

# The Contribution of Point and Diffuse Sources of Nutrients to Lake Diefenbaker: A Sensitivity Analysis

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# Background

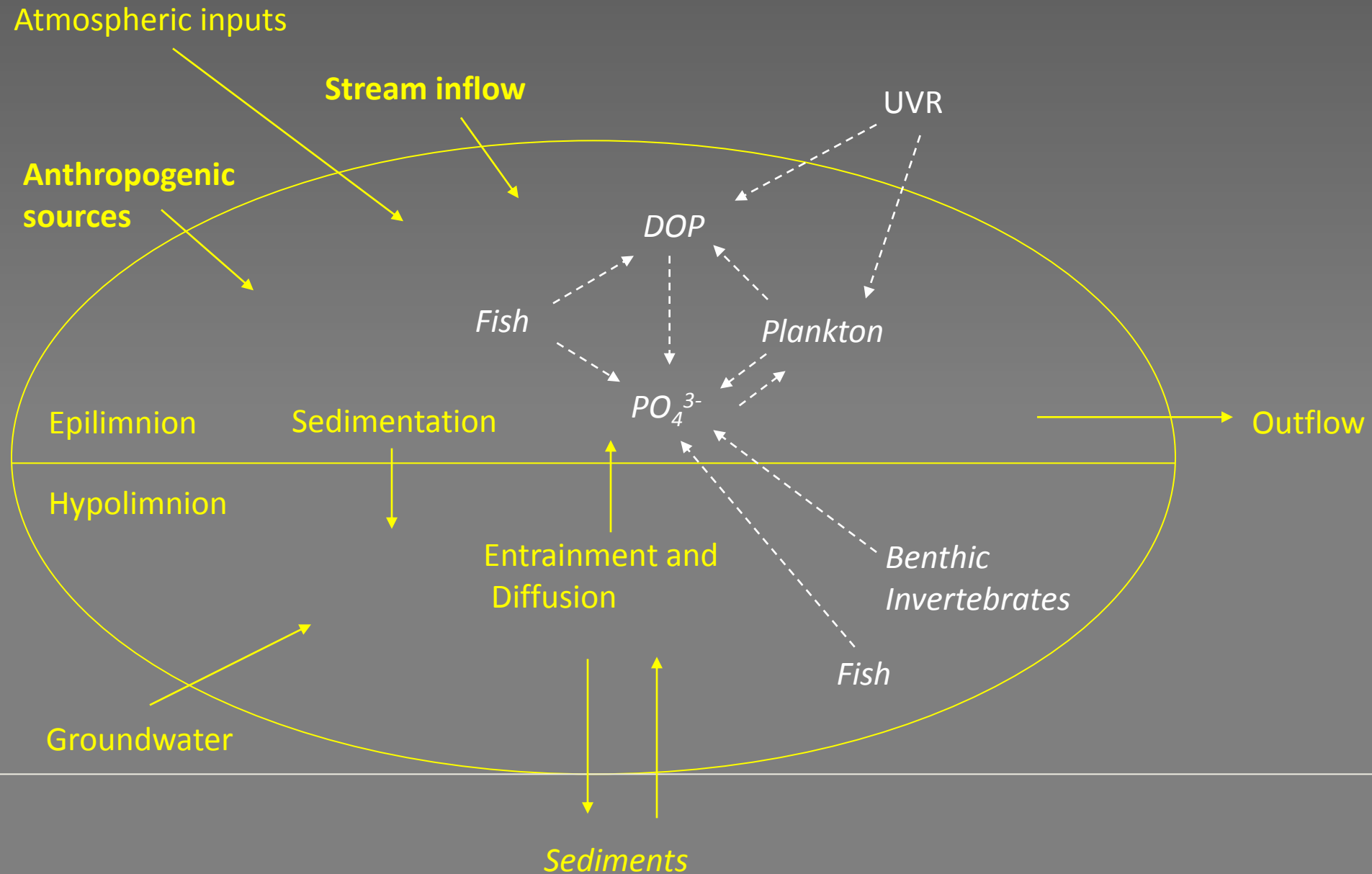
- Lake Diefenbaker:
  - Large reservoir
  - Surface Area: 500 km<sup>2</sup>
  - Shoreline: ~760 km
  - Mean depth: 33 m
  - Annual water level fluctuation: ~6m
  - Significant annual variation in water and nutrient loading

**= A COMPLEX SYSTEM**

# Background Cont'

- Important site for recreation, industry (Aquaculture), irrigation, and municipal water
- Apparent increase in the frequency and intensity of algal blooms
  - May be a heterogeneous distribution of these blooms
    - Distribution may be related to in-lake processes and/or local nutrient sources

