

TODAY'S GOALS

- Dams and reservoirs
 - Types of dams
 - Purposes of dams
 - Impacts of dams and reservoirs
 - Rivers, dams, and rehabilitation efforts
 - Should dams be removed?
- At the end of the lecture, we should be able to understand the impact of dams and reservoirs and how they fit into the water cycle.

INTRODUCTION

- Dams and reservoirs
 - Dams are the largest structures ever constructed by humans (except for the Great Wall)
 - Many purposes:
 - Flood control
 - Hydropower generation
 - Irrigation
 - Municipal water supply
 - Recreation
 - In 1950, there were 5,700 large dams. Today, there are over 45,000.
 - Vital for our civilization, but comes at a cost.

TYPES OF DAMS

Beaver dams

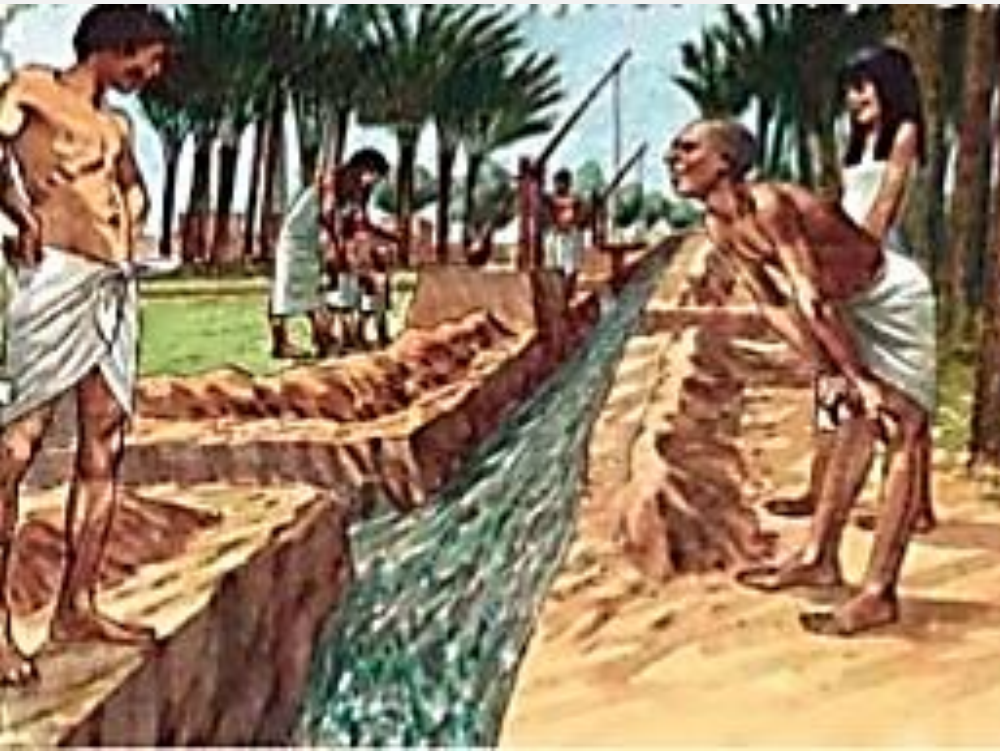
- Beavers build them to create ponds and wetlands – which have a huge impact on the ecosystem
- The beaver-made ponds provide homes for dozens of species
- As populations of beavers decrease, so do their dams, harming the ecosystems they have created



TYPES OF DAMS

Human-constructed dams

- Early dams were usually constructed for crop irrigation
- As technologies improved, large dams could be constructed and more civilizations relied on dams for food, irrigation, and drinking water



- Irrigation allowed humans to develop social order, laws, and human interdependency beyond what was previously seen in small clans or clustered communities

