Hydrology and U.S. Mammals

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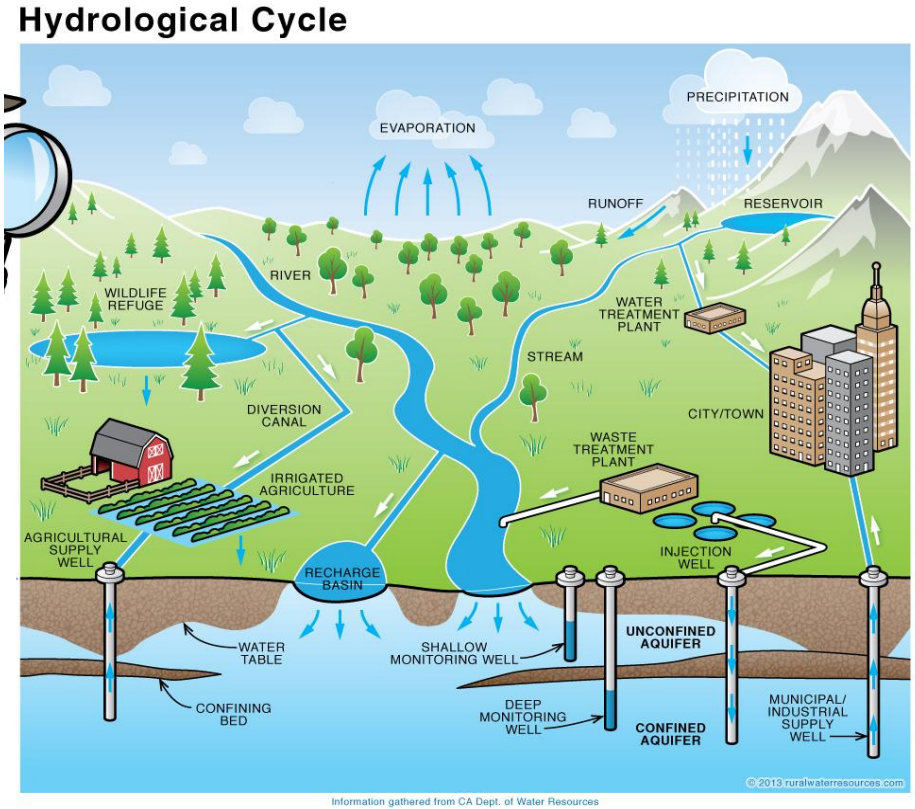
What you will learn



- Hydrology and its effect on mammals naturally through:
  - Floods and drought

- Hydrology and its effect on mammals unnaturally through:
  - Water pollution
  - Dams
  - Agriculture and Irrigation

Areas looked into

- Mexico (rivers)
- North American Arctic
- Mississippi River
- S. Illinois
- Wisconsin
- Gulf of Mexico
- Central Brazil
- California

Natural hydrology

- Caused by natural events happening such as flooding and droughts.
- Causes fragmentation and isolation.
- Also can cause travel for marine and land mammals, increase in biodiversity, and local extinction.

Flood v. Drought

- S. Illinois: **flooding** caused fragmentation of land and populations (tested on rodentia).
  - Affect: local extinction, vegetation change, slowed colonization

- Wisconsin: **drought** was researched to cause
  - Disease outbreak (botulism)
  - Increase in predation rates
  - Decrease in food
  - Dehydration
  - Areas of travel, no fragmentation (compared to floods)

