Reducing Pollution Through Partnership

Angola

Evidence Project: Pollution in Angola

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Summary

This Evidence Project is part of the JNCC's Partnerships for Pollution Reduction project to design a wider pollution programme that will support increased capacity in low-income countries to better manage air, soil, waste, and chemical pollution. Overall, the aim of the project is to use information about the reality of these countries, to reverse biodiversity loss, build ecological resilience in the face of climate change, and improve human health.

In order to produce this document, most of the information has been taken from reports, articles, books, among other types of databases. Although the various types of pollution are notorious in Angola, there are still very few studies or scientific data around the theme. To support some data, specific case studies were described for certain locations in Angola to highlight some types of pollution.

In conclusion, it can be said that there is very little information about pollution in Angola, increasing the need for more studies, the creation of a database with information and the promotion of awareness campaigns about the various types of pollution for the general population, as well as influencing the implementation of more complete and realistic programs, framed to the needs of the country.

Contents

Abbreviations

OECD - Organization for Economic Cooperation and Development

UNEP - United Nations Environment Programme

WHO - World Health Organization

MPAs - Marine Protected Areas

USW- Urban solid waste

COD- Chemical oxygen demand

ADD- Acute diarrheal disease

1. Introduction

According to the Environment Framework Law (in Angola), Pollution - is the deposition onto the environment of substance or waste, regardless of its form, as well as, the emission of light, sound, and other forms of energy, in such a way and in such quantity as to adversely affect it.

Pollution consists of agricultural, urban, and industrial wastes such as fertilizers, sewage, heavy metals, among others. Many polluting agents that enter ecosystems are very toxic to living organisms and can be destructive to habitats and species, with studies proving the reduction in reproductive success, preventing and/or stunting the growth of a living being, and it can even cause death.

Pollution became more intense with the industrial revolution because there was an increase in industrialization and urbanization. According to a study published by the portal Aguenta (2018), experts released the list of the ten dirtiest capitals in the world and Luanda (capital of Angola), figured in the second position due to the high levels of pollution that have influenced a yellow fever outbreak which ravaged the country a few years ago and led to the death of thousands of people. Compared to Kigali, which was considered the cleanest city in Africa with its tree-lined streets, spotless and in beautiful order (Time, 2016).

The Evidence Project: Pollution in Angola, is a document that will demonstrate the current state of pollution in Angola based on conducted studies, despite their scarcity, and the few existing ones being mostly inaccessible.

Talking about pollution in Angola is a great challenge as there are still very few studies already done on the subject. Surprisingly, even with the visible number of different types of pollution (and their impacts) and the tendency to worsen, there seems to be a very low amount of concern from the government agencies that should address the situation, and that is seen in the national strategies that are created but not implemented.

2. Development

2.1. Pollution in Africa

In Africa, pollution kills more than malnutrition and untreated water. More than a third of the population lives below the poverty line, on less than $2 a day. However, another villain has been deadlier than lack of food or access to clean water: air pollution (Floresti, 2016).

Researchers from the Organization for Economic Co-operation and Development (OECD) calculated the impacts of air pollution in the region. It was found that nothing kills more than air pollution: there are 712,000 deaths per year caused by air pollution-related diseases and infections. The problem is worse in countries that have developed the most in recent decades - Egypt, South Africa, Ethiopia, and Nigeria. According to the study, old cars, and trucks, imported from other countries, are the main culprits for the poor air quality.

The Africa Waste Management Outlook published by UNEP in 2018, revealed that the total waste collected in 2012 in Africa was only 55 per cent of the total waste generated: 68 million tons, while the average municipal solid waste collection rate in the sub-Saharan region was only 44 per cent.

According to Josefa Sacko (African Union Commissioner), plastics are estimated to account for about 10 percent of the total global waste that humans generate, as modern lifestyles prefer easily disposable products leading to the accumulation of plastic products and increased environmental pollution across the world, including in Africa.

Josefa Sacko also pointed to the illegal dumping of toxic waste, including radioactive waste on African soil, as another challenge facing the cradle continent. She recalled that Africa adopted in 1991 the Bamako Convention (Mali), a treaty prohibiting the import of any hazardous waste, which came into force in 1998, with the aim of protecting human and environmental health.

