Title
NIMS Public Health Applications: Algal Blooms

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Introduction: Watershed Health and Water Quality

**Anthropogenic Influences**

- **Landscape Changes**
  Developments cause physical changes in streams and the surrounding watershed. These alterations result in noticeable changes in stream dynamics. Some alterations include: reduction in tree cover, changes in stream substrate, channelization of runoff, and widening of stream basins.

- **Nutrient and Pollution Loading**
  Streams receive nutrients and chemicals through runoff and subsurface flow. In developed areas, nutrients and other pollutant loads increase. Some pollutants include: nitrate, ammonia, phosphates, and heavy metals.

**Ecological Response**

- **Algal Blooms**
  Algae responds quickly to fluctuations in stream conditions. Changes in nutrients, light, substrate, etc. can enable increased algal production. *Algal blooms* can cause a variety of negative effects: fish/invertebrate kills, foul odors, reduction in ecosystem quality, aesthetic degradation, toxicity, and loss of recreational waters.

- **Other Water Quality Effects**
  Waste waters can also carry harmful bacteria and toxic chemicals, which can be a significant public health risk in recreational waters.

Problem Description: High Resolution Spatial and Temporal Water Sensing

Algal blooms and other negative stream conditions result from dynamic, interrelated factors. Understanding complex biotic and abiotic interactions require multi-scale, high-resolution measurements. Stream conditions can change rapidly. Conventional low-resolution field sampling may miss important system dynamics.

Proposed Solution: NIMS-RD & NIMS-3D high resolution sampling

Current Project: Medea Creek

- Monthly 24-h cross section sampling with MiniSonde 4A accompanied by: Dissolved Oxygen, light readings, oxygen isotope analysis, velocity, algal biomass, algal point samples and MiniSonde point sample (Cond., NO₂, NH₄, pH, Temp.) at sites throughout the stream.

- Conventional grab sampling cannot provide even a fraction of the temporal or spatial resolution provided by the NIMS-RD

- Point sampling makes assumptions regarding homogeneity of nutrients at a sampling site over a 24-hour periods

Emerging Projects: Merced River

- Deploy NIMS-RD with MiniSonde 4A to explore the dynamics at the junction between two streams: one with heavy industrial runoff and one without

- Opportunity to apply NIMS-RD technology to a larger river system

NIMS-3D Stream Lab

- Modeling these complex nutrient dynamics in an artificial stream lab is very challenging. However, using automated injections with the NIMS-3D system, it is possible to create several nutrient (or pollutant) regimes simultaneously.

  - This enables the controlled study of the integrative effect of dynamic exposures to algal taxa by measuring their productivity potential with a colorimetric test.

  - Once algal response are quantified, a similar analysis can be used in the field to integrate natural chemical regimes.

- MiniSonde Sensors system includes: temperature, pH, conductivity, nitrate, and ammonia.