

# ***Impact of Human Activities on Water Pollution of Yangtze River Basin***

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**Abstract:** An essential component of China's environment and a major driver of economic growth is the Yangtze River, which is irreplaceable in production and life. However, in the industrially dense sections of the Yangtze River Basin, there is organic and heavy metal pollution, and some tributaries have severe total phosphorus emissions. The problem of sewage treatment in some cities is prominent. This paper analyzes the contamination of the Yangtze River brought on by the inflow of agricultural contaminants, the discharge of industrial effluent, and the dramatic rise in household sewage. For instance, the government has suggested pertinent actions to combat pollution which is in the Basin of Yangtze River , like leveraging data to improve enterprise pollution oversight, developing green ecological agriculture, and widely setting up sewage collection pipelines in urban and rural areas. It is crucial to investigate how human activity affects the Yangtze River's ecology in order to preserve natural balance and guarantee sustainable economic growth. This study offers a foundation for developing practical methods of reducing Yangtze River water pollution, which should aid in the long-term preservation and restoration of the river's natural ecosystem and foster the growth of peaceful coexistence between people and the environment.

**Keywords:** Yangtze River Basin, water pollution, environment, Human activities

## **1. Introduction**

The Yangtze River is the world's third-longest river and the first in China. The Yangtze River flows through eleven provinces, municipalities, and autonomous areas before emptying into Shanghai from the Qinghai Tibet Plateau [1]. The Basin of Yangtze River is densely covered with water systems and abundant lakes, and it covers an area of 1.8 million square kilometers. And it has grown to be a significant agricultural production area because it supplies abundant water for farming and living along the line, supporting numerous people and towns inside the basin. The Yangtze River has a rich ecosystem, which is the habitat of many rare animals and plants. In addition, the Yangtze River is the most developed inland waterway in China, known as the "golden waterway".

However, the chemical industry along the Yangtze River is highly concentrated, resulting in severe pollution. More than 300 kinds of toxic and harmful substances were detected in the water in the pollution zone stretching over 600 kilometers [2]. Dongting Lake and Taihu Lake's water quality has significantly deteriorated along the Yangtze River as a result of continuous industrial pollution erosion [2]. This kind of industrial pollution has seriously damaged the river ecology and has directly threatened the safety of people's drinking water [2]. Significant impacts on the Basin of Yangtze

River are caused by agricultural non-point source pollution, chemical fertilizer and pesticide use, and inadequate rural sewage and waste treatment, all of which harm water quality. The possibility of water pollution accidents and the different pollutants released from ships should be taken into consideration when discussing mobile source pollution.

The primary goal of this paper is to examine how human activity affects Yangtze River water pollution from three perspectives: domestic water, agriculture, and industrial. A thorough understanding of the Yangtze River Ecosystem's damage process and a strong foundation for developing scientific and practical water pollution management measures may be achieved by analyzing the effects of human activity on pollution which is in the river. This has important real-world ramifications for promoting sustainable development in addition to protecting the health and safety of the basin's residents and contributing to the restoration and conservation of the Yangtze River's natural environment.

## 2. Industrial structure and agricultural structure

The Basin of Yangtze River is the key region for Chinese industrial, agricultural production, and its economy is developing quite quickly.

From 2004 to 2020, the GDP of the Economic Belt Yangtze River continued to rise. The Economic Belt is the main contributor of China's GDP growth, and the industry of the Economic Belt Yangtze River occupies an absolute position in the industry of China. Before 2016, the Yangtze River was home to a large number of industrial sectors, especially those engaged in high-pollution industries including papermaking, textiles, and equipment [3].

The Yangtze River Basin, as a key region for national strategic development, holds a pivotal place in the development of Chinese agricultural economy [4]. As a primary grain crop, rice is widely grown in the middle and lower portions of plains as well as in other regions. Rapeseed is widely planted and is the main oil crop. In the aquaculture industry, freshwater fisheries are well-developed.

## 3. Impact

### 3.1. Impact of industrial production

Heavy industrial enterprises such as chemical and metallurgical companies are scattered along the Yangtze River, and these highly polluting enterprises greatly impact the ecological environment of the region [5]. China is facing the dual problems of water scarcity and worsening water pollution. Industrial wastewater has become a key control object for energy conservation, emission reduction, and water environment governance due to its large discharge volume and heavy pollution [6].