The treaty also prohibits the importation into Africa and the dumping or incineration in the ocean and inland waters of hazardous waste, including radioactive waste, and establishes a precautionary principle, it provides for the adequate management of waste and chemical products in the continent. Yet, this is not the scenario experienced in Angola, particularly due to lack of monitoring and law enforcement.

The African continent is provided with abundant water resources. However, natural phenomena such as spatial patterns of precipitation, natural variability in rainfall and climate change, together with human factors such as population growth, competition for resources, and their degradation by pollution, increasingly threaten the sustainability of water resources in the continent.

In Africa, land degradation, as a process of reducing the capacity of soils to produce food or materials, is estimated to affect 65% of agricultural land, 31% of pastureland and 19% of forest land (FAO 2005). More than a quarter of Africa's arid and semi-arid regions show significant degradation due to soil erosion, nutrient loss, pollution, or salinization (White R., 2000). In general, the only option for the poorest farmers is to cultivate or raise livestock on marginal land, which can lead to a cycle of increased soil erosion and degradation, eventually leading to desertification. At the same time, it has led to increased use of fertilizers to increase productivity on already nutrient depleted soils.

The first two threats to biodiversity in Africa, as in the rest of the world, are agriculture and logging, which are associated with the substantial destruction or alteration and fragmentation of natural habitats. Effluents from agriculture and forestry, industrial effluents, military effluents, and domestic and urban wastewater are the main sources of pollution affecting threatened vertebrates.

Comparing African countries, according to the UN (2007), in Africa, Angola and Nigeria appear among the most affected by pollution. On the other hand, Mauritius and Rwanda are probably the cleanest countries.

3. Pollution in Angola

3.1. Types of pollution

Human beings living in society are constantly producing waste, besides also producing many pollutants that affect the air, soil, water, plantations, natural areas, and others. For this reason, it is necessary to correctly understand how pollution caused by human activities occurs, to obtain new and better measures to combat the environmental problem in question.

The classification that will be presented below refers to the main socio-environmental components affected by the problem of pollution, in general, in Angola.

3.1.1. Atmospheric Pollution

According to Lusa (2016), Angola is the Lusophone country and one of the eight African countries with the highest mortality rate associated with air pollution, with 50 people out of every 100,000 dying due to exposure to poor quality outdoor air.

Compared to other African countries measuring air pollution in urban environments, Angola has the worst results, with an average annual concentration of 42 micrograms of fine particles per cubic meter of air across the country, a figure that drops to 27 when rural and urban areas are considered.

These data count from the report "Ambient Air Pollution: A Global Assessment of Exposure and Disease Burden" (2018) carried out by the World Health Organization (WHO). According to the report, particulate pollutants consist of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air.

According to Almeida (2011) in his master's degree on the Assessment of Particulate Pollution Levels in the city of Benguela, it was a first study in the field of particulate pollution and concluded that particulate matter, in the dry or rainy season, does not present equal concentrations throughout the space, it also varies depending mainly on road traffic of cars, construction and reconstruction work that occur in almost the entire city. The results obtained through the parameters used in the measurement of the samples allowed them to conclude that between the cities of Benguela, Lobito and the town of Catumbela, the highest values, which reflect the highest concentration of particulate matter, were found in Benguela.

According to the international NGO Lead Exposure Elimination Project lead poisoning is estimated to affect over 4.7 million children in Angola, causing widespread negative health impacts for both children and adults and a 6.6% loss of GDP (gross domestic product) due to lost income potential. Lead paint is likely to be a major source of this poisoning.

There is no legislation in Angola regulating air pollution. At the same time, according to the experts consulted for the survey of this evidence project, there is no public or private institution that is monitoring (periodically) the air quality of the cities most affected by air pollution in Angola.

3.1.2. Soil Pollution

Soil pollution corresponds to any change in its nature, caused by contact with chemical products, solid and liquid waste, reducing its productivity and harming the living beings that depend on it. One of the main consequences of soil pollution is de-fertilization, contamination via water and the excessive use of chemical fertilizers.

The main causes of soil pollution are:

- The release of pollutants into the soil such as: solvents, detergents, fluorescent lamps, electronic components, paints, petrol, diesel, automotive oils, and lead.
- The dumping of domestic waste, waste from construction works, waste from industrial activities and sewage directly onto the ground.

