Integrating Invasive Weed and Nutrient Management with Bioenergy Production

Laguna Climate Change Adaptation Conference

14th October, 2009

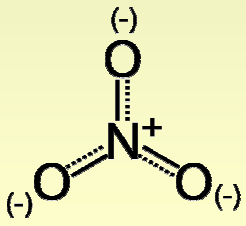
Michael Cohen
cohenm@sonoma.edu

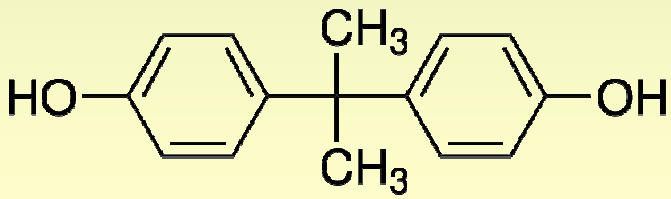
City of Santa Rosa

Sonoma State University

The Problem

- Excess nutrients and organic contaminants in watershed tributaries





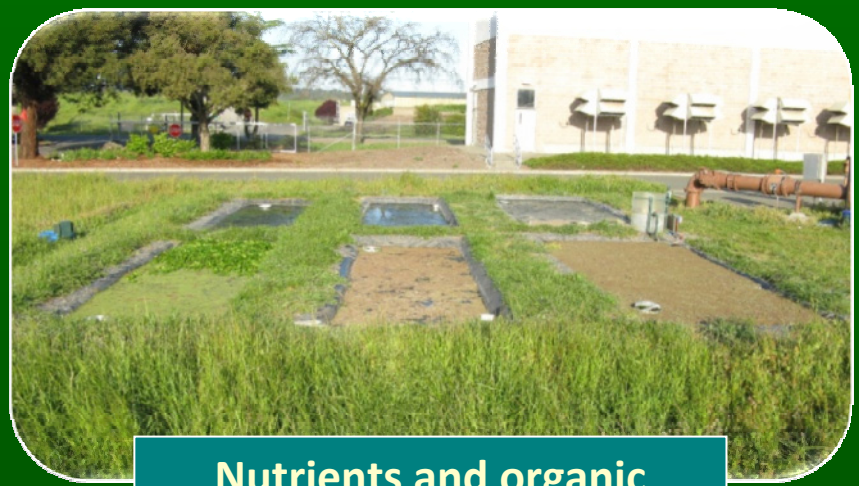
Channelized Aquatic Scrubbers (CAS)

- Design
- Pollutant removal activities and mechanisms
- Potential application in the Laguna
- Integration with bioenergy production and soil improvement

