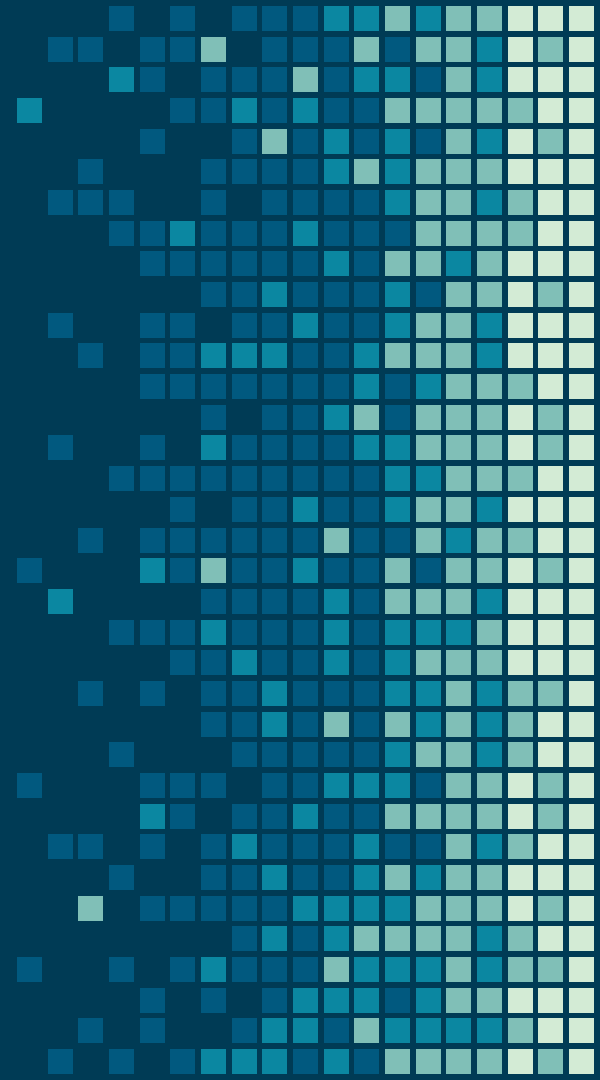


Role of Dams in Depleting Nutrients from the Sediments in the Amazon River

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Function of Dams

- Factors on energy production by changing speed of turbines
 - Reservoir volume
 - Drop in elevation

