

# Research on Influencing Factors of Land Use Carbon Emissions in Shaanxi Province

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## Abstract

**Land use is the main cause of carbon emission. In order to analyze the carbon emission effect of land use, based on the statistical data of Shaanxi Province, the evolution and influencing factors of land use carbon emission in Shaanxi Province from 2009 to 2017 were analyzed. In 2017, carbon emissions in Shaanxi Province increased year by year, with an increase of 28.2048 million tons of carbon emissions, a growth rate of 64.96%. Construction land area expansion is the main reason for the significant increase in total carbon emissions.**

## Keywords

**Shaanxi Province; land use; carbon emissions; influencing factors.**

## 1. Introduction

In the face of a series of social, economic and environmental problems caused by the greenhouse effect, the control and reduction of greenhouse gas emissions such as carbon dioxide has become an important guideline for environmental and economic policies of countries around the world. The report of the Eighteenth National Congress of the Communist Party of China proposed to vigorously promote the construction of ecological civilization, focus on promoting green development, circular development and low-carbon development, and form a spatial pattern, industrial structure, production method, and lifestyle that save resources and protect the environment, and refer to the construction of ecological civilization. Unprecedented strategic heights. China attaches great importance to energy conservation and emission reduction, and has set a goal of reducing carbon emissions per unit of GDP by 40% to 45% compared with 2005 by 2020. In September 2020, General Secretary Xi Jinping announced at the "75th United Nations General Assembly" that my country will strive to peak CO2 emissions by 2030 and strive to achieve carbon neutrality by 2060; my country's "14th Five-Year Plan" and 2035 The outline of the long-term goals proposes that carbon emissions will be included in China's long-term goals in 2035 after peaking. As the carrier of economic development, the transformation of land use types and the adjustment of the use structure are closely related to carbon emissions. As a major economic and energy province in my country, Shaanxi Province has long been characterized by extensive economic growth, which has made land, energy and resource endowments relatively scarce, and the contradiction between economic development and resources and environment has become increasingly acute. In the context of the new economic normal, how to maintain enough development space to take the low-carbon development path is a huge challenge for Shaanxi Province to develop a low-carbon economy.

## 2. Data sources and research methods

### 2.1. Data Sources

The land use data comes from the "Shaanxi Provincial Land and Resources Bulletin" (2009-2017), including 7 categories of cultivated land, garden land, forest land, grassland, construction land, water area and water conservancy facility land, and other land. The energy utilization data used to calculate the carbon emissions of construction land comes from the main energy balance table in the "Shaanxi Provincial Statistical Yearbook", and the comprehensive energy amount of the final consumption part is used as the standard energy consumption data.

### 2.2. Research method

#### 2.2.1. Carbon emission measurement method

This paper mainly considers the carbon emission effect of cultivated land, garden land, and construction land and the carbon absorption effect of forest land, grassland, water area and water conservancy facility land. When calculating the carbon emission generated by each land type, the IPCC carbon emission measurement method is adopted. The specific formula is as follows:

$$E = \sum e_i = \sum A_i \cdot m_i \tag{1}$$

In the formula: E—total carbon emission, 104 t;

$e_i$ —carbon emissions of the  $i$ -th land use type, 104 t;

$A_i$ —the area of the  $i$ -th land use type, 104  $hm^2$ ;

$m_i$ —the carbon emission/absorption coefficient of the  $i$ -th land use type, t/ $hm^2$ , the coefficient is a negative number in the case of carbon absorption.

Combined with previous studies, the net carbon emission coefficients of cultivated land, forest land, grassland, garden land and other land in this paper are taken as 0.422 t/ $hm^2$ , -0.644 t/ $hm^2$ , -0.021 t/ $hm^2$ , and 0.21 t/ $hm^2$ , respectively. and -0.005 t/ $hm^2$ .

## 3. Results and analysis

### 3.1. Land Use Carbon Emission Analysis

According to the land use data and energy consumption data of Shaanxi Province from 2009 to 2017, the carbon emissions of various types of land in Shaanxi Province from 2009 to 2017 were calculated, as shown in Table 1.