The Process

Water flows into CAS

Cleaner water exits

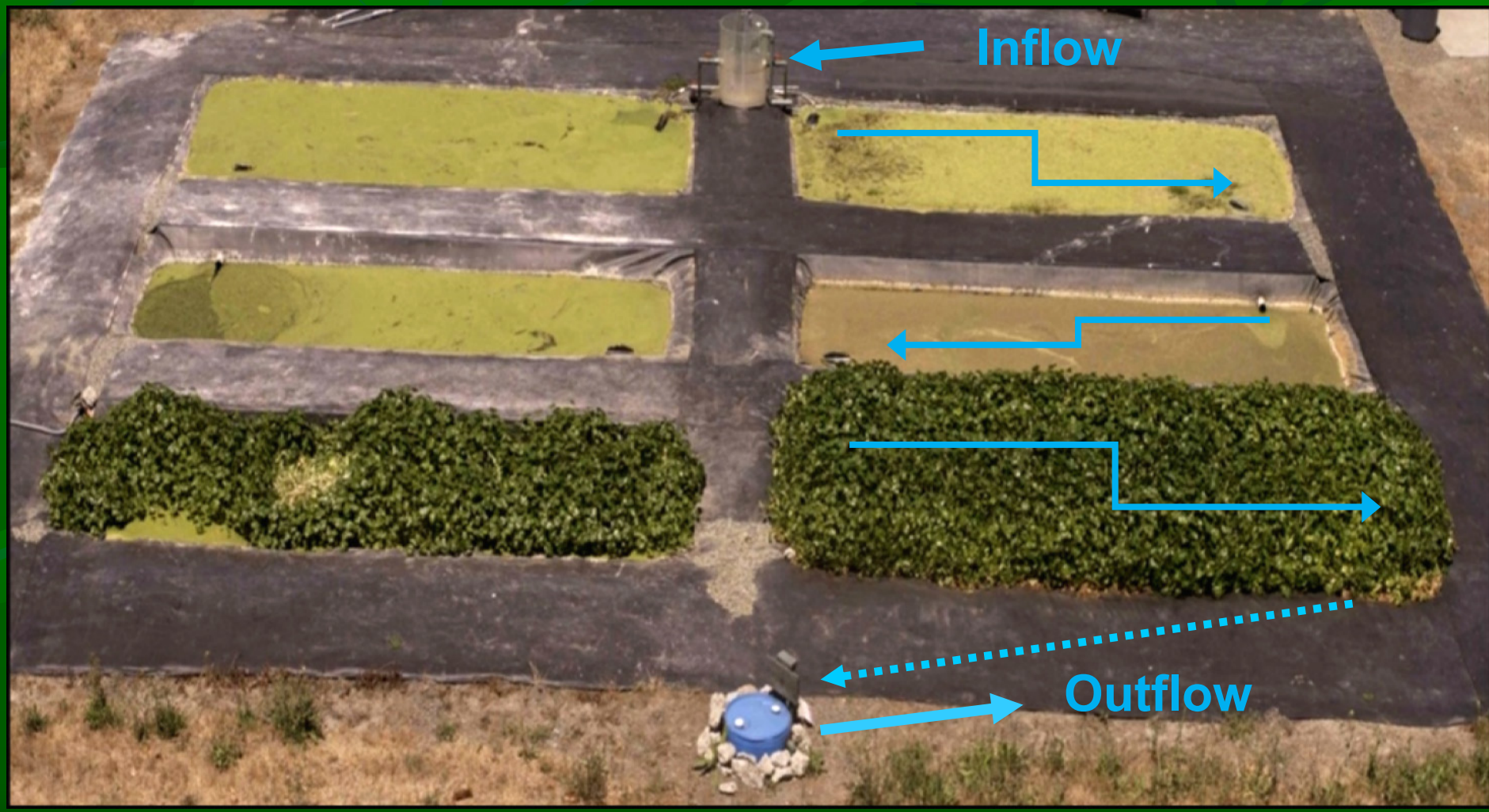


