Issue description

Committee: United Nations Environmental Programme

Issue: Environmental effects of dams

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Introduction

Dams have plenty of functions. The majority of large dams are built for irrigation and almost all major dams are built for hydropower. Nearly one-fifth of the world's electricity is generated by dams. Dams also provide flood control, supply water to cities, and can assist river navigation. Many dams are multipurpose because they are providing two or more of the abovementioned benefits. Although dams could be truly beneficial, their environmental effects are numerous and varied, and includes direct impacts to the biological, chemical and physical properties of rivers and riparian environments.

Definition of key terms

- **Erosion**
  It is the gradual destruction and removal of rock or soil in a particular area by rivers, the sea or the weather.

- **Irrigation**
  Irrigation is the artificial application of water to land for the purpose of agricultural production. Effective irrigation will influence the entire growth process from seedbed preparation, germination, root growth, nutrient utilisation, plant growth and regrowth, yield and quality.

- **Sediment**
  Sediment is a solid material that settles at the bottom of a liquid, especially earth and pieces of rock that have been carried along and then left somewhere by water, ice or wind.

- **Reservoir**
  It is a man-made open-air storage area where water is collected and kept in quality.

- **Riverine ecosystem**
  Riverine ecosystem, also called lotic ecosystem, any spring, stream, or riverviewed as an ecosystem. The waters are flowing (lotic) and exhibit a longitudinal gradation in temperatures, concentration of dissolved material, turbidity, and atmospheric gases, from the source to the mouth. There are two major zones: rapids, shallow water where currents are strong enough to keep the bottom clear and firm; and pools, deeper waters where currents are reduced and silt and other debris collect on the bottom. Each zone has its specially adapted life forms.

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- **Coastal ecosystem**
  Coastal ecosystems are areas where land and water join to create an environment with a distinct structure, diversity, and flow of energy. They include salt marshes, mangroves, wetlands, estuaries, and bays and are home to many different types of plants and animals.

- **Marinal ecosystem**
  Marinal ecosystems are the largest of Earth's aquatic ecosystems are distinguished by waters that have a high salt content. These systems contrast with freshwater ecosystems, which have a lower salt content. Marine waters cover more than 70% of the surface of the Earth and account for more than 97% of Earth's water supply and 90% of habitable space on Earth.

- **Riparian zone**
  Riparian zone refers to a broader zone spanning from the riverbank to the floodplains. It occasionally includes hill slopes that may influence the stream ecosystem. The term can also be used to describe wetlands and lake shores. A riparian zone extends from headwater streams to lowland rivers, from surface waters to groundwater, and from stream banks to hillside slopes. A riparian zone consists of diverse and complex biophysical landscape elements that provide essential habitats for various terrestrial and aquatic organisms in all or specific stages of their life cycles.

- **Hydropower project**
  The term''hydropower project" refers to a water powered power plant, such as dams, underground hydropower plants or tidal power plants.

- **The World Commission on Dams (WCD)**
  With support from the World Bank and IUCN, the independent World Commission on Dams (WCD) was created in May 1998. Its mandate was to review the development effectiveness of dams, and to develop standards and guidelines for future dams. The Commission was chaired by South Africa's water minister Kader Asmal and consisted of twelve members from governments, industry, academia, and civil society.

General overview

Dams have two main functions. The first is to store water to compensate for fluctuations in river flow or in demand for water and energy. The second to raise the level of the water upstream to enable water to be diverted into a canal or to increase 'hydraulic head' — the difference in height between the surface of a reservoir and the river downstream. The creation of storage and head allow dams to generate electricity (hydropower provides nearly a fifth of the world's electricity); to supply water for agriculture, industries and households; to control flooding; and to assist river navigation by providing regular flows and drowning rapids.

Damaging Effects of Dams

Water temperature and dissolved oxygen content
Dissolved oxygen is the leading factor in water quality, and hydropower dams can drastically alter normal levels. Water that is diverted through a hydropower facility is typically much lower in dissolved oxygen than the rest of the ecosystem. When this under-aerated water is released

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downstream, it decreases the oxygen content of the rest of the river, threatening aquatic life below the dam. Not only being a threat to the environment, but dams also endanger some cities, whose income is mostly from fishery.

Extinction of species
It is also connected to the temperature of water and the dissolved oxygen content of rivers. As fisheries become an increasingly important source of food supply, more attention is being paid to the harmful effects of dams on many fish and marine mammal populations. The vast majority of large dams do not include proper bypass systems for these animals, interfering with their lifecycles and sometimes even forcing species to extinction.

Spread of diseases
Dam reservoirs in tropical areas, due to their slow-movement, are literally breeding grounds for mosquitoes, snails, and flies, the vectors that carry malaria, or river blindness.

