# Literature review on the influence of socioeconomic factors on haze pollution

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#### Abstract

As a disastrous weather, haze not only endangers people's health, but also threatens human production and life. In recent years, with the increasingly serious haze weather in our country, haze has become a hot spot and focus of attention from all walks of life. Sorting out the influencing factors of haze pollution plays an important role in the prevention and control of haze pollution. This paper studies the impact of agriculture, industry and city on haze pollution, and sorts out the literature review on the impact of social and economic factors on haze pollution through a large number of literature reading, in order to provide a theoretical basis for subsequent relevant research.

#### **Keywords**

Literature review; Haze pollution; Socioeconomic factors.

## 1. Definition and classification of haze pollution

#### **1.1. Definition of haze pollution**

Haze is a combination of fog and haze. Fog is aerosol particles composed of a large number of tiny water droplets or ice crystals suspended in the air near the ground, while haze is aerosol particles composed of dust, sulfuric acid, nitric acid and other particles in the air, which can cause visual impairment. Therefore, haze weather is a state of atmospheric pollution, and it is also an overview of the excessive content of various suspended particles in the atmosphere <sup>[1]</sup>. The main difference between fog and haze is the amount of water vapor content, when the water vapor content is > 90%, it is called fog; When the water vapor content is < 80%, it is called haze; When it is between 80% and 90%, it is a mixture of fog and haze, that is, haze <sup>[2].</sup>

#### **1.2.** Classification of haze

From the perspective of human production activities, this paper divides haze pollution sources into industrial sources, agricultural sources and urban life sources, and correspondingly studies industrial haze pollution, agricultural haze pollution and urban life haze pollution. At present, population, ethnicity, religion, agriculture, industry, transportation, commerce, city and science and technology are listed as socio-economic factors in academic circles. In this paper, based on the classification of haze pollution, the three socio-economic factors of industry, agriculture and city are the main factors, and the literature related to the impact of industry, agriculture and city and other socio-economic factors on haze pollution is sorted out. In order to provide a theoretical basis for subsequent research <sup>[3]</sup>.

#### **1.3.** Distribution characteristics of haze

Haze pollution has temporal and spatial distribution characteristics. Due to the dispersion of the atmosphere, haze pollution is similar to that of neighboring areas <sup>[4]</sup>. The influence of different intensity of cold air on pollution degree and region is different. In the development and peak stages of pollution, boundary layers are inversion or isothermal stratification, and the whole layer is controlled by high humidity and low wind, which is not conducive to the vertical diffusion of pollutants and aggravates the development of pollution events <sup>[5]</sup>. Wang Zhenbo et

al. <sup>[6]</sup> used the observed PM2.5 concentration values of 190 cities in China in 2014 and adopted a spatial metrology model to reveal the temporal and spatial characteristics of PM2.5 in Chinese cities, and found that the Beijing-Tianjin-Hebei region was the most polluted and the Pearl River Delta region had better air quality. Zhang Yinjun et al. <sup>[7]</sup> analyzed the current situation and distribution pattern of PM2.5 pollution in China, and the results showed that PM2.5 in China was concentrated in the Beijing-Tianjin-Hebei region, the Yangtze River Delta, the Pearl River Delta, central China, North China and Southern Jiangsu.

#### 1.4. Harm of haze

Haze pollution is harmful to human health and economic development. Smog is harmful to human health and urban economic development. Chameides et al. [8] found that the haze concentration in China reduced the optimal productivity of about 70% of crops in China at the level of 5% to 30%. Liu Hongzhi [9] believes that haze affects public life, such as travel, physical health and emotions. Affecting social management and government credibility; Cause the loss of agriculture, aquaculture, aquaculture and even tourism; It will harm the balance and stability of the ecosystem, and then bring more serious harm to human beings [10]. Chen Renjie and Kan Haidong [11] found that particulate matter in haze can stay in the air for a long time and spread for a long distance, which reduces air visibility, harms air quality, and increases the disease rate and fatality rate of respiratory system-related diseases in the population. Zhang Shaohong and Yu Shaohua [12] found that haze inhalation by pregnant women may induce congenital malformations in infants.