In Angola, agriculture continues to be the main source of food and income for the majority of the population, particularly inhabitants in rural areas.

Since the beginning of the armed struggle (colonization period and civil war after independence), the Angolan soil has been contaminated by numerous pollutants from weaponry, destruction of buildings, bridges, and other infrastructure. With the achievement of peace, it is expected that pollution levels have increased because of the reconstruction of most of these infrastructures, urban growth and the expansion of cities, agriculture, mineral exploration, onshore oil exploration (namely in Cabinda province) and the industrialization that grows every day, thus polluting the soil of urban and rural centers.

Anthropic factors such as deforestation, continuous cultivation without restoration of plant nutrients or fertilization, burnings/forest fires that are too frequent and increasingly intense, with the consequent exposure of the soil to rain and wind, are events that occur all over the country and contribute to soil degradation. In certain types of soils,

when erosion reaches a high level, cultivation areas are rendered useless, not only by the wearing away of the surface layer, but also by the formation of gullies, at various stages of depth, which prevent the continuity of economic exploration. The effects of soil erosion and degradation in hydrographic basins are also mentioned: high sediment production, degradation of ecosystems and water contamination, contributing to the pollution of watercourses, dams, weirs, lakes, and ponds, not only by the presence of solid materials, but also by the concentration of various types of agricultural additives with a high toxic potential, such as insecticides and fungicides, among others. It may also result in siltation (accumulation of sediment), favoring floods and inundation, and may even compromise urban areas (Base, 2015).

In Angola there are some legislative mechanisms to control soil pollution, such as:

- **Presidential Decree 190/12 of 24 August - Regulation on Waste Management**: Establishes the general rules concerning the production, deposit in the soil and subsoil, release into water or into the atmosphere, treatment, collection, storage, and transport of any waste, except those of a radioactive nature.
- Executive Decree 234/13 of 18 July - Provincial Waste Management Action Plan and Executive Decree 12/05 of 12 January - Regulation on Operational Discharge Management: These decrees only cover the waste management system in order to prevent pollution. It is still necessary to establish elements that quantify and qualify soil pollution in relation to the different ways of polluting it. At the same time, there is a high need for monitoring of private companies that greatly contribute to pollution, and which are not penalized according to national laws, especially also due to the difficulty of response from national constitutional courts, with cases being held up for years.

3.1.3. Pollution by chemicals (including fertilizers and pesticides)

National agriculture is strongly based on family farming, in which the use and technological assistance is scarce, and manual tools are used for land preparation, weeding, sowing, and harvesting. The use of fertilizers, correctives and pesticides is low, and production is usually low compared to world production.

Rural families usually own two or more plots of land. Production is based on a single rainy season, which extends from September to December in most of the country, and in most of the country no mechanized technologies are used, and animal traction is often the option.

The average fertilizer application rate in Angola was less than 5 kg per hectare in 2005. This is low even compared with the average for Africa of 13 kg per hectare, and very low compared with averages in other parts of the world (FAO).

More up-to-date reports and periodic monitoring are needed to further understand and compare if these figures are still the current reality. It is assumed that fertilizer application levels have increased since then, due to the growth of agricultural production in the country.

3.1.3.1. Prospects for the evolution of agriculture in Angola's Huila province: Case study of the Matala Irrigated Perimeter

Production levels are very low in almost all crops, because in most cultivated areas agrochemicals are not applied, which leads to very low productivity as some areas in Angola have low nutrient soils. The non-application of chemicals in this perimeter, and according to their reports, is mostly due to the lack of know-how from most farmers when it comes to applications and fertilization recommendations, particularly their safety. The few who make use of agrochemicals must travel great distances to acquire them, many going to Namibia for procurement. A great area is cultivated without the application of agrochemicals (fertilizers, herbicides, fungicides, and insecticides) or with very limited applications due to the scarcity of the products on the market. When available, they also present high costs, which also prevent their use by most farmers (Katata, 2019).

