

# Heavy metal accumulation within urban regions of china



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## Introduction

The adverse health effects associated with heavy metal accumulation within the body are well documented with problems leading to cardiovascular, nervous system, blood and bone diseases. Heavy metals can be easily transferred to human bodies directly through inhalation, ingestion, and absorption from the skin. The predominant pathway of ingestion is through the soil-crop system due to the accumulation of heavy metals in agricultural areas. This is quite prevalent in rural areas of China as waste water is recycled to tend crops which provide the food for the urban population. Alongside wastewater irrigation, solid waste disposal and sludge applications; vehicular exhaust and industrial activities are the major sources of soil contamination with heavy metals, resulting in an increased metal uptake by the food crops grown on such contaminated soils (Khan *et al.* 2008). In the urban environment itself, a wide range of toxic substances can be released during recycling and disposal in industrial processes which cause environmental damage and threaten public health. Heavy metals such as lead, cadmium, copper, zinc, and chromium are an important class of hazardous chemicals that can be released from out-dated industrial practices. Therefore a relationship exists with a high population density within China's urban centres and heavy metal accumulation within the urban environments (soils, atmosphere and drinking water). Industry and economic activities are more concentrated in urban areas, and cities have become the geographic focus of resource consumption and chemical emissions, which cause many environmental problems (Luo *et al.* 2012). Heavy industries such

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as metal smelting, manufacturing, energy production, construction and the coal/fuel combustion techniques associated with the mentioned industries are usually localised within the urban centres of China. This is due to their close proximity to the large percentage of the urbanised population who commute to their workplaces, and also double up as consumers (and polluters). Because of this, industries release harmful pollutants as by-products into the atmosphere, or can infiltrate the drinking water, and/or affect soils within close proximity. Heavy metals in urban soils may come from various human activities such as vehicle exhaust, waste disposal, as well as coal and fuel combustion (Chen *et al.* 2005). A recent emergence is that of electronic waste recycling which is infamous for releasing heavy metals.

### Biophysical and Socioeconomic Background

The cause for the environmental degradation which effects are now widely seen in China are by no means an issue that has sprung up overnight. Domestically, the modernisation drive of the Chinese government over the past 30 years has been the main contributor for the environmental degradation, in that the priority of urbanisation, industrialisation, and a stronger economy with the intent of increasing the standard of living for its citizens (reflected by higher consumption) has placed environmental concerns as inconsequential. Because of this, environmental policies over the past 30 years have been considerably lax or non-existent due to conflicting with economic targets. This deregulation by the environmental sector of the government has granted China unprecedented growth and surpass economic goals, but at great consequence to the environment with <https://assignbuster.com/heavy-metal-accumulation-within-urban-regions-of-china/>

widespread pollution in all the major cities. Only recently has the Chinese government realised the magnitude of their actions on the environment which have been revealed through recent studies. The first national soil pollution survey conducted between 2005 and 2013 by the Chinese government's Environmental Protection Ministry showed that 16.1% of China's soil and 19.4% of its arable land was contaminated with cadmium, nickel and arsenic (BBC, 2014). China's rapid and extended period of industrial development with subsequent high pollutant emissions has left many regions with deteriorated land quality and soil pollution. Compared to the surveys conducted between 1986 and 1990, levels of inorganic materials were markedly higher. This has dire consequences for the food security of the Chinese people and both the global community, as China currently relies heavily on grain imports to satisfy the needs of its citizens. The Chinese government set the minimum arable land for food production just over 300 million acres, of which this recent study has shown their available arable land does not meet this minimum – meaning that China lacks agricultural self-sufficiency (Pei, 2014). Reversal of the degradation is costly and generally avoided, thus the Chinese government is opting to invest in foreign land and agriculture. Many of the recent surveys and research conducted by the government has had loose affiliation with scientific bodies and subsequently distorted evidence with the intent to strengthen political and economic motives, while masking the true nature of the situation. As a result, initial conservative estimations made by the government are insufficient and by no means an accurate representation of the environmental issues facing China.

Internationally, the demand for cheaper Chinese labour and consumables has only perpetuated and reinforced the economic drive and manufacturing capabilities of China over the past 30 years – with the environment suffering due to inadequate regulation, economic priorities and a lack of perception for wider issues such as environmental. Specifically, with the expansion of the global market and increased demand for electrical and electronic products (and their short lifespan), electronic waste has become one of the most rapidly growing problems pertaining to waste in the world. A great quantity of electronic waste originating from developed countries has been transferred to developing countries such as China, India, and some African countries where electronic waste is processed using less advanced technology. A wide range of toxic substances can be released during the recycling and disposal and cause environmental damage and threaten public health, especially those of heavy metals (Zheng *et al.* 2013).

