

Address & reduce pollution in air, water and soil

Pollution is a global problem that affects all living things, as they depend on the Earth's supply of clean air and water, but when these resources are polluted, all forms of life are threatened. Every year, an estimated 11.2 billion tonnes of solid waste are collected worldwide, and its poor management causes air pollution and contamination of water and soil, which can lead to infections and transmission of diseases. The UN (United Nations) revealed that pollution-related deaths have increased by 66% over the last two decades. Every year, 9 million people die from causes related to air, soil, and water pollution, making it the greatest environmental threat to human health.

Egypt is no exception to pollution problems, as it contains many severe problems caused by the tremendous amount of PM (particulate matter), CO (carbon monoxide), and other gas emissions increasing air pollution in Egypt; some of them even increase climate change, as Egypt produced 0.6% of global greenhouse gas emissions in 2022, which is equivalent to 217.806 million tons. The most polluted area in Egypt is Greater Cairo in the ND region

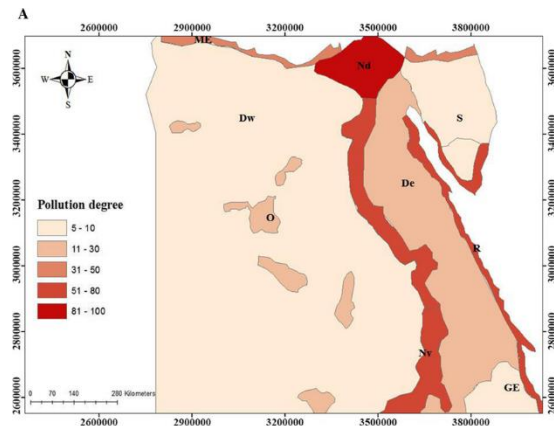


Figure 1: Pollution degrees in the phytogeographical regions of Egypt.

(Nile Delta), as shown in **Figure 1**. Another cause for pollution problems is the great amount of waste thrown by people and industrial factories into water, causing it to be polluted, especially in the Nile River in the NV region (Nile Valley), although Egypt receives over 55 billion m³ of Nile water per year, and 98% of all drinking water in Egypt comes from the Nile. Furthermore, land degradation causes land pollution, as it has been reported that urban areas in Egypt have increased by 30,510 feddan during the period from 1998 to 2014. This result illustrates the loss of fertile soils has increased dramatically during that period.

Causes

- Industrial power

Industrial power is the third highest contributor to the concentration of Cairo's PM_{2.5} (tiny airborne particles that measure less than 2.5 micrometers in diameter), as it contributes to 17% of the total concentration of PM_{2.5} in Cairo, as Cairo hosts a third of the nation's industry, although most of these industries are natural resource-based.

For example, the petroleum sector of the industry consumes huge amounts of energy carriers that produce toxic gases polluting the air when combusted such as the combustion of natural gas that represents the majority of total energy consumption in petroleum sector occupying 73.7% as shown in **Figure 2** producing nitrogen oxides which are precursors to smog, and small amounts of sulfur, mercury, and particulates.

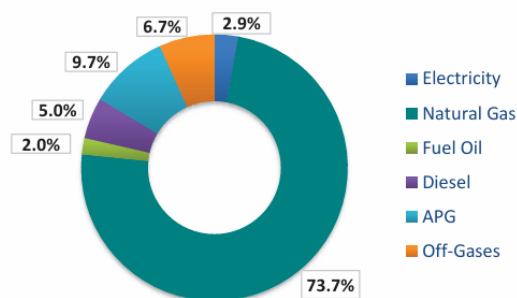


Figure 2: Petroleum sector total energy consumption by energy carrier 2021

- Wastes

The river Nile, the longest river in the world (as its length is about 4,258 miles), is the primary source of water in Egypt, but it is heavily polluted, as it is estimated that about 4.5 million tons of untreated or partially treated industrial pollutants enter the water supply per year, however the leading contributor of water pollution is agricultural waste as it makes 35% of all solid wastes as shown in **Figure 3**, and a big part of it enters the water polluting it, other contributors of water pollution in agricultural field are pesticides and chemical fertilizers residue from an agricultural application, and agricultural water drainage in river Nile.

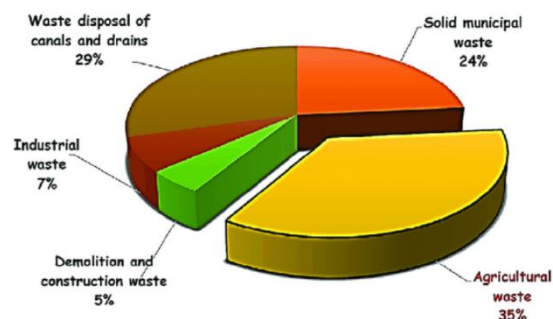


Figure 3: The annual solid waste by types and percentage of different solid wastes in Egypt 2016.