Soil erosion
Soil erosion is defined as the wearing away of topsoil. Topsoil is the top layer of soil and is the most fertile because it contains the most organic, nutrient-rich materials. Therefore, this is the layer that needs to be protected for growing crops and grasses.

Social Effect of Dams
The building of dams can also have far-reaching and often unintended social consequences as well. It is estimated that almost a quarter of a million square kilometres of land has been inundated by the impoundment of river waters over the last century. The World Commission on Dams estimates that 40-80 million people have been displaced by dam construction in living memory. There are also increased health risks associated with the construction of large dam and reservoir systems, especially in tropical and sub-tropical areas. The increased transmission of malaria has been directly linked to the construction of dam impoundment reservoirs in Southeast Asia and Africa. A further health risk associated with dam reservoirs is the accumulation of toxins that can leech into impounded waters and be released downstream into the water supply used by people.

Major Parties Involved

China
Most of the world's dams are located in China. In their search for renewable electric power, China's engineers have been building mega dams at a rate unmatched in human history. Many large dams are being constructed on China's greatest rivers. Best known is the Three Gorges Dam, which stretches a mile-and-a-half across the Yangtze and can generate ten times the hydropower of the Hoover Dam. Yet the Three Gorges is only a fraction of China's current dam program. The government is now engaged in a new expansion of dams in great staircases, reservoir upon reservoir some 130 in all across China's Southwest. By 2020, China aims to generate 120,000 megawatts of renewable energy, most of it from hydroelectric power. The government declares that such dams are safe, avoid pollution, address future climate change, control floods and droughts, and enhance human life.

United States of America
The USA has a major problem because of its aging dams, which are known as the high-hazard dams. By 2020, 70% of the dams in the USA will be more than 50 years old, according to the

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American Society of Civil Engineers. These dams are extremely dangerous because they may induce flooding. In 2016, the Association of State Dam Safety Officials estimated that it would cost $60 billion to rehabilitate all the dams that needed to be brought up to safe condition, with nearly $20 billion of that sum going toward repair of dams with a high potential for hazard. Although a great amount of money is being invested in, the USA still has a complex problem because of its dams.

India

Although the detrimental effects of dams are well-known, India announced the expansion of dams throughout the country. „India is on a large-dam building spree, with more than 5,100 large dams already blocking almost all of its important rivers, and more to come. These dams have had a profound negative impact on communities and ecology upstream and downstream. While promised benefits of these dams (irrigation, hydropower or flood control) have been overstated, numerous interrelated and complex negative impacts have simply not been studied or documented. Nonetheless, communities and ecosystems continue paying huge prices of these impacts."[1]

Africa

„More than a billion people spread across 54 countries inhabit Africa, the world's second largest continent. International Rivers is tracking nearly 150 proposed large dams across those 54 countries. People from Kenya to Ghana, from Sudan to Zambia, from Uganda to Lesotho are under threat from dam building. Yet the immediate threat facing African rivers – including its biggest, such as the Congo, Nile, Niger and Zambezi – is relatively small compared to other basins, such as the Mekong. The limited number of dams is due to the same factors that threaten Africa's development overall: intense concentrations of poverty, corruption, violent conflict, and political illegitimacy. Once these investment risks are lessened, Africa's rivers could face a far greater assault by dam builders."[2]

Timeline of Events

- 3000 BC: The first known dam to be built is the Jawa Dam, which is actually the largest in a series of dams that are all part of one reservoir system. It was located in modern-day Jordan.
- 60 AD: The Romans started to build dams
- 5th century AD: The Sinhalese built several dams to form reservoirs to catch the monsoon rains for their intricate irrigation system, and many of these reservoirs are still in use today.
- 12th century AD: 4,000 dams were built by an egotistical Sinhalese ruler, King Parakrama Babu.
- 15th century AD: the construction of dams came to a halt.
- 1900s: Major advances in concrete dam design were made.
- 1936: The Hoover Dam was built, on the Colorado River.
- Mauvoisin Dam was built in Switzerland, in 1957.
- From the 1960s until today: Better and better dams are being built. But dams are started to be replaced by eco-friendlier variations, such as wind power plants.

[1] Quoted from: https://www.internationalrivers.org/resources/taking-action-in-india-on-downstream-impacts-of-dams-1672

[2] Quoted from: https://www.internationalrivers.org/solutions

Possible Solutions and Approaches

- The disposal of large, high-hazard dams. Although large dams are generating so much of many countries' electricity, but dams are also having a detrimental effect on the environment and the ecosystem near it.

- Replace dams with wind, solar and micro-hydropower plans, which has become much more affordable. Not only being more affordable, these new power plants are also widely available in most countries.