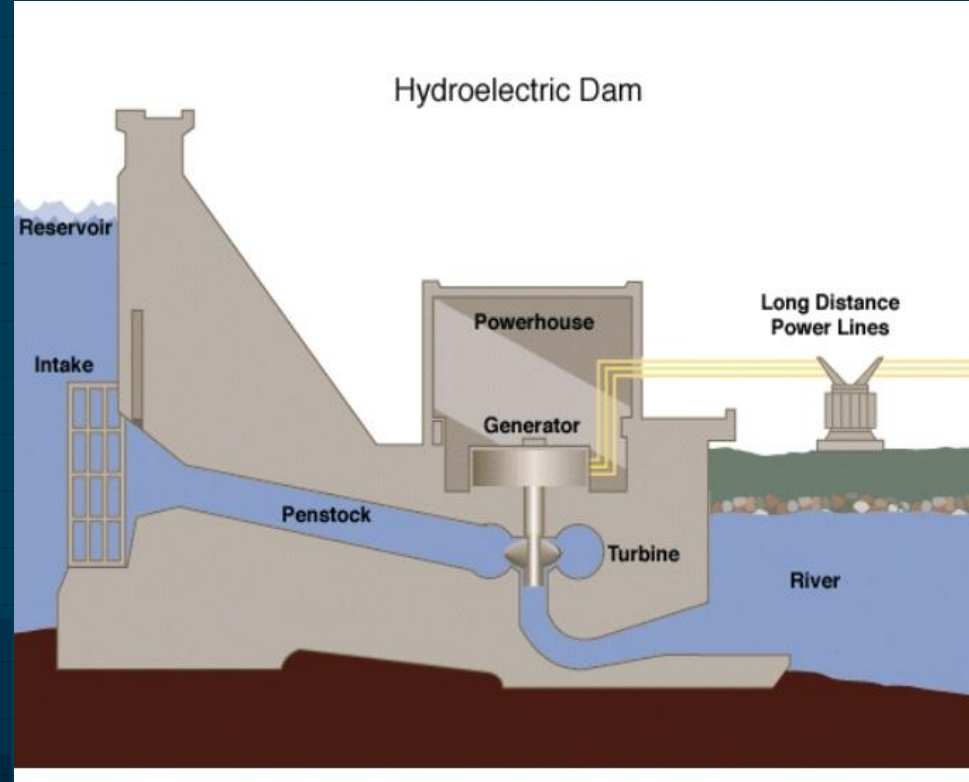


Figure 1. Shows the typical layout and procedure of a hydropower dam (U.S. Energy Information Administration, 2017)

Number of Dams in the Amazon River

- Over 50 large dams
 - 150 more planned
 - Hundreds of smaller, less impactful dams

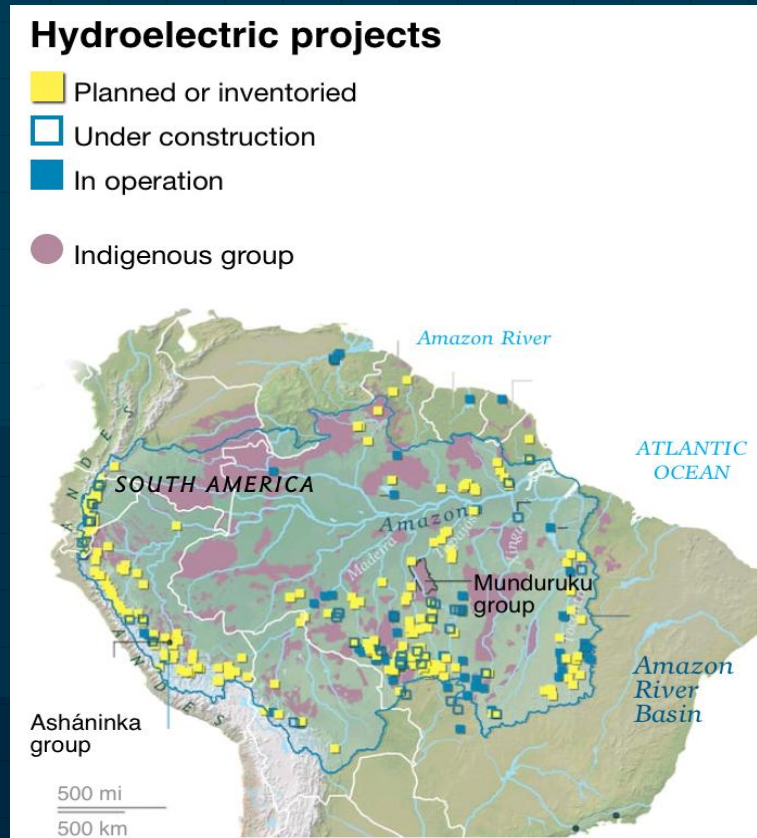


Figure 2. Shows the future and current projected number of dams (Vaidyanathan, 2012).