Unnatural hydrology

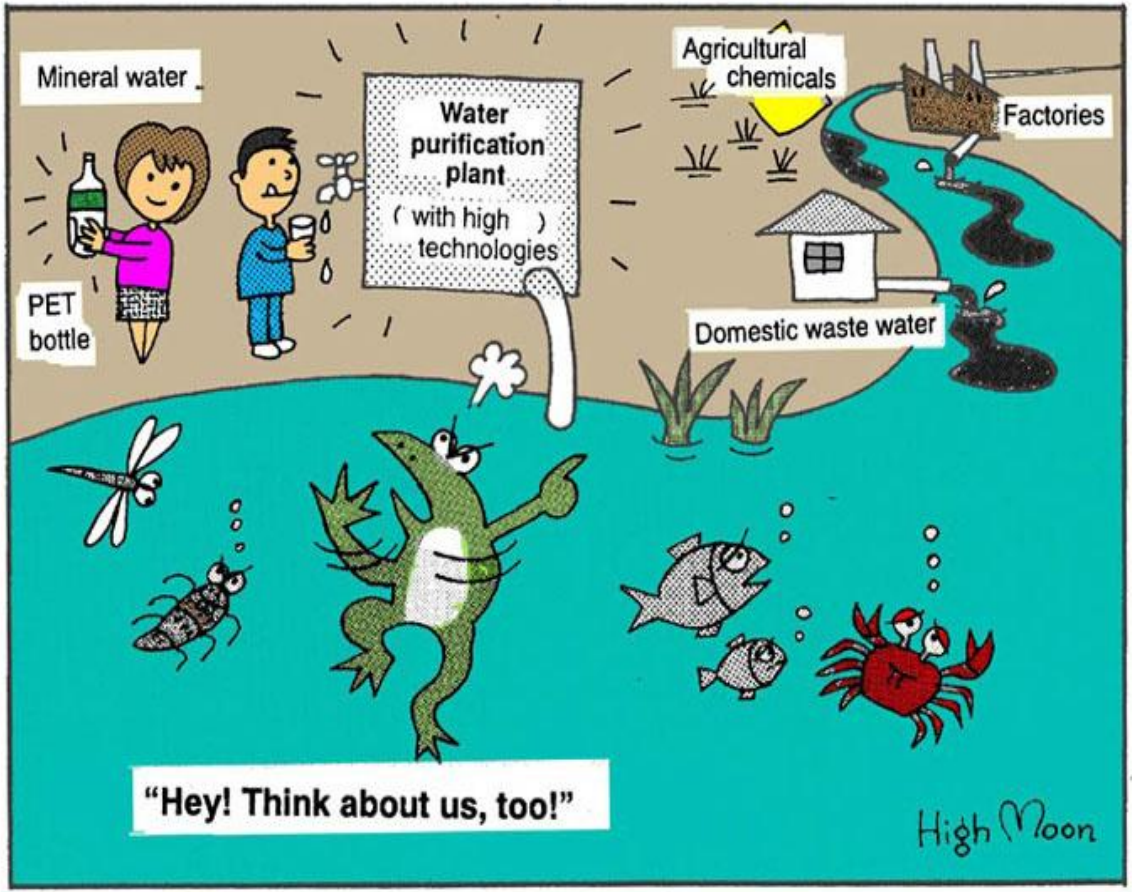
- Floodplain agriculture has been practiced in what is now the United States since at least 200 CE, with extensive canal systems developing by the 1200s
- Between 1834 and 1988, 195,000-260,000 km2 of United States wetlands was drained and converted
- Today approximately 60% of the world's river flow is regulated

Water pollution

Mississippi River Area:

- Chemical pollution:
  - Oil spills
  - Fracking
  - Human waste
  - Factory waste release
  - Pesticide/agricultural chemical release

- Solid pollution:
  - Litter
  - Flushed/improperly disposed products



Note: Prevention of ecosystems is a vital consideration in water issues.

Dams

- Small mammal (sampled from Didelphimorphia and Rodentia) decrease indicates most could not escape the flooding--being unable to travel long distances--and so some species went locally extinct although some predators initially benefitted
- Hydroelectrics generally create land islands without medium or large mammals, explaining the initial uptick in abundance due to lack of predation
- Dams built by humans contribute to global warming by the emission of greenhouse gases, which cause overall change in climate and affect living mammals as well as the surrounding environment

Case Study on Russell Lake

When Hubbard Glacier's ice dam broke, 4 million cubic feet of water gushed out to release marine animals who had been trapped by the advancing ice for four months. They were lucky to get a "nice ride out" to the sea, as until then saltwater seals and porpoises had been facing rising freshwater levels from glacial melt. This clearly shows however that dams (natural or not) cause travel barriers for mammals and may even trap and thus kill them as water levels rise and water content changes.