Nutrients and organic contaminants are removed

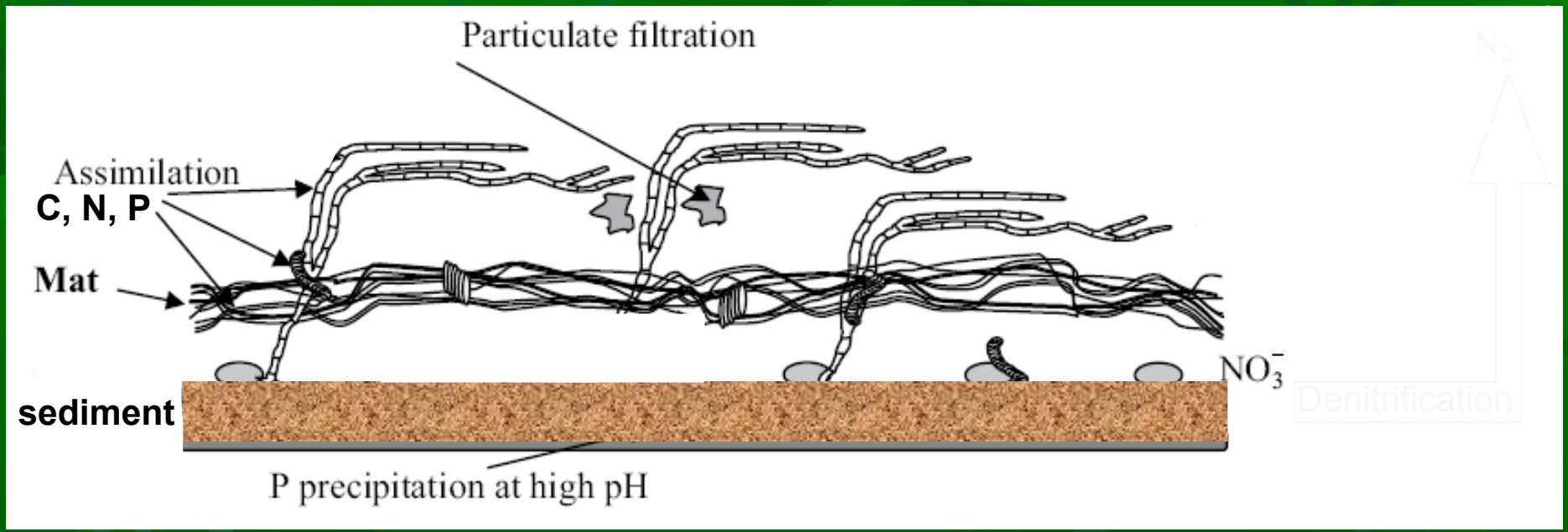
Harvested aquatic biomass is converted to biofuel