- Store rainfall can supply water without the serious impacts of large dams. It became easier and easier thanks to the wide variety of techniques that can be used for storing rainfall.

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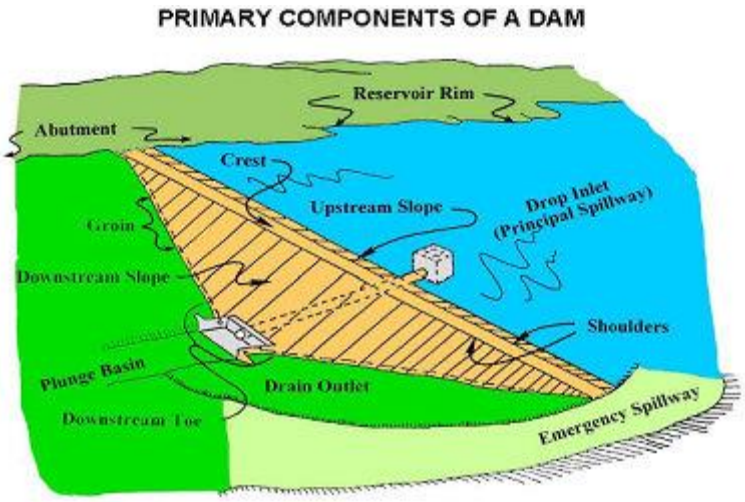
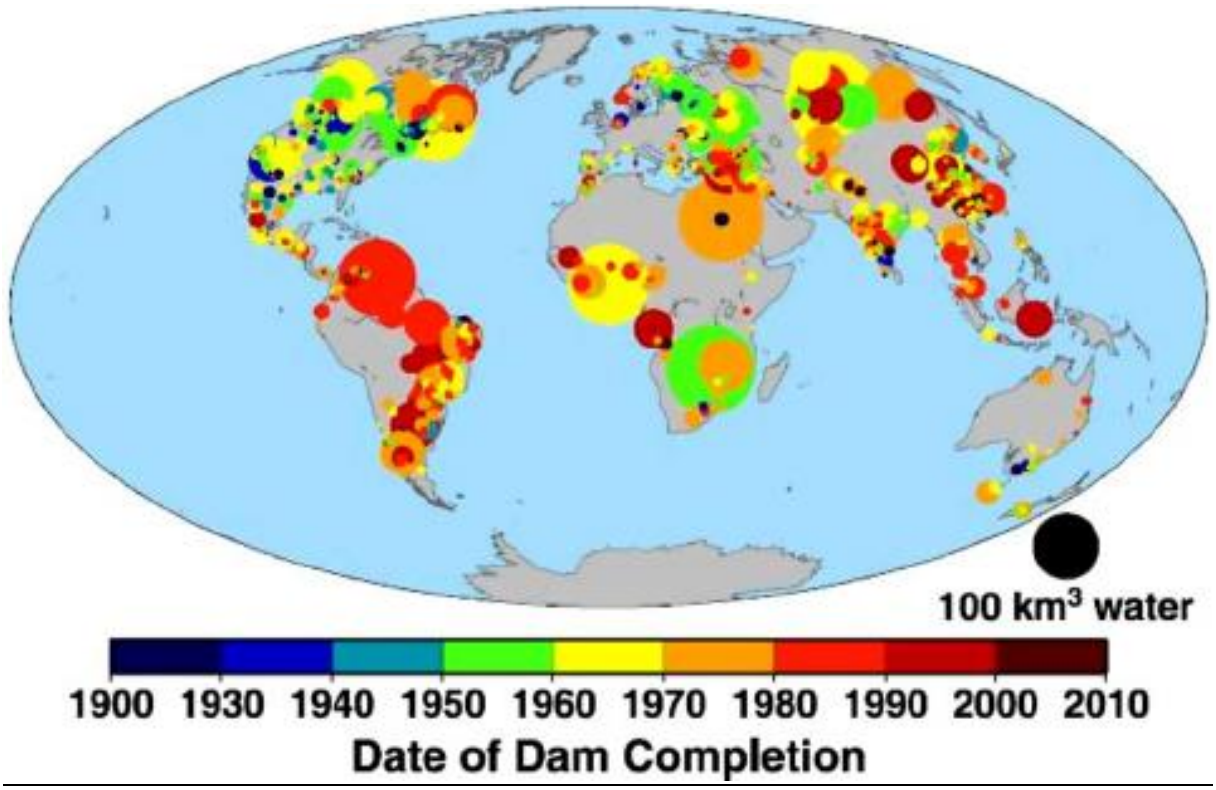
Annex





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