### Management Approaches in the Past

It was in 1973 where the Chinese government held its first national conference on environmental protection. For the following 20 years, emphasis was placed on pollution control and prevention as the major cities faced industrial and pesticide pollution. Again in 1983 environmental protection was announced as one of the two basic state policies (the other being family planning, or notoriously known as the ‘one child policy’). However proper action to environmental impact has only occurred relatively recently (the mid to late 1990’s) marked by the issuing of the national strategy of sustainable development: ‘Ten strategic Policies for Environment and Development’ and in 1994 the publishing of ‘Agenda 21’. Subsequently, <https://assignbuster.com/heavy-metal-accumulation-within-urban-regions-of-china/>

China has implemented a strategy of two fundamental transformations – the transition from a planned economic system to a socialistic market economic system (Wang 2010). Policies within the 1990's focused mainly on point source control of pollution from industries, and heavily around catchment systems (due to the problem of contaminated water) in contrast to remediation of areas affected by pollution. As is still problematic today, government bodies responsible for the implementation are hindered by weak institutional capacities and generally lack experience in the new field of environmental management (Wang 2010) leading to confusion between local and central governments in relation to the arbitration of policies. Guidelines of environmental protection have been established through many separate rules and regulations authorised by different government entities at different phases adding to this disarray. Local governments also lacked the financial capacity to compensate residents in natural reserves causing conflict within the communities. Centralisation of this organisation appears to be an ongoing process. Similarly, it is all well and good announcing what is going to be done (albeit vaguely) but whether or not action is taken is another matter. Adding to this significance is that the Chinese government is both the regulator and polluter in many instances, and must realise this.

#### Management Approaches at Present and for the Future

Presently, the government has specific planned efforts to protect species and ecosystems and have greatly increased over the past decade, but effectiveness has not kept pace with degradation. Major problems exist such as low levels of staff training, inadequate funding and rampant commercial development. The central government's large-scale payment for ecosystem <https://assignbuster.com/heavy-metal-accumulation-within-urban-regions-of-china/>

services campaigns are remarkable in terms of funding and longevity but program effectiveness remains unclear due to a general lack of science based assessment and conflicting outcomes with positive results that meet program goals (Grumbine & Xu 2013). The issue of heavy metal accumulation within soils (be it rural or urban) is not directly targeted with China's environmental management plans of the future. Although management plans incorporate the cleaning up of industries and practices which will hopefully have flow down affects leading to the reduction of problematic pollution (namely, heavy metals). These newly implemented, almost 'ad hoc' environmental standards may not be up to speed to match the ever increasing economic growth and continual urbanisation. Similarly, implementing policy is one thing, enforcing it is another. In rural areas, China did not begin to invest in water pollution control until 2008 with the Ministries of Environmental Protection and Agriculture expecting coverage of 10% of all villages by 2015. In 2012 and again in 2013, the State Council and Ministry of Environmental Protection issued new national policies and funding to strengthen water use and decrease pollution, but institutional reforms necessary for improved implementation have not been addressed (Grumbine & Xu 2013). Reformation of current environmentally specific laws (water, biodiversity, conservation) and forging of legal management mandates between provinces and government bureaus within their specific areas, alongside encouraging more policy participation from citizens, non-government organisations and businesses is desirable. Some of these reforms go against current government norms, but international scholars believe that significant environmental degradation impacts (such as water scarcity or hazardous materials) will drive more cooperative institutional

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behaviour (Grumbine & Xu 2013). There is little interdisciplinary framework to address the lack of policy connections within and across China's social-ecological systems. At the national level, ministerial actions often lack coordination and officials often do not have the capacity to enforce regulations. There are disconnects between central and local decision making; at local levels, Beijing's edicts are subject to behaviour where officials often act contrary to central government mandates resulting in poor policy implementation. With environmental problems now openly acknowledged but solutions still far off, and already-unprecedented urbanisation rates gaining speed. But there still are no functional national-level regulations in place to guide the largest and most rapid urban expansion in world history (Grumbine & Xu 2013).

### Conclusions and Recommendations

After three decades of unconstrained economic growth, China's social and ecological debts are coming due. The new Chinese leadership has a full agenda yet measured against broad adaptive capacity standards, thus the government remains weak at solving complex, cross-cutting problems. Experts are in agreement that open information exchange, government transparency, institutional coordination, public and private sector participation, iterative decision making and conflict resolution are critical to resolving environmental and social issues under 21<sup>st</sup> century conditions. These capacities may have little to do with supporting economic expansion under a command-and-control decision making system, but they are recommended repeatedly to solve governance problems in a world of



decreasing resources and increasing uncertainty. China must realise that it is both the polluter and regulator so must mediate the two with particularly stronger enforcement of environmental concerns. Short term economic goals should not outweigh the long term importance of the environmental order. Soil is an important component of urban ecosystems, thus its quality must be recognised and integrated into environmental monitoring and management programs. Extensive investigations into urban soil contamination in China have been conducted in the last 25 years but prove inadequate. Given the importance of urban soils, future research should focus on making comprehensive assessments of urban soil quality for better city planning and the sustainable management of urban soil resources. Since metals and organic pollutants have been found many cities of China, these and other emerging contaminants should be included in a multi-compartmental environmental surveillance of urban areas. Biological indicators could be used such as plant, soil invertebrate and microbial assays leading to an improved assessment of soil quality than physico-chemical measurements alone. Attention should be paid towards semi-rural and peri-urban agriculture practices with potential to human health implications. In addition to routine urban soil surveys, a land use-based and environmental availability-based integrated risk assessment framework of pollutants for urban soils needs to be developed in China (Luo *et al.* 2012).

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