Native vegetation

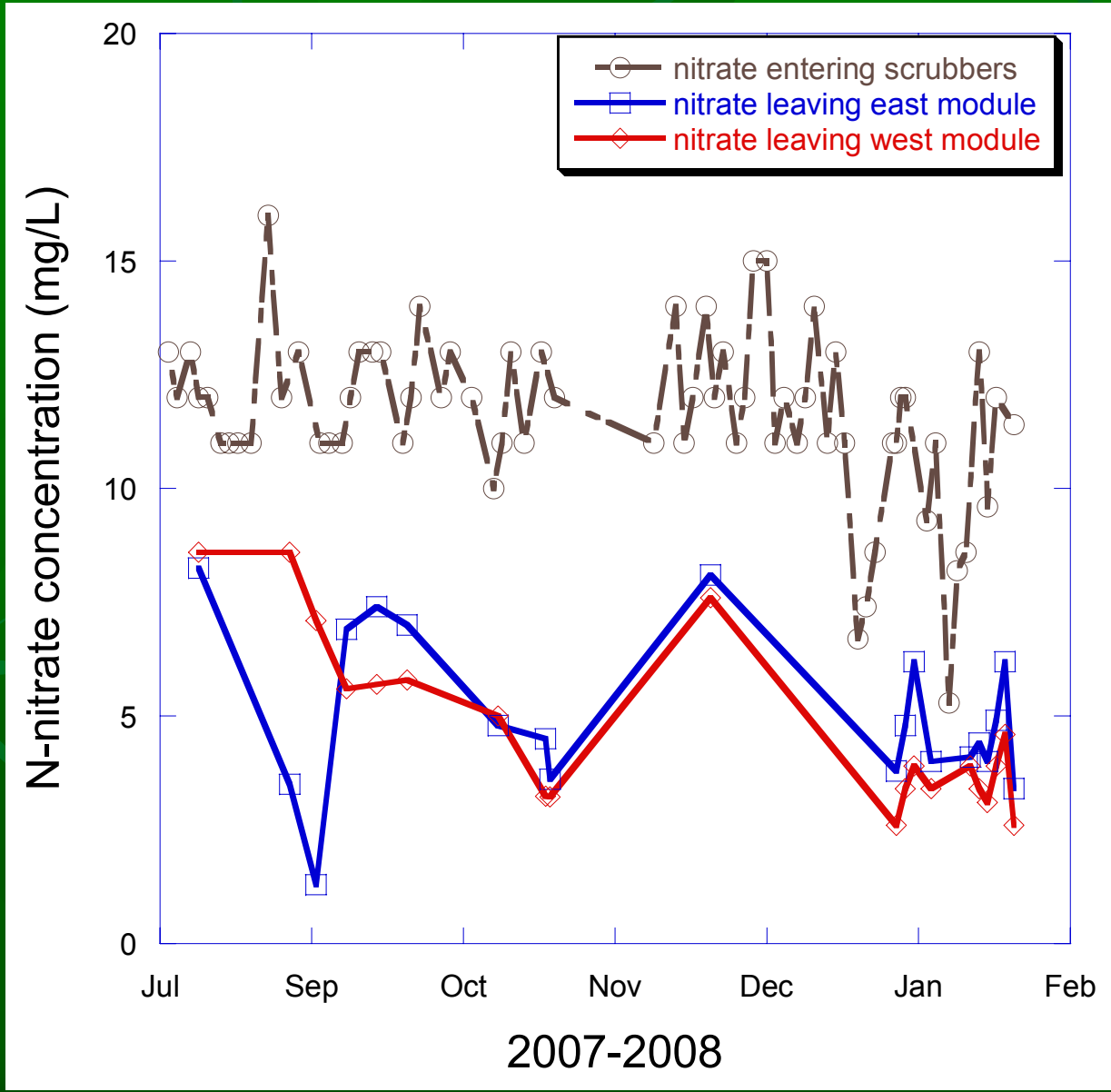
Pilot CAS system at the Laguna Treatment Plant