## 2. Industrial haze pollution

In terms of industry, industrial haze pollution has attracted much attention due to its large volume and wide range of pollution, and relevant studies have emerged endlessly. In addition to the well-known industrial waste gas causing haze and haze, other industrial behaviors will also aggravate haze pollution. For example, Feng Kuo et al found that enterprises' stolen discharge at midnight will aggravate haze pollution <sup>[12]</sup>. Zhang Nian and Zhang Cheng found through model regression that the increase of industrial solid waste storage would aggravate the haze problem <sup>[13]</sup>. Zhang Xiguang et al. took the panel data of 13 cities in the Beijing-Tianjin-Hebei region from 2013 to 2020 as research samples and used STIRPAT model to investigate the impact of scientific and technological innovation efficiency on haze pollution in the Beijing-Tianjin-Hebei region <sup>[14]</sup>. The results show that the efficiency of scientific and technological innovation may increase the haze pollution in the short term, but reduce the haze pollution in the long term. There is a U-shaped curve between haze pollution and economic growth. The level of urbanization will significantly improve the haze pollution, while the proportion of industrial added value in GDP will increase the haze pollution. Sun Tieshan and Liu Yuqi found that among the mutual investment in manufacturing between Beijing, Tianjin and Hebei, the investment in polluting manufacturing industry has the most significant growth, and compared with other types of manufacturing investment, the investment in polluting manufacturing industry is more dispersed in the city network, which is an important channel that causes the spillover effect of urban industry on haze pollution <sup>[15]</sup>. Lei Yutao et al. found that haze pollution in key urban agglomerations had significant positive spatial spillover, but the spillover degree was different. In order of their magnitude, they are the middle reaches of the Yangtze River, Yangtze River Delta, Chengdu-Chongqing, Beijing-Tianjin-Hebei and Pearl River Delta. For every 1% increase in haze pollution of the neighboring cities of the city, the haze pollution degree of the city increases by 0.73%, 0.70%, 0.54%, 0.49% and 0.18% on average, respectively <sup>[16]</sup>. The relationship between industrial agglomeration and haze pollution in the Yangtze River Delta and Pearl River Delta is an N-shaped curve. The industrial agglomeration in the Beijing-Tianjin-Hebei region and the middle reaches of the Yangtze River has a positive linear effect on

haze pollution. There is an inverted N-shaped curve relationship between industrial agglomeration and smog pollution in Chengdu-Chongqing <sup>[17]</sup>.

## 3. Agricultural smog pollution

#### 3.1. Pollution from land consolidation

Before agricultural production, it is necessary to restrict the cultivation of cultivated land, the promotion and popularization of new technologies and methods of land cultivation and management. Nitrogen oxides, sulfur oxides and various organic compound particles in soil are not effectively controlled, and organic carbon in soil is decomposed by microorganisms and injected into the atmosphere in the form of greenhouse gases, or into the air in the form of dust to form haze [18].

Seeds (seedlings) packaging, transportation, storage pollution: agricultural production of seeds (seedlings) packaging, transportation, storage methods are extensive, dust is not controlled, resulting in pollution emissions to the air to form haze.

Feed (bait) processing pollution: livestock, poultry, aquatic feed (bait) processing management is not fine, scientific, in the production, packaging, transportation, storage process does not effectively control dust, pollutants discharged into the air to form haze; In addition, overgrazing destroys grassland and vegetation, resulting in the reduction of grassland and vegetation will also increase greenhouse gas emissions.