Industrial production plays a central role in promoting the process of economic development [7]. However, its impact on the water environment should not be underestimated [7]. According to the findings, the principal "perpetrators" of ammonia nitrogen ( $\text{NH}_3\text{-N}$ ), chemical oxygen demand (COD), total phosphorus emissions, and total nitrogen are now the food and tobacco manufacturing (MFT) and chemical industry (CI) in Jiangxi, Jiangsu, Hunan, and other regions, as well as coal, petroleum, and nuclear fuel processing (ppcn) in Chongqing [7].

COD<sub>Cr</sub> is the chemical oxygen demand obtained by potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) as an oxidant. In water quality monitoring, the higher the value of COD<sub>Cr</sub>, the more serious the pollution of the water body by reducing substances such as organic matter. In water,  $\text{NH}_3\text{-N}$  is the product of decomposition of nitrogen-containing organic matter by microorganisms. Its high content usually means that the water body is polluted with nitrogen-containing pollutants. The main pollutants of the Basin of Yangtze River are COD<sub>Cr</sub> and  $\text{NH}_3\text{-N}$ . Industrial pollution of the basin of Yangtze River levels vary by location, with the middle and downstream (except for Chongqing) often producing more pollutants than the upper reaches. Among these, the middle sections of the Yangtze River

produce an average of 67040 tons of COD<sub>Cr</sub> and 16818 tons of NH<sub>3</sub>-N, two industrial pollutants. In the lower parts of the Yangtze River, pollutants COD<sub>Cr</sub> and NH<sub>3</sub>-N are produced on average at 118372 and 13904 tons, respectively [6].

Excessive COD<sub>Cr</sub> can consume a large amount of dissolved oxygen in water, causing aquatic organisms to die due to hypoxia, and can also lead to water quality deterioration, blackening, and odor. NH<sub>3</sub>-N not only causes excessive reproduction of algae and other organisms, but also has toxicity to aquatic organisms, reduces biodiversity, and seriously damages the Yangtze River's ecological balance. Ultimately, Industrial wastewater discharge leads to the deterioration of water quality in the Yangtze River and affects the safety of drinking water. In addition, sulfur dioxide can be converted into sulfate particles to pollute water and soil.

### 3.2. Impact of agricultural production

Water quality is greatly impacted by agricultural production, which is a major industry in the Basin of the Yangtze River. Fertilizer and pesticide use is high in the Basin of Yangtze River because of high multiple cropping index [8].

According to statistics, in 2020, 16.8455 million tons of fertilizer were sprayed over the Belt of Yangtze River Economic, with an intensity of 282.52 kg/hm<sup>2</sup>, which is 1.26 times the international safe application level (225 kg/hm<sup>2</sup>) [9]. The high-intensity use of fertilizers has caused serious nitrogen and phosphorus loss in farmland and gardens, leading to eutrophication of water bodies and groundwater pollution. Non-point source pollution in agriculture has gradually become a major problem that needs to be solved urgently. The main manifestation is that under the background of rapid urbanization, human socio-economic activities affect land use patterns, agricultural production methods and management levels, industrial structure, etc., which in turn leads to high levels of non-point source pollution in the greenhouse sector.

Pesticides have a significant impact on water pollution in the Yangtze River. Highly toxic components such as pyrethroids directly threaten the survival of aquatic organisms, residual pesticides pose a threat to human health through bioaccumulation, carcinogens such as atrazine contaminate water sources, and livestock manure contain antibiotics. The intensive agricultural areas have a high intensity of pesticide use, coupled with industrial pollution, leading to deterioration of the quality of water.

The Basin of Yangtze River, the Chinese primary location for the production of pigs and freshwater aquatic items, has contributed significantly to agricultural non-point source pollution from aquaculture and livestock [9]. Monitoring shows that the overall phosphorus emissions from livestock and poultry production accounted for 68% of the basin's total phosphorus emissions from non-point agricultural sources and are the major source of pollution [9]. The production of freshwater pond aquaculture accounts for over 60% of the national total, but the supporting rate of pollution treatment facilities is insufficient, and the phenomenon of substandard discharge of aquaculture effluent is common, resulting in prominent environmental risks [9]. The imbalance between production scale and pollution control capacity poses sustained pressure on the Yangtze River's ecological security.

### 3.3. Impact of domestic water

One factor contributing to water pollution in the Basin of Yangtze River is the release of urban sewage and it significantly degrades water quality and poses serious threats to both the ecosystem and human health. A substantial volume of untreated or inadequately treated sewage is continuously released into the river, carrying high concentrations of pollutants, including nutrients such as nitrogen and phosphorus.