- Land degradation

Land degradation is caused by soil erosion and any other alterations in the hydrological, biological, physical and chemical properties of the soil. Soil erosion is classified into three types which are wind, water and tillage erosions, for example wind erosion depends on its speed in the amount of erosion it causes to soil as shown in **Figure 4**, and its severity arises from the selectiveness of the erosion process which transport fine particles that are important to plants like silt, clay, and soil organic matter, and their content of plant nutrients, another example is water erosion which is the removal of soil from one part to another, by the action of the movement of the water, furthermore tillage erosion is also a critical cause of soil erosion, as recently tillage erosion considers one of the drivers of land degradation.

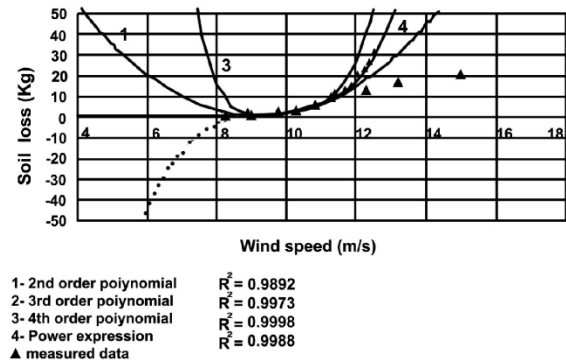


Figure 4: Regression analysis for soil loss experimental data.

Impacts

- Public health

Annual average ambient $PM_{2.5}$ in Greater Cairo shown in **Figure 5** is many times higher than WHO (World Health Organization) air quality guidelines, where particulate matter (PM) and especially $PM_{2.5}$ is the air pollutant that is globally associated with the largest health effects, as the health effects of ambient $PM_{2.5}$ exposure are ischemic heart disease (IHD), cerebrovascular disease (stroke) (CBV), chronic obstructive pulmonary disease (COPD), lung cancer, and diabetes Type II among adults (25+ years of age), and acute lower respiratory infections (ALRI) among children and adults (all ages), these diseases in addition to other diseases caused by air pollution causes around 18,000 premature deaths in Cairo, or 16% of the annual total, and 90,559 premature deaths in Egypt in 2019.

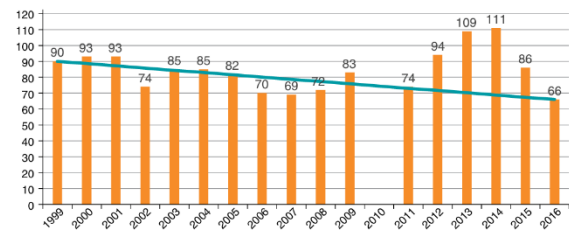


Figure 5: Annual average $pm_{2.5}$ in greater Cairo

- Economic cost

Egypt receives over 55 billion m³ of Nile water per year, although it is facing an annual water shortage of around seven billion cubic metres and the country could run out of water if this shortage continued to increase, this shortage plays an important role on increasing the economic burden in Egypt in addition to health effects caused by water shortage and pollution, as the annual cost of the health effects associated with poor drinking water, sanitation, and hygiene as shown in **Figure 6** is estimated at LE 26 billion to 56 billion in 2016/17, which is equivalent to about 0.75% to 1.61% of Egypt's GDP that year, other than that, the cost of diarrheal disease (which is caused by water pollution) accounts for 81% and schistosomiasis (which is also caused by water pollution) for 14% of the total cost of morbidity.

	Low	Central	High
Cost of mortality	13.3	20.2	28.1
Cost of morbidity	12.8	19.2	27.9
Total cost of health effects	26.1	39.4	56.0
% equivalent of GDP, 2016/17	0.75%	1.14%	1.61%

Figure 6: Estimated annual cost of health effects of poor water, sanitation, and hygiene in Egypt, 2016/17 (le billion)

- Land productivity

The total agricultural area of Egypt is about 8.5 million feddans, which means that only 4 % of Egypt is arable, and this percentage is decreasing due to land pollution, where soil degradation issue is one of the most important factors of land pollution as it lowers the quality of the soil as shown in **Figure 7** causing the land to not be able to grow plants in high quality or not to be able to grow plants at all threatening agricultural crops.

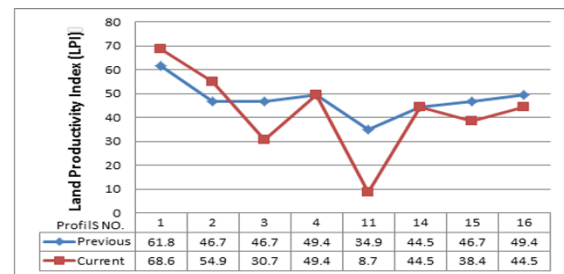


Figure 7: Changes in the LPI in the different Soil Profiles in the flood plain units.

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