3.1.3.2. Case study - The soil of the commune of Funda

This work was carried out with the objective of evaluating the chemical degradation of the black clay soil of the Funda Prédio area (Bongue, 2018). The commune of Funda belongs to the municipality of Cacuaco, in Luanda province. What contributes to the chemical degradation of the soils of Funda is the excessive application of fertilizers. The black clay soil, predominant in Funda Prédio, has high fertility and does not require additional fertilizer applications unless the soil chemical analysis justifies its application. The excessive addition of fertilizers, in addition to increasing production costs and affecting the environment, can acidify the soil. On the other hand, the use of fertilizers with high saline content such as urea and nitrates, widely used by farmers in the region of Funda, promote an increase of osmotic pressure in the soil solution, damaging the development of crops.

As for other types of pollution by chemicals, no data was found that could support or demonstrate the assumption of visible pollution that occurs in the most different cities of Angola and its rural areas.

Pollution by other petroleum products used in cars and generators also occurs particularly in places where these vehicles and/or generators are serviced, and few are the workshops that dispose of and/or treat appropriately the remains of oil, among other chemicals, used.

A specialized and scientific study to make a survey on this aspect is urgent and necessary to better frame the potential resources of the programme to combat pollution in Angola.

3.1.4. Pollution from solid waste

In Angola, despite **Presidential Decree nº 190/12 of 24 August approving the regulations on waste management** in accordance with the provisions of article 11, paragraph 1, of Law nº 5/98 of 19 June (Angola's Environment Framework Law), the issue of urban solid waste is still a problem that deserves greater attention from the competent authorities, since urban solid waste is also responsible for the production of greenhouse gases (carbon monoxide, methane and carbon dioxide) which cause a significant increase in average global temperatures, as well as causing acidic rain (Mateus, 2020), resulting in very negative impact on people's health and biodiversity.

In 2014 the National Waste Agency (ANR) was inaugurated, where its main functions were to regulate the activity and concession of public services in the solid waste sector, develop and execute public policies, support country waste management (mainly affecting urban centres) and the creation of programmes for prevention in the generation, reuse, recycling, treatment and final disposal of waste, obeying environmental protection criteria, quality and efficiency of services without forgetting the economic viability of the projects.

However, in June 2020 a state reform resizing Public Institutes was made to increase efficiency in the provision of public services. This reform resulted in merging bodies such as the Support Unit for Environmental Monitoring, Industrial Audit and Spill Management and the National Institute of Environmental Management - INGA, giving rise to the new National Institute of Environmental Sustainability. It is now up to the new Institute along with ANR, to work on actions to mitigate the impacts that the "USW" (urban solid waste) and prevent that from continuing.

3.1.4.1. Main problems identified in the management of solid waste in Angola

Despite the efforts undertaken in Angola, with the creation of a National Waste Agency, practices that do not reflect good solid waste management are still frequent, namely:

- Deficient waste collection, due to lack of means (as pointed out by municipal administrations), leading to the scenario of deposit and accumulation of waste on the ground, open drainage ditches or next to standing water.
- Shortage of containers for disposal, creating the accumulation of waste in inappropriate places and influencing the increase of open air burning in peripheral neighborhoods (and not only).
- Little or even no environmental education and sensitization of communities.
- Little incentive for selective collection and no deposition points.
- Non-collaboration of the population in the disposal of waste in the proper places. Waste is often disposed of on the public highway, even with the presence of containers.
- Flooding of some neighborhoods in rainy weather, preventing the circulation of people, because of the accumulation of waste in the drainage ditches.
- Poor families become waste scavengers for sustenance, with no means of protection, running serious risks of contracting diseases.
- Lack of institutional collaboration between governmental institutions, academic/research and the private sector. It is important to also mention that same lack of collaboration with local NGOs, and the integration of their work in the National Strategies.

3.1.5. Water Pollution

Water pollution is the contamination of water resources through the release of physical, chemical, and biological compounds harmful to living beings. It destroys food sources, causes the death of animals, and contaminates drinking water. The main causes of water pollution are:

- Discharge of sewage into aquatic environments.
- Dumping of waste directly into the sea, rivers, or lakes.
- Leakage or spillage of oil from maritime accidents and/or offshore oil exploration.

- Pollution of groundwater with pesticides and fertilizers that are carried by rain (runoff).
- Erosion processes on the banks of rivers and lakes.