#### 3.2. Pollutant discharge in agricultural production forms a pollution source

Chemical inputs such as fertilizers and mulch film: In a long period of time, China's agricultural development was at the expense of ecological environment, and agricultural production was excessively dependent on input of factors such as fertilizers <sup>[19]</sup>. The use of chemical inputs such as fertilizers and mulch films is unreasonable, and various organic compound particles such as nitrogen oxides and sulfur oxides continue to react in the air to form a more stable gas form, and the concentration is higher and higher, and the adverse climatic conditions will form haze. Livestock and poultry feed and aquatic feed produce pollutants: livestock and poultry industry feeding, aquaculture management is not fine, not scientific, feed (bait) overfeeding, the remaining feed (bait) long-term exposure in the air, water immersion, fermentation, decomposition, will produce greenhouse gases to form pollutants. The use of pesticides, veterinary drugs and fish drugs produces pollutants: in order to prevent and control diseases and pests in agricultural production, pesticides, veterinary drugs and fish drugs need to be applied, and excessive application of household drugs will produce pollutants, which will form haze sources after entering the air. In rural farms and domestic livestock, some livestock (such as pigs, sheep, dogs, etc.) and poultry (such as chickens, ducks, geese, pigeons, etc.) are in a freerange state, and the manure of livestock is discharged everywhere to form a pollution source of haze <sup>[20]</sup>.

#### 3.3. Pollutant discharge in agricultural production forms a pollution source

Crop straw incineration produces soot and pollutants: After crop harvest, crop stalks such as wheat, rice, corn, oilseed and cotton need to be treated. Due to the lack of popularization of harmless treatment technology of straw, direct incineration is used to make fertilizer into the field, and a large number of oxidized particles, carbon monoxide and other pollutants are discharged at low altitude to form haze pollution sources <sup>[21]</sup>. Livestock and aquaculture produce pollutants: After the end of livestock farming and aquaculture, the enclosure is repaired and the pond is cleaned without timely protection of the environment, resulting in oxidized particulate matter, carbon monoxide and other pollution sources.

## 3.4. Pollutant Extensive production of planting industry produces pollutants and causes haze

Irrational use of fertilizers and pesticides in the planting industry: In the ammonia emission inventory at the regional scale, agriculture and animal husbandry contribute a lot, and ammonia nitrogen produced by irrational use of chemical inputs such as fertilizers and pesticides forms agricultural non-point source pollution <sup>[22]</sup>. After the application of chemical fertilizers and pesticides, some of them enter the soil in the form of organic or inorganic nitrogen, and are reduced to nitrite under the action of soil denitrification microorganisms, converting into N<sub>2</sub>O and NO<sub>x</sub> into the atmosphere. It is estimated that the N<sub>2</sub>O emissions caused by fertilization and drug application account for about 79.9% of the total emissions from agricultural sources. Nitrogen oxides, sulfur oxides, and various organic compound particles produced in the process of agricultural production continue to react in the air to form a stable gas form, and the concentration is higher and higher, and eventually the formation of haze. It is estimated that the utilization rate of nitrogen fertilizer is only 30%-50%<sup>[23]</sup>. Dust particles from crop straw burning: Agricultural production harvest season, such as wheat, rice, corn, oil, cotton and other crops after harvest, farmers processing crop straw, directly burning in the field to make fertilizer, will produce a large number of particulate matter, carbon monoxide and other pollutants, through low-altitude emissions cause the concentration of smoke, particulate matter and other pollutants in the air increased sharply. The rapid decline in air quality leads to haze. Unscientific land farming and planting management: Unscientific agricultural farming will cause the organic carbon in the soil to be decomposed by microorganisms and injected into the atmosphere in the form of greenhouse gases, and human cultivation of the land will accelerate and release a large number of greenhouse gases. Agricultural mechanization also emits some greenhouse gases <sup>[24]</sup>.

