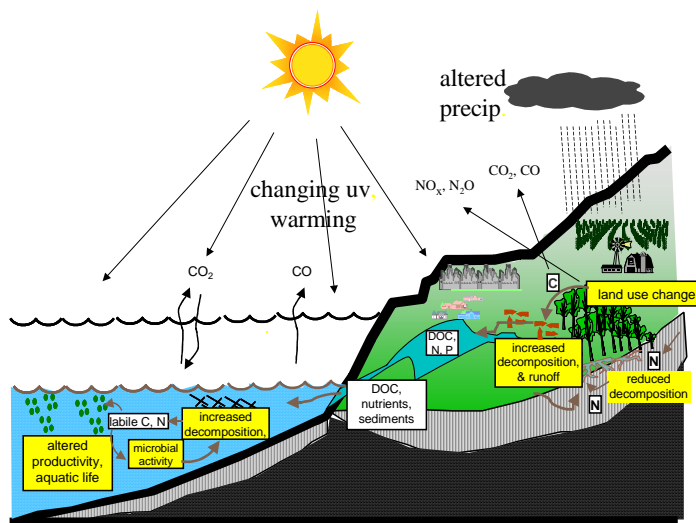# Microbial Indicators
What do microbes tell us about the health of aquatic ecosystems?

Impact of Land Use Changes on Aquatic Ecosystems

One of the most important components of global change over the next three or four decades will be land use/cover change in watersheds and basins including a range of freshwater, estuarine and coastal ecosystems in the United States. These changes, which are mostly driven by human activities, will likely interact with other changes, such as climate change, to alter aquatic ecosystem functioning and structure. These changes will produce alterations in the quality of drinking water, diversity of aquatic life, and resilience of ecosystems to natural disturbances. Boundaries between land and water, such as riparian zones in water basins and estuarine zones in coastal environments, are affected rapidly by land use changes.

Why Microbial Indicators?

Microorganisms form an integral part of an ecosystem's health by controlling activities such as the cycling of nutrients like nitrogen, control of oxygen levels, modulation of inputs of nutrients from land into water, control of the soil emissions of nitrogen oxides and carbon gases that affect air quality and global warming, indicating the source of water pollution, and biodegradation of anthropogenic contaminants. Therefore, determining the response of microbial communities to land use changes and establishing the relationship between the structure and specific microbial activities

Changes in watersheds and basins.

Microbial Indicators

microbial activities is of great importance in determining the role of microorganisms in the functional capacity of ecosystems.

Research Objective

Research is underway to assess the vulnerability of aquatic ecosystems and water quality to environmental disturbances using microbial indicators. Assessments of the long-term impacts of land use and global climate changes on aquatic ecosystems require combining experimental results with models that describe the responses of ecosystem health to stresses related to the changes. Data obtained from field and laboratory research to determine the impact of climate and land use changes on microbial activity and community structure, and of nutrient and carbon cycling will be used to develop models that can predict environmental responses with greater accuracy.

Research Approach

Scientists are identifying microbial indicators using a combination of molecular techniques that target different levels of the microbial community structure and functional capacity:

- Biomarker compounds, such as phospholipid fatty acids, to obtain a general view of the microbial community structure, identify key microbial groups, and compare broad community profiles.
- Terminal restriction fragment length polymorphism and amplified fragment length polymorphism to achieve a higher degree of specificity in comparing microbial communities and closely related strains of bacteria.
- Application of compound specific isotope analysis of phospholipid fatty acids and other lipids in environments with distinct terrestrial or aquatic end members to determine the source of the carbon used by members of the microbial community.

Current research projects include:
- A comparison of the microbial community structure and carbon utilization in sediments of two southeastern estuaries with different land use histories.
- The effect of land use changes on the functioning and structure of soil microbial communities in tropical savannas of central Brazil.
- Application of DNA-based technology to detect and track fecal contamination back to its source in complex environmental matrices.

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