The Yangtze River shipping industry has demonstrated tremendous vitality in tandem with the economy's fast development, but at the same time, the problem of ship pollution has become increasingly prominent, especially the most serious pollution caused by ship domestic sewage [10]. In the absence of governance measures, the Yangtze River's water supplies will be harmed, which will have an impact on the natural environment and public health. Ship domestic sewage contains a large amount of suspended solids and harmful bacteria such as *Escherichia coli* [10]. They pose a risk to public health and safety since they can create widespread epidemics in addition to drastically lowering water quality if they are dumped straight into the Yangtze River. Additionally, urban sewage often contains toxic substances such as persistent organic pollutants (like pesticides and industrial chemicals) and heavy metals (like mercury, cadmium, and lead). These contaminants accumulate in water bodies and sediments, entering the food chain and posing long-term risks to human health through the consumption of contaminated water or aquatic products. Chronic exposure to these pollutants can cause severe health issues, including neurological disorders, cancer, and reproductive problems.

Furthermore, because the entry of hazardous compounds and excessive nutrients lowers the river's natural resilience and reduces biodiversity, the Yangtze River Basin's ecological balance is seriously upset. This reduces the river's potential to deliver vital ecosystem services including habitat provision and water filtering in addition to jeopardizing its ability to self-purify.

#### 4. Measures and suggestions

China should focus on promoting the strategic adjustment of the industrial model, effectively improve the utilization rate of resources and energy, and changing to the green development model as soon as possible. Improve the green treatment capacity of industrial pollutants and strengthen the recycling of industrial solid waste [11]. All regions should carry out rectification and construction around core elements such as energy conservation and carbon reduction, pollution prevention and treatment, and resource recycling [11]. All industries should comprehensively improve the level of industrial scientific and technological innovation and green low-carbon technology [11]. The government should strengthen environmental supervision and use scientific and technological means such as UAV patrol to monitor the pollution discharge of enterprises in real time.

Food security and the prevention and control of agricultural non-point source pollution are the main objectives of China's agricultural environmental policy during the "14th five-year plan" period. Promoting organic fertilizer, decreasing and increasing the effectiveness of chemical fertilizer, and increasing the rate at which nitrogen fertilizer is utilized can all help to lessen the adverse effects on the agricultural environment[12].The development of sewage treatment facilities, the enhancement of waste recycling systems and other infrastructure, and the establishment of ecological buffer zones to capture nitrogen runoff are some of the management and control measures proposed for rural areas based on local characteristics[12].

In order to tackle environmental pollution challenges faced by the Yangtze River Basin. The River Chief Policy(RCP), which was introduced and implemented in 2007 by Wuxi City(Jiangsu Province) to address the blue-algae outbreak in Taihu Lake [13], designates local leading officials as "He Zhang" (river chiefs) for particular river sections [13]. The management and preservation of water resources within their various administrative domains are then the responsibility of these river chiefs.RCP ensures that each river section has a dedicated person responsible for achieving full basin coverage and compacting responsibilities at all levels. This strategy seeks to protect the water area's ecological environment and improve the effectiveness of water environment administration.

The sewage collection pipe network shall be laid in the Yangtze River to stay away from home sewage that is dumped into the river. Encourage the use of advanced sewage treatment processes. Boost public awareness and education about the dangers of Yangtze River water contamination and

the need for protection, and enhance public awareness of environmental protection. Individuals should reduce plastic use and encourage them to participate in environmental supervision.

## 5. Conclusions

This paper primarily examines how the Yangtze River Basin's water pollution problem has been exacerbated by the discharge of domestic, agricultural, and industrial water. A large number of pollutants enter the river, resulting in the decline of water quality, eutrophication of some river sections and lakes, and damage to the ecosystem. These pollutants also threaten the survival of aquatic organisms and the safety of human water use.

Industrial structural pollution is prominent, and the pollution is aggravated by the large amount of pollutants from the chemical industry and papermaking industry along the river, especially the pollutants such as COD<sub>Cr</sub> and NH<sub>3</sub>-N. In agriculture, non-point source pollution, pollutants from livestock and poultry breeding, pesticide and fertilizer use enter the Yangtze River through surface runoff. When it comes to household sewage, some urban and ship domestic sewage have inadequate treatment capacity and are released straight into the environment without being adequately treated. The Yangtze River's natural biological equilibrium has been damaged by these sewage flows, which have also decreased the water body's ability to purify itself.

The government needs to further strengthen collaboration and cooperation, strengthen the supervision of industrial enterprises, promote industrial upgrading and reduce emissions. Rural areas should improve rural environmental protection infrastructure and promote ecological agriculture. The government is expected to raise the standard of treatment for shipped household sewage and urban sewage. The ecological environment has been repaired and quality of water which is in the Basin of Yangtze River can be steadily enhanced with these all-encompassing approaches.

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