Mechanisms of nutrient removal



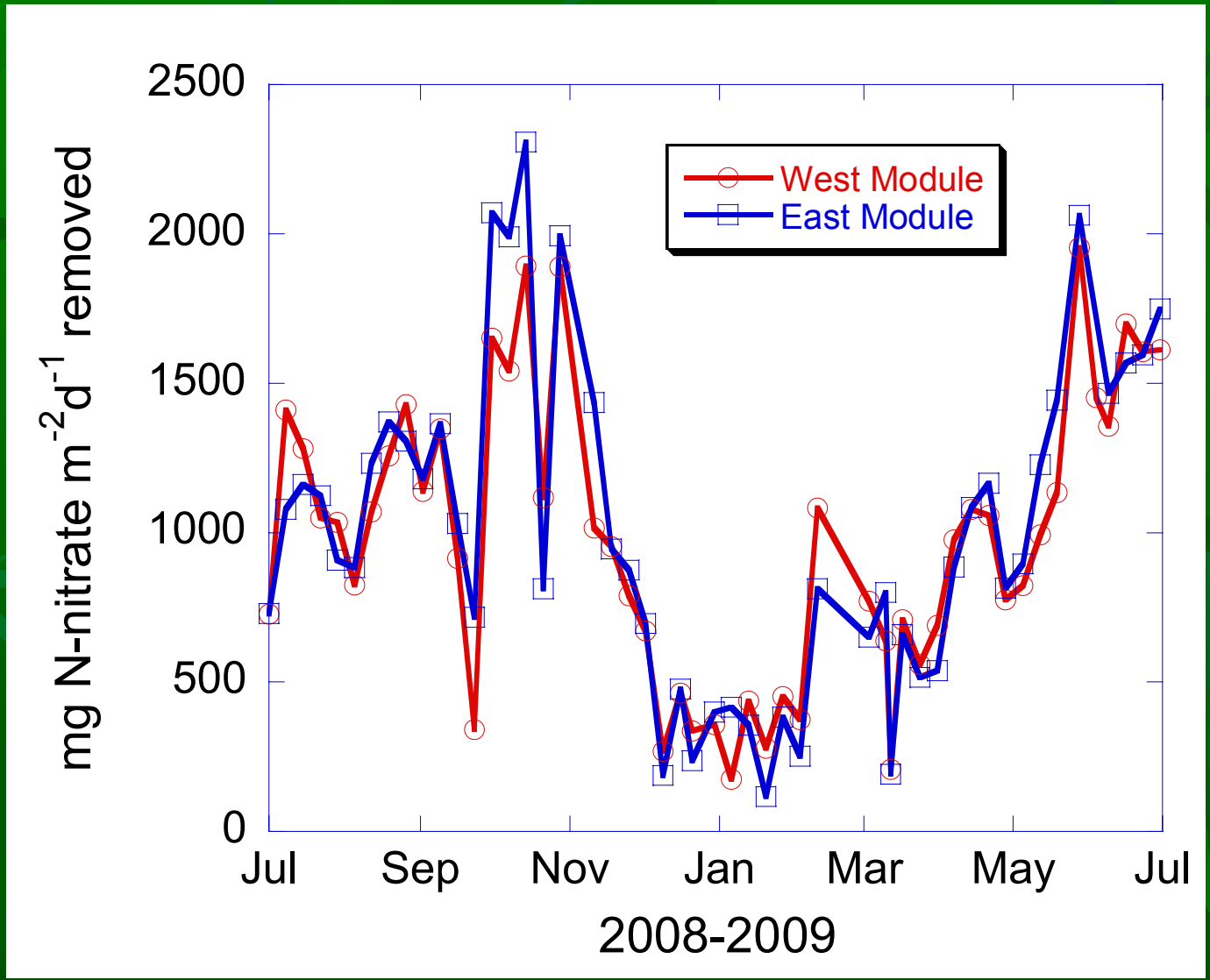
Nitrate removal: preliminary study



INFLOW

OUTFLOW

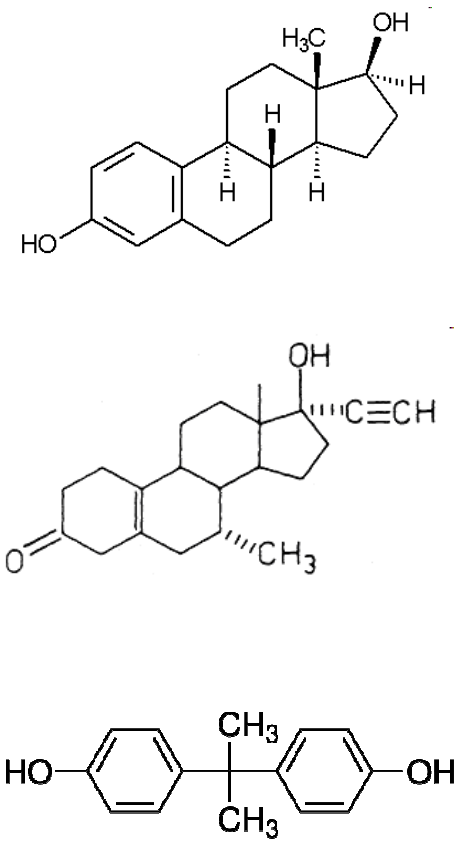