# Pathways in the P Cycle of Lakes



# Why Phosphorous?



Lake 226

C, N

C, N, P

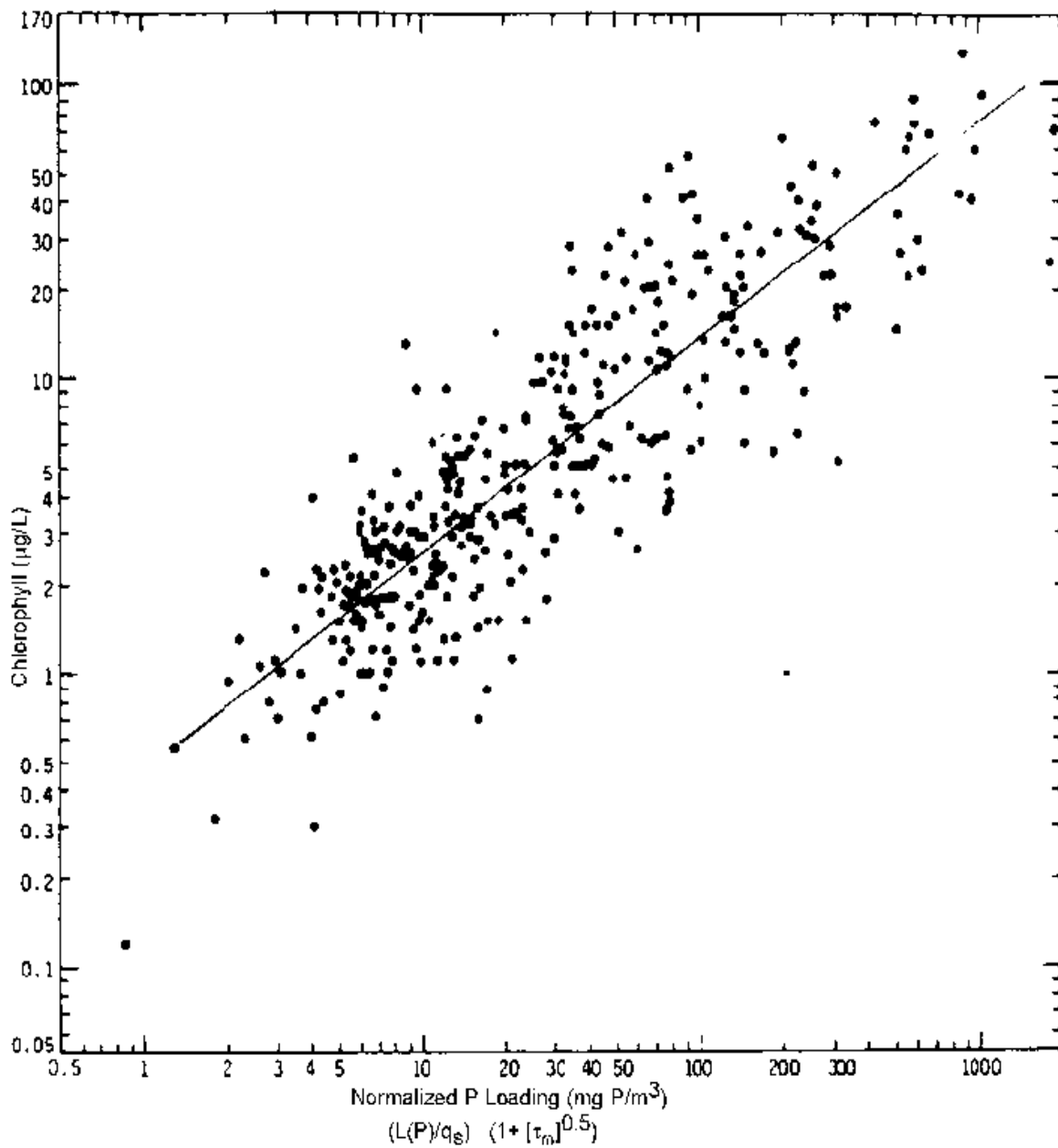
An aerial photograph of Lake 226. The lake is divided into two distinct regions by a yellow floating barrier. The upper region is clear, dark blue water, labeled 'C, N'. The lower region is a bright green, turbid water, labeled 'C, N, P'. The barrier runs diagonally from the top left towards the bottom right.

- Leibigs Law of Minimum
- Phosphorus is the nutrient that regulates primary productivity



Lake 227

An aerial photograph of Lake 227. The lake is a uniform, clear blue color and is surrounded by a dense forest of evergreen trees. The lake is roughly oval-shaped and occupies the lower half of the frame.



Updated Vollenweider-OECD normalized  
P loading/chlorophyll response relationship

Chlorophyll *a*  
vs. Total P

# Primary Research Objectives

## **1. Develop a nutrient mass balance (nitrogen and phosphorus)**

- quantify major nutrient inputs and outputs
- quantify internal nutrient fluxes (i.e., sedimentation and internal loading)
- characterize the potential bioavailability of nutrients derived from each source

# Primary Research Objectives Cont'

## 2. Characterize bacteria and algal sensitivity to nutrient inputs

- determine the type and degree of nutrient limitation both spatially and temporally

## 3. Characterize algal and bacterial groups

- determine the frequency, intensity and spatial distribution of algal blooms (field observations and satellite imagery)
  - Can we relate this to point source nutrients, in-lake processes, or weather?
- What is the assemblage composition? (i.e., Cyanobacteria, E-coli, Fecal Coliform)

# Primary Research Objectives Cont'

## 4. Lake sediment dynamics

- determine the deposition rate of sediments and nutrients to the lake bottom
- determine the degree of nutrient saturation of the sediments and their potential to absorb further nutrients

## 5. Quantify diffuse nutrient input from agriculture

- dependent on land management (i.e., riparian zone) and agriculture practices (i.e., tillage, fertilizer application)
  - Model/study on small scale research plots along SC Creek?
  - Scale up to the rest of the lake?

# Primary Research Objectives Cont'

## 6. A Community-Based Participatory Research Approach

- Provides the opportunity for stakeholders to:
  - 1) partner and actively participate with researchers in understanding their unique nutrient contributions to Lake Diefenbaker
  - 2) become educated on water resource issues and the scientific methods of water resource research and interpretation of results
  - 3) facilitate development of new policy and management ideas that address all stakeholders in decision making and that account for local industrial, community and agricultural arrangements