TYPES OF DAMS

Earthen dams

- The first dams ever constructed by humans were probably earthen dams on the eastern edge of Mesopotamia in the Middle East
- 8000-year-old canals have been found in this region
- Easy and cheap to build, which makes them the most common
- These dams have to be much larger than concrete dams because soil material cannot handle as much pressure



TYPES OF DAMS

Gravity dams

- These are thick, heavy, triangular-shaped walls of concrete or stone blocks
- Generally built across narrow river valleys with firm bedrock foundations
- The weight of the material is able to hold back the massive amount of water
- The oldest known gravity dam remains were found in 1885 in Egypt. Estimates date the dam around 2800 BC.
 - 350 feet high
 - 80 feet thick

TYPES OF DAMS

Arch dams

- Limited to narrow rivers with solid rock walls
- Much more thin than other dams, as it gets its strength from its shape



- One of the earliest arch dams was found in modern-day Iran in 1956.
- The structure still exists and is thought to have been built around 1280.

TYPES OF DAMS

Buttress dams

- First conceived in 1736, then constructed in 1747
- Supports that look like vertical ribs strengthen the dam

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PURPOSES OF DAMS

1. Flood control
2. Urban water use
3. Irrigation
4. Power generation
5. Inland navigation
6. Recreation

IMPACTS OF DAMS AND RESERVOIRS

Good and bad effects can come from dams

Good

- Water releases from dams dilute harmful dissolved substances during times of low water (maintains water quality)
- Dams can trap and bury harmful substances beneath sediments

Bad

- Water releases are usually low in dissolved oxygen
- Many species have evolved so that their reproductive cycles match flood seasons – this is disrupted
- Natural river temperature fluctuations negatively affects the ecosystem

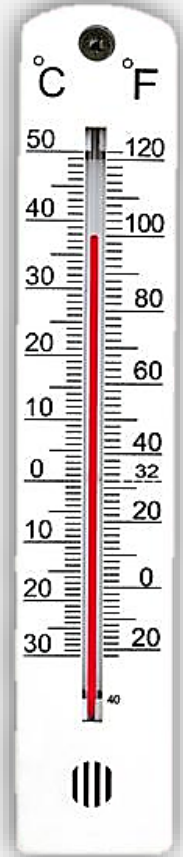
IMPACTS OF DAMS AND RESERVOIRS

Nutrient capture

- Dams hold back nutrients in the form of leaves, twigs, branches, and entire trees that would normally provide organisms with food
- These items also serve as shelter for many organisms

Water temperature

- Typically rivers do not change much in temperature
- Reservoirs have temperature layers
 - Summer: warm water on top and cold on bottom
 - Winter: cold on top and warm on bottom
- This means that the water released from the dam changes with the seasons



IMPACTS OF DAMS AND RESERVOIRS

Mercury

- Mercury affects the nerve cells in human brains and can be deadly
- Mercury is made into its toxic form by bacteria when their habitat doesn't have enough oxygen
 - Recall that the water released from dams is low in dissolved oxygen
- We will have a future lecture that focuses on mercury contamination.



IMPACTS OF DAMS AND RESERVOIRS

Dissolved oxygen levels

- Dissolved oxygen is reduced when the water is held in a reservoir for an extended period of time
- When the reservoir is first formed, submerged vegetation decomposes, contributing to this problem
 - Bacteria use the oxygen while they are breaking down the organic material

Fragmentation of river ecosystems

- Places a barrier between two sections of a river
- Isolates species that live upstream or downstream of a dam
- Example: salmon that spawn upstream no longer have access to that habitat

IMPACTS OF DAMS AND RESERVOIRS

Elimination of flood flows

- Dams capture floodwaters which keeps the floodplains from receiving the necessary nutrients to support vegetation and organisms
- Fish and wildlife have adapted to natural river flows, including flood seasons and removing the floods will disrupt the connection between the organisms and the environment

Urbanization

- Construction of dams and creation of reservoirs often leads to urbanization in the area
- Increase in roads, buildings, parking lots will replace natural vegetation