Nitrate removal efficiency

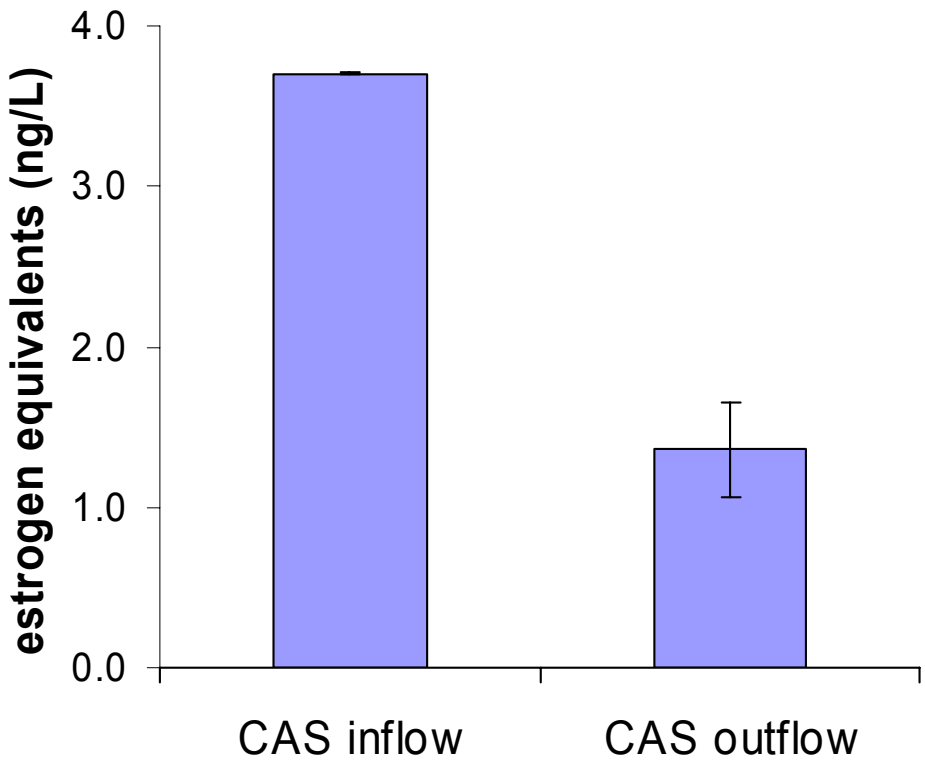


Comparative nitrate removal efficiencies

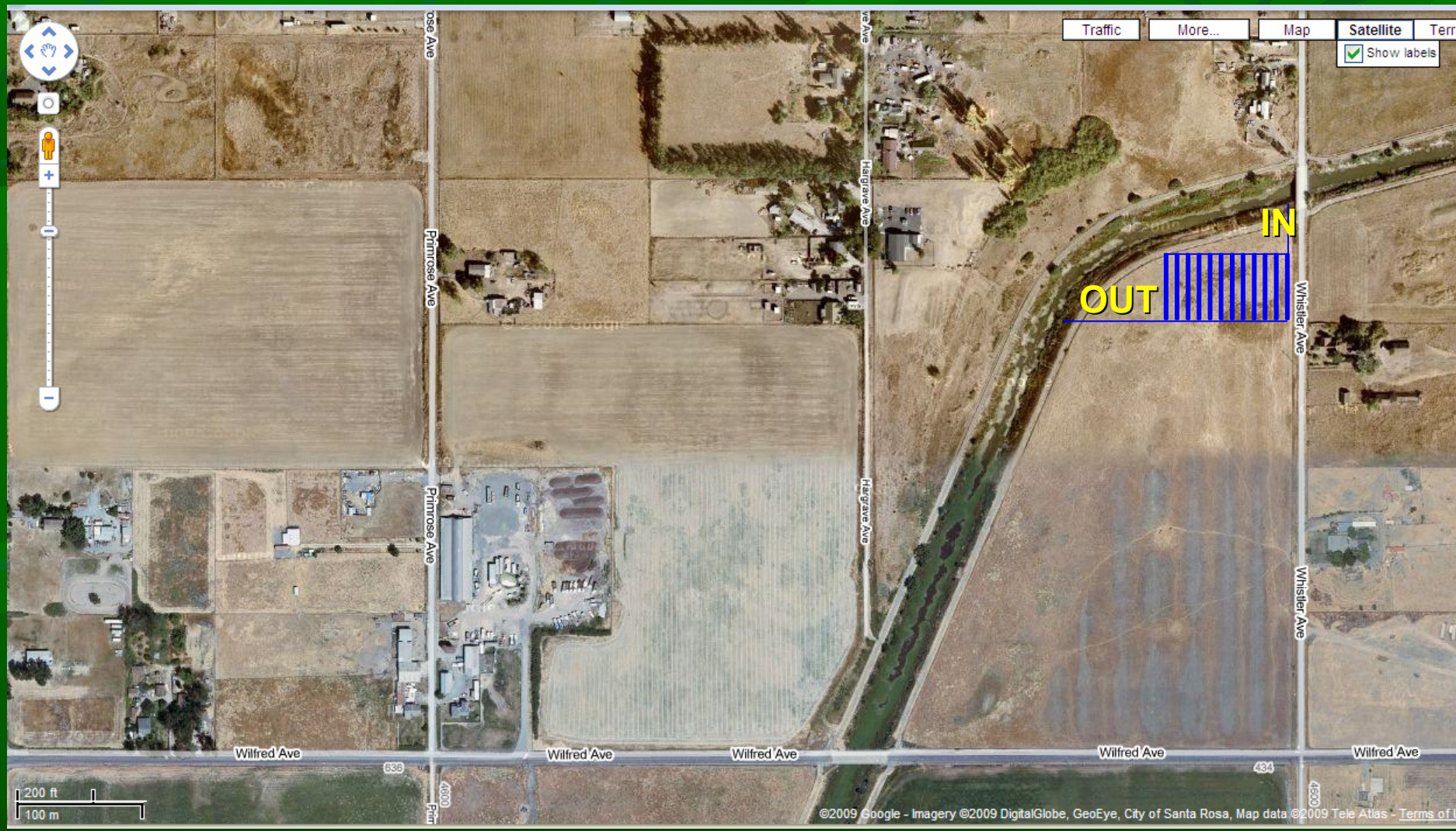
Treatment Systems	Average nitrate removal efficiency (mg N m^{-2} day^{-1})
Arcata Wetlands	800
Kelly Farm Wetlands	625
Prado Wetlands	522
Channelized Aquatic Scrubbers (1 July 2008 – 30 June 2009)	988