Water pollution has some policies and regulations that could support the prevention and mitigation of water pollution in Angola, but law enforcement is still one of the biggest gaps. Some of the main laws are:

- **Presidential Decree 141/12 of 21 January - Regulation for the Prevention and Control of Pollution of National Waters**: Establishes the regime for the prevention, surveillance and control of pollution of national waters by pollutants from ships, vessels, platforms and industrial establishments.
- **Presidential Decree 261/11 of 6 October - Regulation on Water Quality:** Determines the standards and criteria for water quality, in order to protect the aquatic environment and improve the quality of waters, according to their main uses.
- **Executive Decree 12/05 of 12 January - Regulation on the Management of Operational Discharges**: Establishes the rules and procedures on the management of operational discharges carried out by oil companies both onshore and offshore.
- **Presidential Decree 82/14 of 21 April - Regulation on the General Use of Water Resources:** Defines the regime for the general use of water resources, including the mechanisms for planning, management, and economic and financial retribution.

Although Angola has all these regulations, most of them are quite generic. Progress is urgently needed in relation to ways of preventing and controlling water pollution, especially due to the high quantities of plastic generated that are not adequately disposed of and/or treated, as well as the industrial and domestic sewage that ends up in water bodies. At the same time, there are only a few water treatment stations that are active in the country, and those are barely monitored by the government.

The major "handicap" of the Angolan Water Law is the absence of regulation to govern the activities related to public water supply and sanitation, itinerant water supply, the attribution of licenses and concessions for the use of water resources, water quality, pollution control (Jacinto, 2012).

3.1.5.1. Case studies: Water pollution from mineral extraction

According to Martins (2021), the Catoca mining company admitted a spill of waste from its diamond mine, in Lunda Sul, northeast of the country, which would have contaminated the waters of the Lova river, before the leak was, in the meantime, stopped. On the other side of the border, in the Democratic Republic of Congo, the authorities have denounced the pollution of the Kasai river with red waters that have caused the death of fish and even hippopotamus. No further studies were carried out or conclusions drawn after the complaint was made.

Other studies carried out by Ferreira (2016), in the region of Nzagi in the municipality of Cambulo, also in Lunda Norte province, showed the environmental and social impacts caused by artisanal diamond mining in that region. The study showed that illegal mining in the region takes place in the open air, mostly in rivers and illegally, causing soil erosion, deforestation, diversion of rivers and silting up, in addition to air pollution and noise pollution. The rivers have a high rate of turbidity caused using water for washing gravel, clothes and even for bathing, as well as used for many other domestic tasks. The author points that the large number of areas occupied for concessions, leave very few options for the development of other economic activities by the population, who end up subjecting themselves to precarious housing and working conditions, and without the minimum of basic sanitation.

Another example is the contamination of water resources through mining activities along the Kunene River basin (Huíla province), which may increase significantly due to recent developments in this sector. As large-scale mining activities were disrupted by the civil war, the Angolan government is now encouraging large investors to resume the exploitation of mineral resources within the basin.

A major concern about pollution in the mining industry is the inevitable contact of solid by-products with water from certain mining processes and/or run-off water generated by precipitation. Drainage water from mining areas also influence the increase of heavy metals such as copper, lead, cadmium, chromium, and zinc concentrations on these water sources.

Potential sources of groundwater and surface water pollution due to mining activities are:

- Toxic effluent from tailings ponds or other mining processes related to surface water.

- Unprofessional/inadequate storage of toxic by-products against percolation into groundwater.
- Acid mine drainage that has high sulfur ore (e.g., pyrite);
- Inadequate disposal of chemicals used in flotation or other concentration processes.
- Surface runoff poses a significant threat of environmental problems through erosion, transport of tailings and other mining waste.
- Transport of mining materials.
- Maintenance and repair of machinery.

In Angola, after diamonds, the development of the stone extraction industry is a priority for the Ministry of Mineral Resources, Oil and Gas. This sector has recently experienced rapid growth, with exports of black granite almost doubling in recent years. A variety of stone deposits including marble, crystalline quartz, red and black granite occur in the middle of the Kunene River basin in Huila Province.