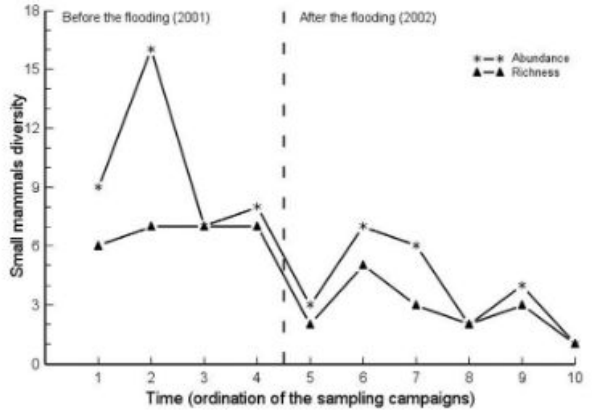
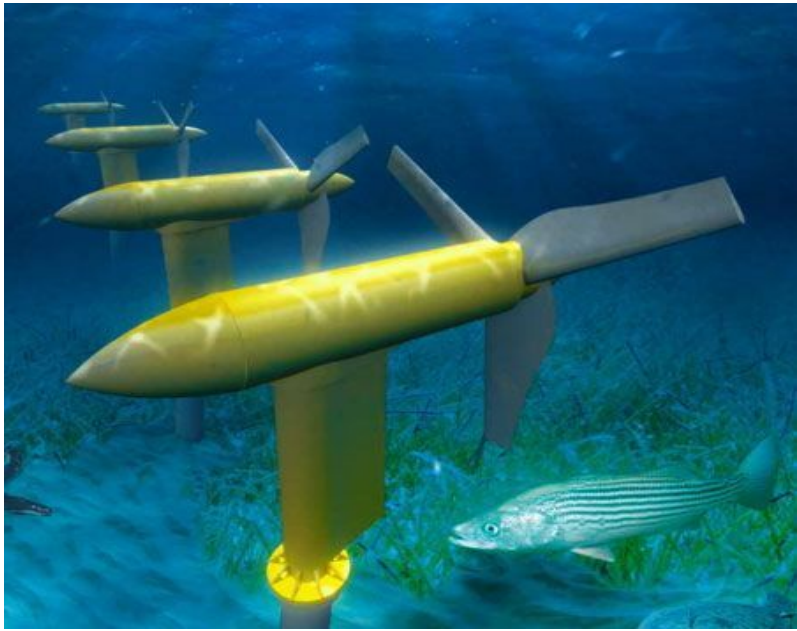


Figure 2. Abundance and richness of small mammals in the Capivara site per sampling campaign during the study period in the state of Tocantins, central Brazil. The dashed line represents the flooding of the Luís Eduardo Magalhães hydroelectric dam.

Alternatives to Dams

- Dams cause many problems from ecological disruption of the movement of fish, sediments, vegetation, and nutrients to the displacement of people and wildlife
- Some alternatives are
  - Free Flow Kinetic Hydropower systems
  - Water supply from underground aquifers
  - Solar or wind energy



Agriculture and Irrigation

- Agricultural water use contributes to conversion of wetlands, and combating drought
- 80% of California's water use supply is used by industrial agriculture, often at highly subsidized rates
- Many mammals, including large predators like bears and bobcats, have been threatened by large-scale vegetation death or pressured to move into urban areas
- Fertilizers and other chemicals in runoff lead to problems such as algal bloom and changes in water chemistry

Conclusion

- Hydrology affects mammals naturally through floods and drought, and unnaturally though water pollution, dams, and agriculture/irrigation
  - Natural hydrology: causes fragmentation and isolation, as well as often increased travel and biodiversity or local extinction
    - Flooding is correlated to fragmentation and thus extinction
    - Drought is correlated to higher predation, disease, and dehydration but lower food levels and no fragmentation
  - Unnatural hydrology: over half the world's water is regulated,
    - Causing chemical or solid pollution
    - Creating barriers for or changing the environment of marine animals
    - And reducing wetlands and causing drought (through irrigation), threatening many mammals and changing water chemistry through runoff

Sources

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