Removal of organic contaminants





A vision for Laguna tributaries



Nutrient removal capacity in submersed macrophyte pond systems in a temperate climate

Ecological Engineering, 2 (1993) 49-61

Thomas Gumbricht

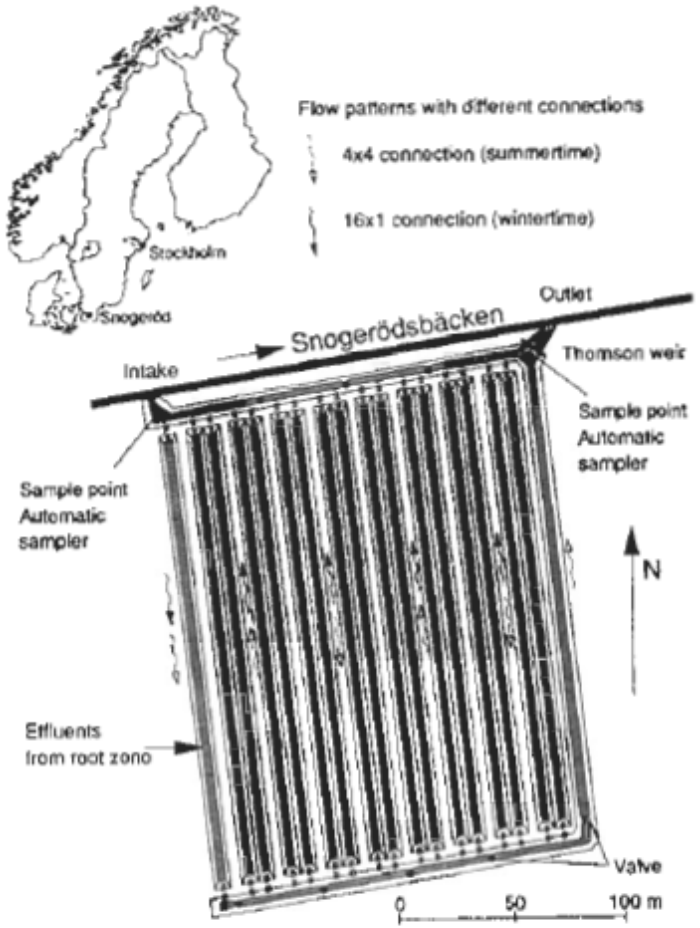
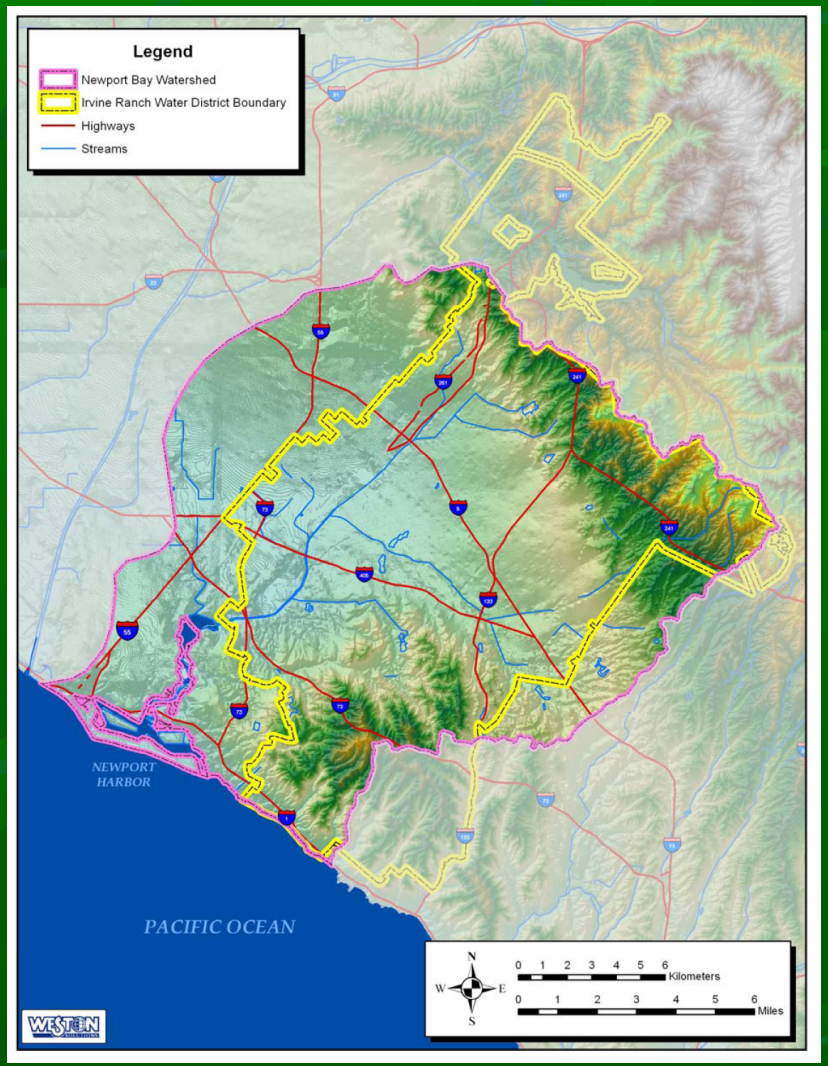


Fig. 1. Principal arrangement and location of the submersed macrophyte pond at Snogeröd, Sweden.

Newport Bay, CA watershed



Mats are easy to harvest

Harvesting *Ludwigia* in the Laguna watershed

Biomass to energy

Soil improvement

Cost-benefit analysis

Costs	Benefits
Land	Nutrient removal
Construction	Bioenergy production ▪ GHG reduction
Labor	Flood control
Transport	Soil improvement
Processing	Endocrine-disruptor removal

Acknowledgments

Funding Agencies:

STATE OF CALIFORNIA ENERGY COMMISSION

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Committed to Achieving Clean Air to Protect the Public's Health and the Environment

SONOMA STATE UNIVERSITY

Graduate students:
Aaron Agostini
Catherine Hare
John Kozlowski

Undergraduate students:
Meghan Parish
Linden Schneider
Marianita Vieira

City of Santa Rosa

Dell Tredinnick
Nicole Dorotinsky

Everyone at the Laguna Treatment Plant!

San Francisco State:
Dr. Lily Chen
Rachel McCormick

Duckworth Construction
Robert Duckworth