The lower Kunene River basin has not been well explored and its full potential is not yet known. Recent exploration in the area has failed to locate important natural resources but has revealed a considerable number of deposits (titanium, nickel, lead-zinc and copper) that may be viable for small-scale mining operations. Several small-scale mining operations are currently underway in the region. These include two garnet rock mines in the Otjindjangi area and the blue sodalite mine in Swartbooisdrift (ERM 2009).

There is also a need for further studies and surveys on pollution from this type of exploration, particularly given its exponential growth in recent years. This would contribute not only in the strategy to reduce its impacts and minimize pollution, but also to prevent it from occurring, especially in places that can impact thousands of people and that can easily transport pollution, such as rivers.

3.1.5.2. Case study: Pollution in the Bay of Luanda

The “Baía de Luanda” is in an urban perimeter and is subjected to several industrial and domestic waste discharges.

For those who pass by the place, can quickly notice its contaminated conditions of the water, by its color, smell, and it’s easy to identify solid waste contained there, such as pieces of paper, plastics, aluminum, microparticles and other insoluble chemicals in liquid state. This tends to worsen in areas of greater dumping. It is also possible to see fauna surviving in these conditions, such as several colonies of sea snails, beach

cockroaches, barnacles, and some fish. However, the water proves to be contaminated by the type of community present and the little biological diversity in it (Abreu, 2019).

The situation of Luanda Bay is alarming due to the degradation of its ecosystem and because it is a tourist and commercial point of interest in Luanda, therefore also an environmental, economic, and social challenge. However, it is quite possible that the prolongation of this degradation could become a major public health problem in a few years.

Figure 1: An image showing pollution in the Baia de Luanda. Source: Adapted from EcoAngola, 2019.

There are few studies on the subject, despite it being one of Angola's main calling cards. At the moment, the Luanda Waterfront project is underway, where they indicate the preparation of an ecological report of the area. They were contacted by EcoJango, but the report is not yet available.

3.1.5.3. Case study: Pollution from the oil industry

In the ranking of the largest oil producers in Africa, Angola is in second place and is in an important marine traffic area. According to an article published by EcoAngola in 2020, Angola has already had several oil spills along the coast, but these were not

reported by the authorities and media, particularly in cases where the authorities could not identify the source of these spills. Cabinda recorded several serious oil spills as it was in 2001, 2011 and 2015 by Chevron and in 2019 by Somoil. In February 2020 oil slicks were detected on the beaches of Quinfuquena, in the municipality of Soyo, Zaire province, and which have advanced as far as Cabinda. These occurrences have dramatically affected the ecosystem of the Maiombe National Park in the most varied aspects. According to fishermen and local people, the spills caused the death of some rare species of marine animals in Cabinda, especially turtles and whales, and may be one of the factors causing the disappearance of mangroves at the mouth of the Chilongo river. There was no further public statement about the mitigation of this problem, nor an accessible/public report on the matter.

More recently, during March 2022, an oil spill that occurred in an inactive onshore well in Sassa-Zau Road, commune of Malembo, not far from the largest water storage and collection point in Cabinda province, was also reported by civil society. Now, there is an expectation to receive a response from the competent institutions about this occurrence, the staunching of this spill, and the accountability of the companies that worked at the site.

3.1.5.4. Case study: Pollution in the rivers that cross the centre of the town of N'dalatando, Kwanza-Norte province

According to Jornal de Angola in 2018, the former Environment Ministry, was concerned about the high pollution indices that characterize the rivers that cross the centre of the city of N'dalatando, in Kwanza-Norte province.

Figure 2: An image showing the pollution in the rivers that cross the centre of the town of Ndalatando (Kwanza-Norte, Angola). Source: Jornal de Angola, 2018.

The Ministry, who visited the capital city of Kwanza Norte province, noted that this location, as well as its resources, are used by the population as a rubbish dump and therefore suggested the construction of a sanitary landfill to deal with the situation. During the two-day visit to the region, the former Environment Ministry agreed that necessary actions were needed to evaluate the pollution levels of the waters of these rivers.