Down Stream Depletion

- Decrease of 20% in sediment concentration
 - Sediments blocked by dam

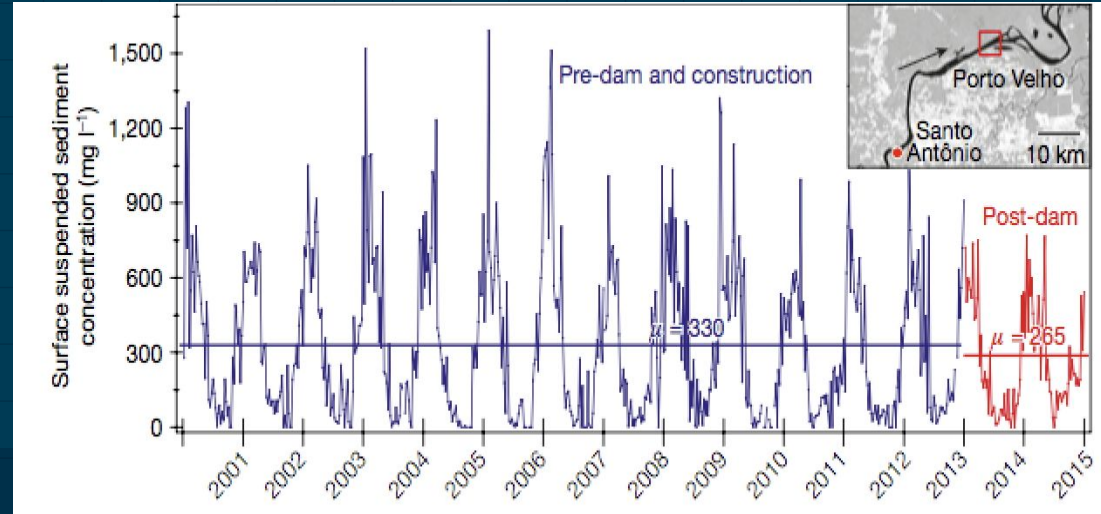


Figure 3. Shows a decrease in surface sediment concentration after the creation of the Porto Velho dam (Latrubesse, 2017).

Sediment Blockage

- Dams stop the release of sediments
 - Buildup of sediments at and above dam
 - Sediments begin to decompose
 - Sediments interfere with dam, reducing usage life

Increased Acidification

- Organic substances decompose leading to a release of carbon dioxide and methane in the form of gas

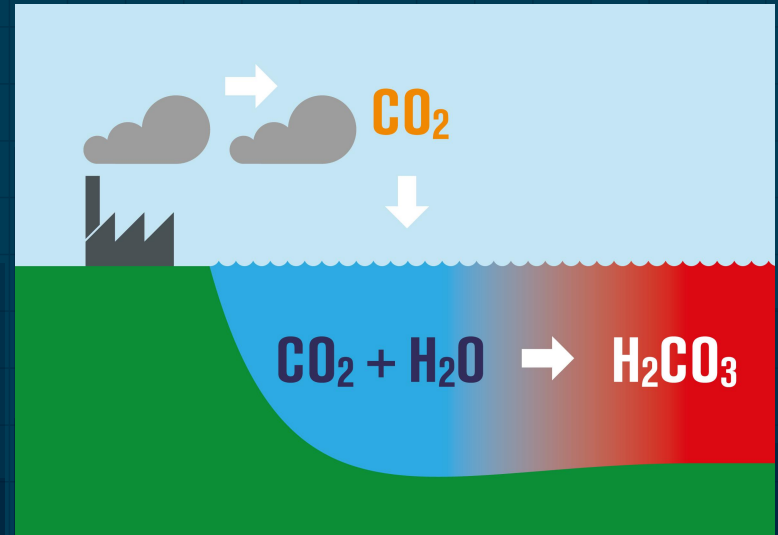


Figure 4. Shows the reaction between carbon dioxide and water to form carbonic acid (Penn State, 2017).

Changes in Solubility

- Increased production of carbonic acid decreases the pH
 - Increased acidity leads to a greater solubility of lead and other toxic metals in the water

Release of Methane

- Sediments decompose, releasing methane gas
 - Sediment levels differ at different distances from dam