#### 4. Urban haze pollution

In terms of urban haze, urban haze pollution mainly includes common automobile exhaust emission and urban coal heating <sup>[25]</sup>. Xu Yingzhi et al. analyzed the mechanism of pollutant source control on haze pollution prevention and control, and proposed to clarify the key points of haze prevention and control and formulate prevention and control measures from the perspective of "three sources" control, that is, to control combustion sources, industrial sources and traffic sources <sup>[26]</sup>. In addition, Feng Guoqiang et al. found that traffic jams would also increase vehicle exhaust emissions and thus worsen haze pollution <sup>[27]</sup>. Based on the empirical analysis of the panel data of 65 large and medium-sized cities, Zhao Chunming et al. concluded that private transportation in large and medium-sized cities could restrain the aggravation of urban haze pollution through the expansion of urban space and the optimization of urban transportation network construction in the early stage of development <sup>[28]</sup>. However, due to the limited carrying level of private traffic on urban roads, there is a significant positive "U" -shaped relationship between the development of urban private traffic and haze pollution, and the inhibiting effect of private traffic development level on haze pollution will be weakened with the increasing number of private cars <sup>[29]</sup>.

#### 5. Research review

It can be seen from the above literature review that haze pollution, an environmental problem, has attracted much attention in recent years, and the academic community has conducted multi-dimensional and multi-angle research on it. Some scholars have explored the causes, classification and spatial and temporal distribution characteristics of haze, while more scholars have focused on the impact between secondary and tertiary industries and haze. Sorting out the impact of social and economic factors on haze will greatly improve the severity of haze.

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At present, some policies issued by the state have increased restrictions on the second and third industries such as industry and construction, and achieved remarkable results, which has also been verified by the general research of scholars <sup>[30]</sup> <sup>[31]</sup> <sup>[32]</sup>. Liu et al. empirically studied the impact of China's innovation policy on haze pollution by using the DID model. The results showed that NIIDZ policy promoted the control of urban haze pollution, and confirmed the applicability of experimentalist governance model in the practice of innovation policies in developing countries <sup>[33]</sup>. Such as Feng Kuo found that China's industrial enterprises often choose to steal between eight o 'clock to zero in the evening; Enterprises in non-provincial capital cities and cities with strict environmental regulation policies have a more serious phenomenon of stolen emissions, and domestic enterprises are the main body of stolen emissions at night, which is also a major reason for the high level of haze pollution <sup>[34]</sup>. Therefore, breaking through the difficulties of the traditional environmental supervision system, targeted emission management is conducive to reducing industrial haze <sup>[35]</sup>. Based on the PM2.5 concentration data of 30 provinces from 2006 to 2016, Deng Huihui and Yang Luxin used instrumental variable regression (IV-2SLS) and generalized spatial three-stage regression (GS3SLS) models to identify the causal relationship between haze control and industrial development. Haze control can significantly promote the green transformation of local industry, and the improvement of industrial structure and production efficiency are important ways for haze control to promote the green transformation of industry <sup>[36]</sup>. According to Lin Yiquan and Wang Di through empirical test and mechanism analysis, it is consistent with neoclassical economic theory, and the test results suggest that "smog" control has a negative impact on the quality of industrial economic development, but its intermediary effect on the quality of industrial economic development through industrial economic scale, technological cleanliness and technological upgrading is significantly positive <sup>[37]</sup>. Zhou Jieqi and Liu Shenglong proposed that environmental regulation can not only alleviate haze pollution through economic scale effect and industrial structure effect, but also have a multidimensional impact on haze pollution through the fit and dynamic matching with skill premium. In addition, many scholars agree that financial activities can also affect smog <sup>[38]</sup>. Using the intermediary effect model, Zeng et al. found that green finance had a significant negative impact on urban haze pollution <sup>[39]</sup> : one standard deviation increase in green finance reduced PM2.5 concentration by 8.8mug/(m3), and then proposed a new pollution solution, that is, the use of green finance tools to promote the progress of environmental protection technology <sup>[40]</sup>. In terms of the research on the prevention and control mechanism of haze, the key factors and mechanism affecting the control of haze pollution in China are discussed from the perspective of social and economic factors, and the current situation of haze pollution in China can be effectively alleviated with the help of the joint prevention and control ideas of the source control and control at the production end of haze pollutants and the diffusion end of haze pollutants [41].

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