3.1.5.5. Case study: Study for the urgent rehabilitation programme of the ports of the Republic of Angola: Final Report

A study was carried out in the ports of Luanda, Namibe, Lobito and Cabinda by the Japan International Cooperation Agency (JICA) and the Ministry of Transport (MINTRANS) in August 2006 to evaluate prospects on their rehabilitation. The report did not include water quality tests and therefore there is no previous data on water quality in these and adjacent areas. Thus, although being outside the Study sphere, a simplified test for turbidity, COD (chemical oxygen demand) and fecal coliforms was carried out in September and October 2005. Collections were also made outside the bay of these ports for comparison purposes. The results showed that, in general, the COD (chemical oxygen demand) values are not high, and it can be concluded that there is no pollution in advance. However, at the bottom of Luanda and Lobito Bays, there were areas presenting figures higher than 4mg/l, indicating the existence of point source pollution. Such areas also present large numbers of fecal coliforms, with values higher than 5,000 MPN/100mg (a value that indicates high pollution). According to

interviews conducted at these sites, it was reported that there are also domestic effluent discharge points adjacent to the ports. Cabinda Bay presents high turbidity due to sand loading from the Congo River, but in terms of COD (chemical oxygen demand), it and Namibe Bay present good water quality.

We conclude that this study may not show the real state of pollution in this area, due to the many different interests to conclude this study.

3.1.5.6. Case study: Water quality in Uige province

According to Manuel, Leitão, & Boaventura (2018), the situation in the city of Uíge is historically drastic in terms of the quality of the water used for consumption by the populations. In 2013 more than 90% of the population of this city did not enjoy drinking water, a situation that has not improved until the date of the survey, and in recent years, the city became a hotspot for various endemics and epidemics, with greater emphasis on waterborne diseases, such as cholera, typhoid fever, acute diarrhea, and many others, which originate a good portion of hospital admissions and even high occurrences of deaths. Although the relationship between water quality and health is evident, there is still a large gap regarding subsidized studies for accurate assessments on waterborne diseases and the effects of multiple environmental factors on such diseases and their evolution. In Uíge, there are no reports of such studies (as in most other provinces). The results of a preliminary study conducted from November 2013 to January 2014, at the Uíge Provincial Hospital, on the prevalence of some waterborne diseases (cholera, Acute diarrheal disease (ADD) and typhoid) in the period 2010 to 2012, indicate a higher prevalence in neighborhoods whose population uses unsafe sources (alternative sources) of water for consumption.

3.1.5.7. Case study: Pollution in the Kunene River basin

The Kunene River basin is located on the western side of southern Africa and comprises portions of southern Angola and northern Namibia. The basin is characterized by great climatic diversity - with abundant rainfall in the upper reaches and water scarcity in the lower reaches - a much-discussed hydropower potential and transboundary water resources management scenario. Therefore, the "Kunene River Awareness Kit" (KSR Kunene) was created, which is an information and a knowledge management tool aimed at supporting capacity building and sustainable management of the environment and natural resources in this area.

Meanwhile, the only wastewater infrastructure in the Kunene basin is in its higher reaches, at Huambo, with a sewerage network serving the city centre. However, the limited availability of potable water from the public network has an impact on the operation of the sewerage network. There is a combination of septic tanks and dry latrines serving most of the urban population although many inhabitants still do not have access to any sanitation. This is also a great example of most of the other provinces in Angola, even the most developed ones such as Luanda, Benguela and Huíla.

None of the other cities in the basin, such as Lubango and Matala, have sewerage systems or wastewater treatment plants. It is quite likely that some households and all large commercial and administrative buildings have septic tanks, but most of the population still only has access to simple dry latrines. The same is true for the rest of the country, with rural areas and smaller villages rarely having improved sanitation.

3.1.5.8. Case study: Physicochemical characterization of the water in the Catumbela River in Angola

The Catumbela River is an Angolan river, which rises in the hills of Cassoco and flows into the Atlantic Ocean, just after crossing the city centre of Catumbela. It supplies drinking water to the cities of Catumbela, Benguela and Lobito.

According to studies, the waters of the Catumbela River are contaminated by phosphates, nitrates, and chromium, particularly during the rainy season. Iron contamination is present in both the rainy and dry seasons. Potassium levels in water are present mainly in the rainy season.

