingzhang, Xia Tong. Land system reform from the perspective of spatial development of urbanization in China [J]. Reform and strategy, 2015, 31 (5): 44-49.
[3] Yang Baojun, Chen Peng. How can China’s urbanization go [J]. Journal of urban planning, 2011, 01:5-11.
[4] Bulletin of national soil pollution survey [R]. Ministry of environmental protection (now Ministry of ecological environment) and Ministry of land and resources (now Ministry of natural resources). 2014.
[5] Mao Qizhi. Theory and practice of human settlements in China [J]. International urban planning, 2019, 34 (04): 54-63.
[6] Wu Liangyong. Introduction to human settlements [M]. Beijing: China Construction Industry Press, 2001.
[7] Huang Xianjin. Land policy [M]. Beijing: China Agricultural Publishing House, 2007.
[8] Herrmann E W, Monaghan G W. Post-glacial drainage basin evolution in the midcontinent, North America: Implications for prehistoric human settlement patterns [J]. Quaternary International, 2019, 511: 68-77.
[9] Cristi Nicu I, Romanescu G. Effect of natural risk factors upon the evolution of Chalcolithic human settlements in Northeastern Romania (Valea Oii watershed). From ancient times dynamics to present days degradation[J]. Zeitschrift für Geomorphologie, 2016, 60(1): 1-9.
[10] Li Wangming, Ye Xinyue. Evaluation of urban human settlements: a case study of Hangzhou [J]. Economic geography, 1999, 019 (02): 38-43.
[11] Ning Yuemin, Cha Zhiqiang. Evaluation and optimization of human settlements in Metropolis: a case study of Shanghai [J]. Urban planning, 1999, 023 (06): 15-20.
[12] Liu Jianguo, Zhang Wenzhong. Review of human settlements evaluation methods [J]. Urban development research, 2014 (06): 46-52.
[13] Han Jichang. Introduction to land engineering [M]. Beijing: Science Press, 2013.
[14] Han J C, Zhang Y. Land policy and land engineering[J]. Land Use Policy, 2014, (40): 64-68.
[15] Cheng Jie, Han Jichang, Zhang Yang, Wang Huanyuan, Ma Zenghui. Discussion on the discipline
construction of land engineering from the current land situation [J]. China population, resources and environment, 2017, 27 (5): 147-151.

[16] Liu Yansui. Research progress and development trend of land resources in China [J]. Chinese Journal of ecological agriculture, 2013, 21 (1): 127-133.

[17] Zhang Wenzhong, Chen Li, Yang Yichao. Research progress of human settlement environment evolution [J]. Progress of geographical science, 2019, 32 (5): 710-721.