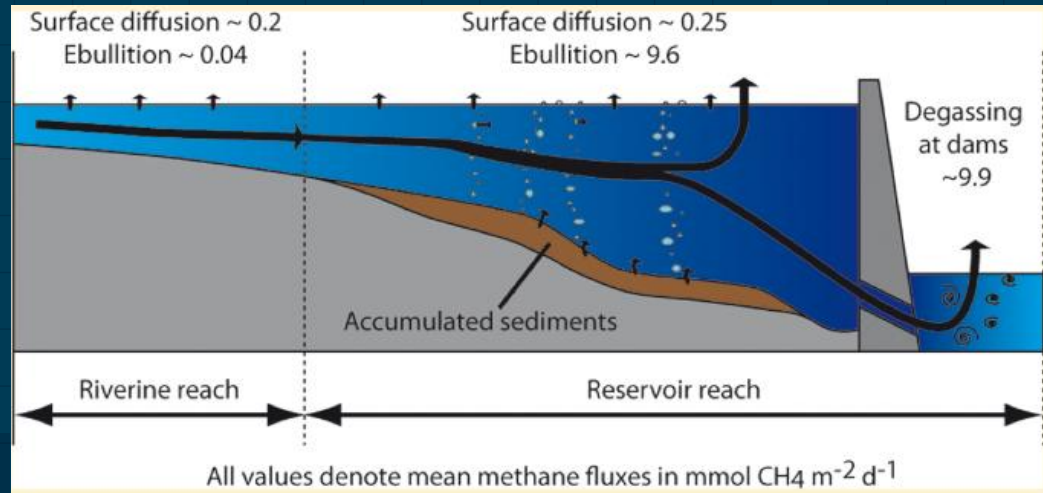


Figure 5. Shows the effusion of methane once the organic sediments begin to decompose (Maeck, 2013)

Purpose

- Identify the effects of Hydropower on sediments in the Amazon River
- Research the role sediments play in the Amazon River

Hypothesis

- Alternative: Dams decrease the nutrients in the river water

Amazon Basin

- Null: Dams have no effect on river sediment

Research Question

- Do dams decrease sediment concentrations downstream leading to increased acidification and release of methane?
- Does increased sediment concentration lead to acidification and release of methane?

Methods

- Systematic literature review
 - Peer-reviewed articles retrieved from various scholarly sites and mentors using keywords
 - The key words included sediment depletion, organic sediments, and sediment decomposition
 - Articles then were analyzed for data about sediments and gas concentrations

Methane Concentrations at Different Depths

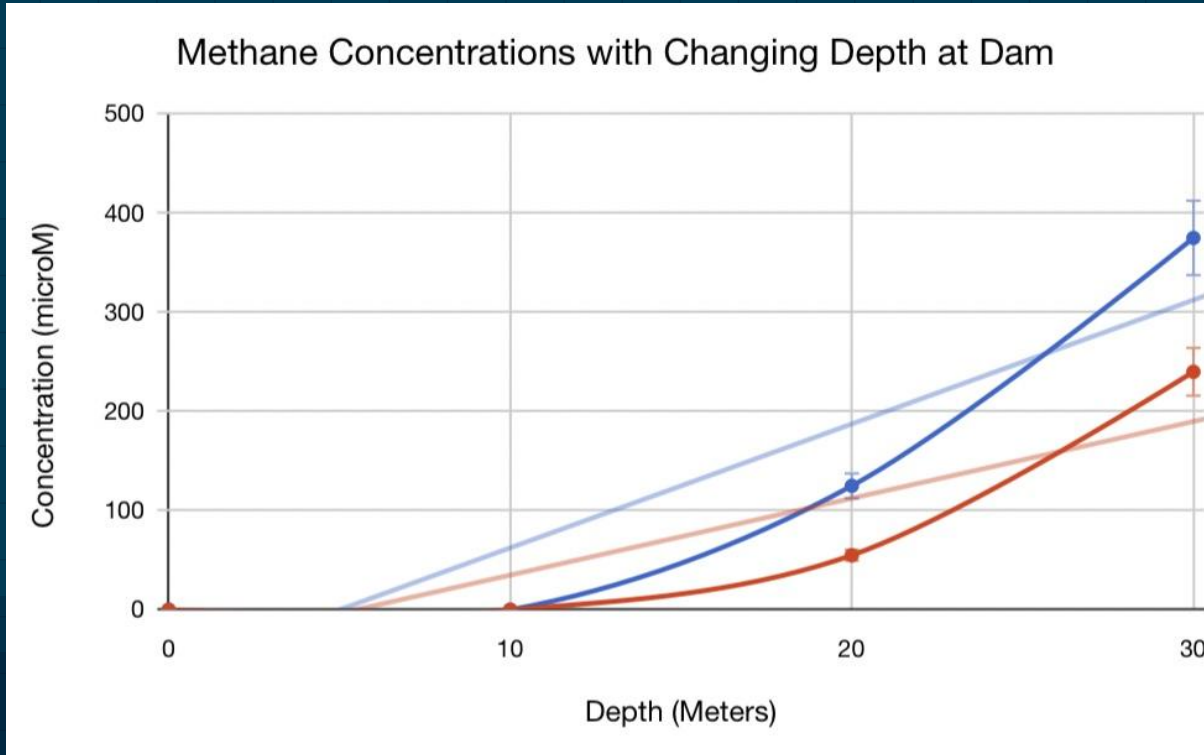


Figure 7. (Left) shows the increasing methane concentrations at lower depths (Kemenes, 2017; Fearnside, 2012).