There is an influence of industrial effluent discharge from local industries in this area, producing drinks, such as beer (SOBA-CATUMBELA) and soft drinks (Coca-Cola). At present there is no collection or treatment of most of the domestic and industrial effluents from the municipality of Catumbela, and they are discharged directly into the river, whichis deteriorating its water quality (Sassoma, 2013). The physical-chemical characterization data from this study show that the area around 60 to 80 meters from the brewery's effluent discharge, demonstrated high levels of turbidity in the water, with high suspended load, heavy flow, and the soil has a brownish colour, sandy, and rich in mica (Sassoma, I. 2013).

4. Most prevalent types of pollution found in Angola (by province)

According to the studies analyzed for the preparation of this document, the higher prevalence of certain types of pollution was highlighted, considering the distribution of the provinces in Angola and their major industries or population growth.

Figure 3: Map of Angola (by provinces). Source: Google.

The table below (Table 1) demonstrates an analysis developed through a quantitative approach from the workshop on pollution held by EcoJango in December 2021, where 29 experts submitted their approaches to pollution in different areas of Angola. The data was collected based on questionnaires, discussions, and raw data analysis using The International Union for Conservation of Nature's (UICN) Red List as a key tool in the Global analysis.

Table 1: Types of pollution found in Angola (by provinces). Source: Adapted from the conclusion of this report.

Number	Province	Type of Pollution	Causes
1	Cabinda	Water Soil	Petroleum Industry Timber exploitation
2	Zaire	Water	Petroleum Industry
3	Uíge	Soil	Solid waste
4	Cuanza Norte	Water	Solid waste
5	Malange	Soil	Solid waste
6	Cuanza Sul	Water	Human use
7	Luanda	Water Soil	Lack of sanitation Solid waste
8	Bié	Soil	Solid waste
9	Lunda Norte	Water	Diamond industry
10	Lunda Sul	Water	Diamond industry
11	Benguela	Soil	Solid waste
12	Huambo	Water	Lack of sanitation
13	Moxico	Soil Wood	Solid waste Exploration
14	Huíla	Soil Water	Solid waste Lack of sanitation
15	Namibe	Water	Lack of sanitation
16	Cuando Cubango	Wood	Coal exploration and production
17	Cunene	Water Deforestation	Beverage production Coal production
18	Bengo	Water	Lack of sanitation

5. Impacts of pollution on biodiversity

There is a major impact on biodiversity in Angola due to the high levels of pollution occurring throughout the country, regardless of its causes, putting at risk the biological resources that Angola has, however diverse they may be.

IUCN red list assessments reveal the lack of data on biodiversity in Angola, thus reflecting a relatively poor knowledge of species at the national level (Huntley, Russo,

Lages, & Almeida, 2019). With the worsening of pollution in its most different ecosystems, it is assumed that the conservation status of species, particularly those most affected by pollution, are moving towards the categories of greatest risk.

The current absence of marine protected areas (MPAs) is another key challenge facing the conservation and sustainable use of biodiversity and marine and coastal habitats in Angola, considering the multiple threats to the ecosystem that are likely to worsen over time.

There is an urgent need for further and more in-depth research on the conservation status and ecology of all species, particularly the endemic ones, especially with the many anthropic impacts that they suffer.

6. Conclusion

The rapid economic and population growth in Angola has an impact on the environment, but the lack of studies, reports, and other types of surveys, make it more difficult to understand the causes, to hold the polluters responsible and most importantly, to create short-, medium- and long-term strategies that could prevent pollution from happening in the first place.

Thus, one concludes that there is a huge need to take urgent measures, such as:

- Develop and establish sanitation strategies and works in larger towns and villages;
- Improve solid waste management and treatment at the national scale;
- Conduce community level awareness campaigns on sustainable use of water resources and proper disposal of their waste;
- Conduce ongoing biodiversity surveys and monitoring that contribute to national conservation plans;
- Apply greater accountability for polluters, and potentially higher fines;
- Improve monitoring and periodic surveys of pollution levels, particularly those that directly and continuously affect people and biodiversity; and
- Develop and implement a nationwide programme to combat pollution, but with higher priority for cities such as Luanda, Lunda-Norte, Lunda Sul, Cabinda, Benguela, Huila, Bengo and Huambo.

In summary, this Evidence Project has the objective to support the creation of a larger programme to combat pollution in Angola (from the causes to accountability and

prevention) in the coming years, with a great urgency to start this work in areas with higher incidence of pollution, loss of biodiversity and impacts on human health.

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