Table 1 2009-2017 year carbon emission table of various types of land in Shaanxi Province

years	carbon source/104 t			carbon sink/104 t			net carbon emissions/104 t
	arable land/104 t	garden/104 t	construction land/104 t	woodland/104 t	grassland/104 t	other land/104 t	
2009	168.70	17.85	4894.19	-723.32	-6.07	-0.19	4341.92
2010	168.45	17.77	5422.22	-722.95	-6.07	-0.17	4869.32
2011	168.29	17.71	6169.62	-722.52	-6.05	-0.17	5620.12
2012	168.19	17.50	6767.23	-721.97	-6.04	-0.17	6217.98
2013	168.46	17.34	7187.27	-721.44	-6.04	-0.17	6638.67
2014	168.58	17.26	7025.39	-721.11	-6.01	-0.17	6477.21
2015	168.60	17.21	7378.61	-720.92	-5.99	-0.17	6830.61
2016	168.36	17.18	7478.99	-719.47	-6.03	-0.17	6932.15
2017	168.08	17.14	7709.21	-719.14	-6.03	-0.17	7162.40

From the analysis of Table 1, it can be seen that among the three carbon emission land types, the carbon emission of construction land accounts for the largest proportion, which is

maintained at more than 96%, and the carbon emission of cultivated land and garden land accounts for a small proportion; , the carbon absorption of forest land accounts for the largest proportion, which is maintained at more than 97%, and the carbon absorption of grassland and other land accounts for a small proportion. Carbon emissions from construction land have grown very rapidly, increasing by 28.1502 million t from 2009 to 2017, with a growth rate of 57.52%, which is the main reason for the significant increase in total carbon emissions. This shows that controlling the area of construction land and increasing the area of forest land can reduce carbon sources and increase carbon sinks, which is an effective way to reduce the total amount of carbon emissions in the province.

### 3.2. Analysis of Influencing Factors of Land Use Carbon Emission in Shaanxi Province

The carbon sink is much lower than the carbon source, and the growing carbon source cannot be offset by more carbon sinks. This is mainly because the rapid process of urbanization has led to continuous changes in land use patterns, and the demand for and consumption of energy has also continued to increase, ultimately showing a trend of significant growth in carbon emissions; while the area of carbon absorbing land has not increased, but This has led to a further increase in total carbon emissions. The total carbon emission in 2014 was lower than that in 2013, and the growth trend of carbon emission slowed down in the following years, mainly due to the vigorous promotion of energy conservation and environmental protection work in Shaanxi Province after 2014, the promulgation of the "Shaanxi Province Energy Conservation Regulations", extremely To a large extent, it has promoted the industrial carbon emission reduction in Shaanxi Province.

The increase in land use carbon emissions in Shaanxi Province is mainly caused by the economic scale effect, followed by the energy carbon emission intensity effect, which leads to an increase in land use carbon emissions; The role of increased carbon emissions from use is limited, so the cumulative increase in total land use carbon emissions is small. The impact of each effect on the change of land use carbon emissions is different in different periods. The energy carbon emission intensity effect, that is, the impact of carbon emissions per unit of energy consumption on the change of land use carbon emissions in Shaanxi has a relatively large fluctuation. The impact of carbon emission intensity on land use carbon emission changes is uncertain. From the cumulative effect of energy carbon emission intensity, there is a positive effect on the increase of land use carbon emission, that is, different energy unit carbon emission intensity promotes the increase of land use carbon emission during the study period.

### 3.3. Analysis of land use carbon emission intensity

Table 2 Carbon emission intensity and carbon emission per 10,000 people in Shaanxi Province from 2009 to 2017

years	2009	2010	2011	2012	2013	2014	2015	2016	2017
carbon intensity/(t/million yuan)	5314.6	4809.92	4491.68	4302.01	4096.57	3661.52	3790.18	3573.35	3270.68
carbon emissions per 10,000 people/t	1.16	1.3	1.5	1.66	1.76	1.72	1.8	1.82	1.87

From 2009 to 2017, the carbon emission intensity of Shaanxi Province decreased year by year, while the carbon emissions per 10,000 people increased year by year. This means that people's daily energy consumption is increasing year by year, and per capita carbon emissions are increasing. At the same time, the intensity of carbon emissions is decreasing. That is, the economic benefits of carbon emissions in Shaanxi Province have shown an increasing trend, which has continued to be realized in recent years. low-carbon development model. The reduction of regional carbon emissions requires the reduction of per capita carbon emissions.

It can be seen that in the future, Shaanxi Province still needs to further optimize and reform to achieve the goal of efficient land use and less regional carbon emissions.

#### 4. Conclusion

From 2009 to 2017, carbon emissions in Shaanxi Province increased year by year, with an increase of 28.2048 million tons of carbon emissions, a growth rate of 64.96%. Among them, construction land contributes more than 96% to carbon emissions, and forest land contributes more than 97% to carbon absorption. The carbon emissions of construction land increased by 28.1502 million t from 2009 to 2017, with a growth rate of 57.52%. The expansion of construction land is the main reason for the significant increase in total carbon emissions.

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