Changes in Concentration

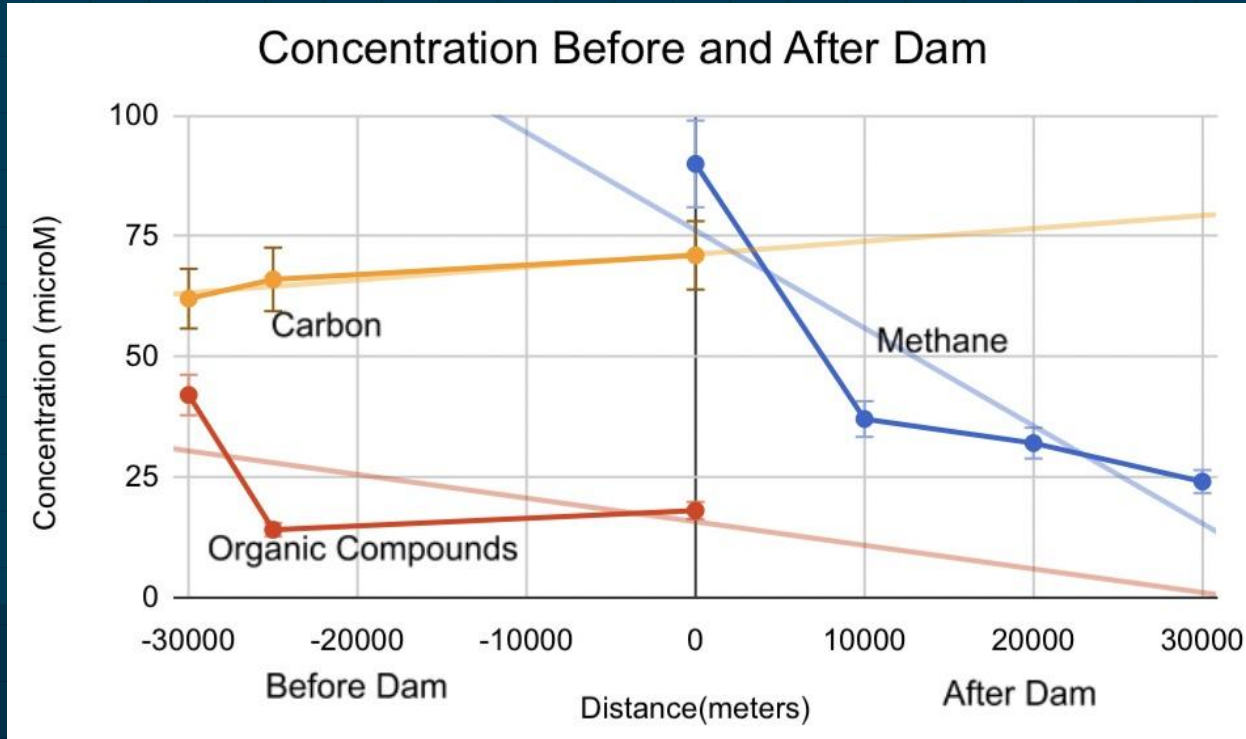


Figure 6.(Left) shows the increasing and decreasing concentrations of carbon, organic sediments, and methane based on their distances from the dam (Kemenes, 2017; Torrente-Vilara, 2011; Fearnside, 2012; Cardoso, 2013)

Discussion

- Dams block sediments from passing on downstream
 - The organic substances begin to decompose
 - The products effuse in the form of carbon dioxide and methane
 - Acidity in the river is increased

Conclusion

- Dams increase concentration of sediments above dam and decrease concentration below
 - Sediments play an important role in maintaining pH
 - Sediments decompose, releasing greenhouse gases
 - Proper work should be done to assess site of dam

Further Work

- Educate people
- Give time for river to slowly adjust to different conditions
- Look into different sources of energy
- Place appropriate restrictions on the locations of new
dams

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