

Integrating Invasive Weed and Nutrient Management with Bioenergy Production

Laguna Climate Change Adaptation
Conference

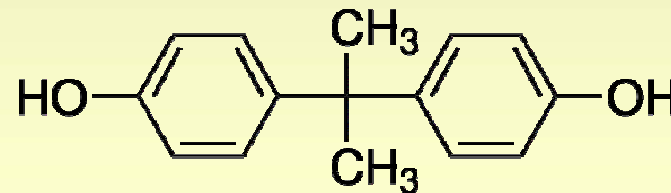
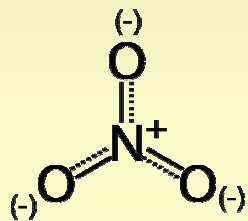
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The Problem

- 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

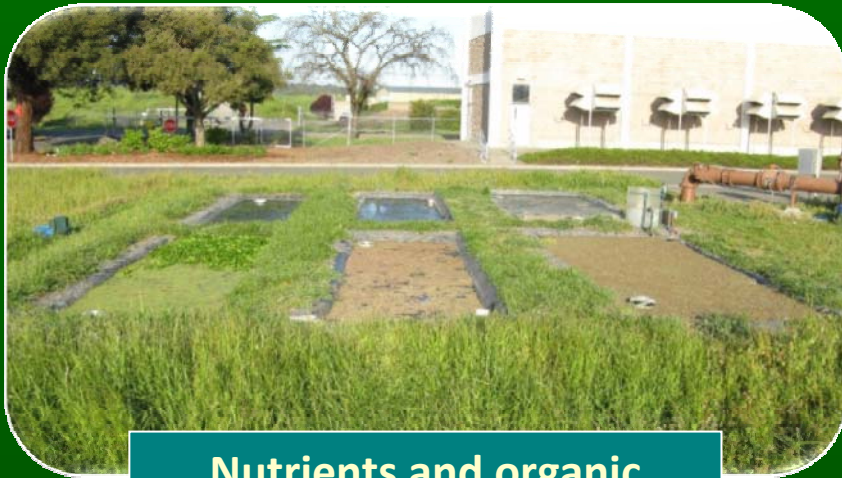
The Process



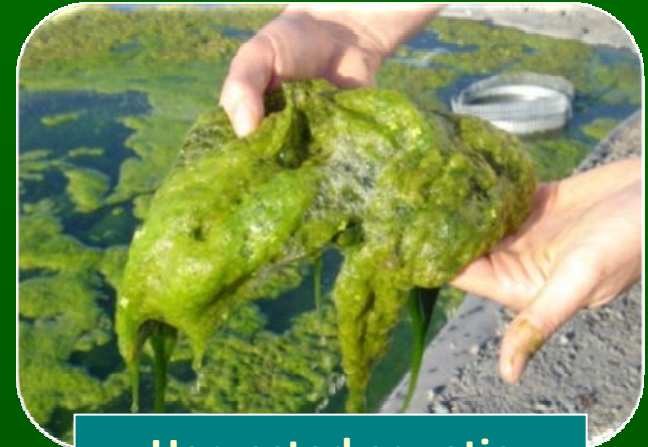
Water flows into CAS



Cleaner water exits



**Nutrients and organic
contaminants are removed**

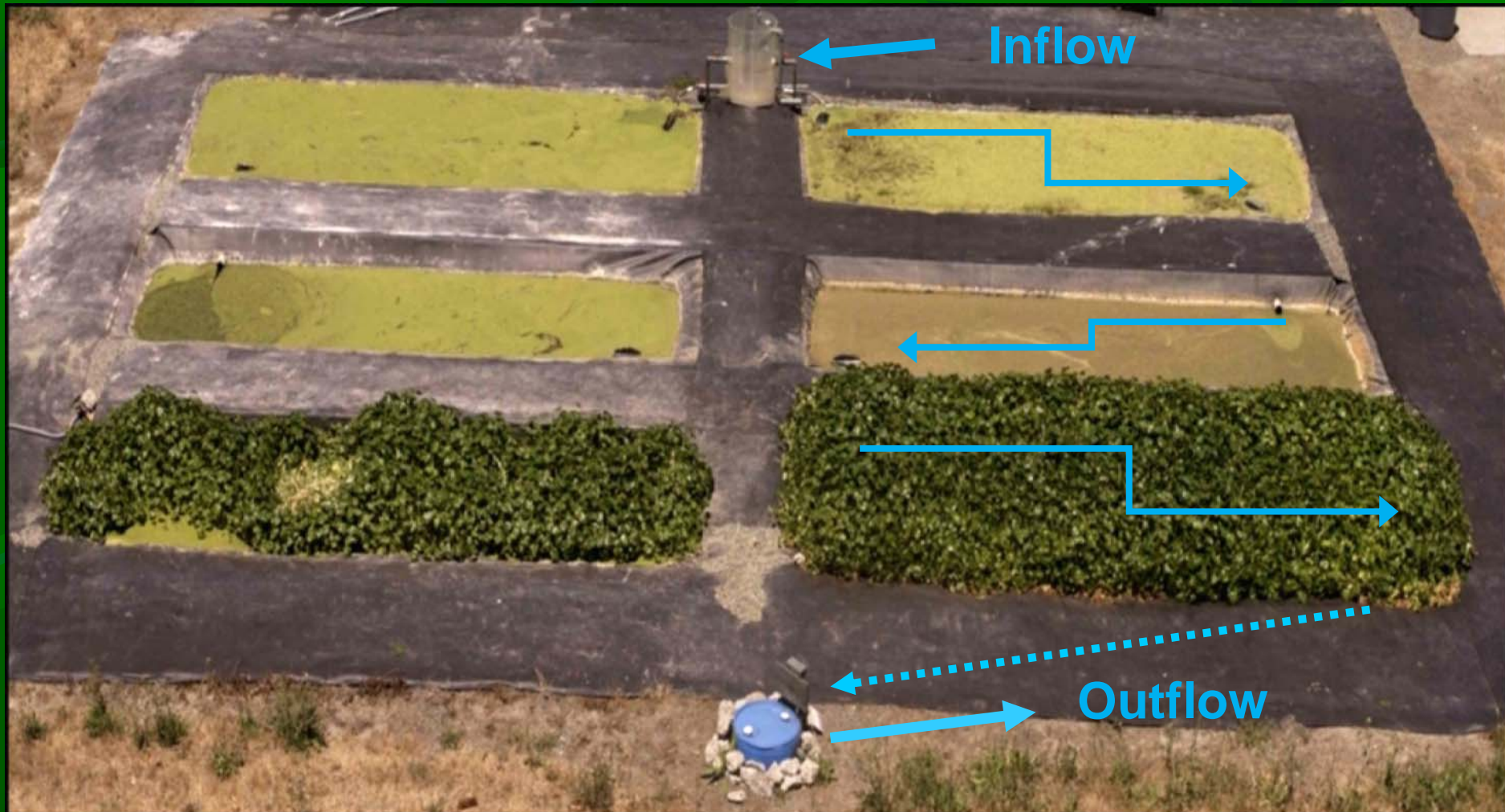


**Harvested aquatic
biomass is converted
to biofuel**

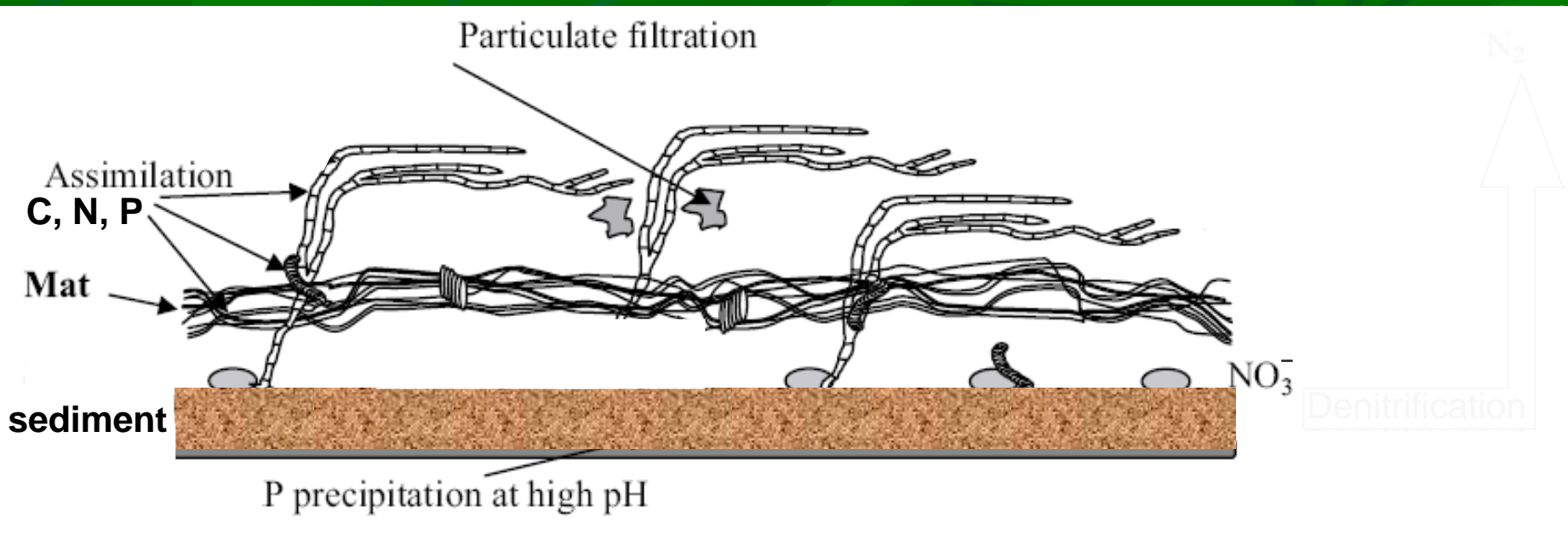
Native vegetation



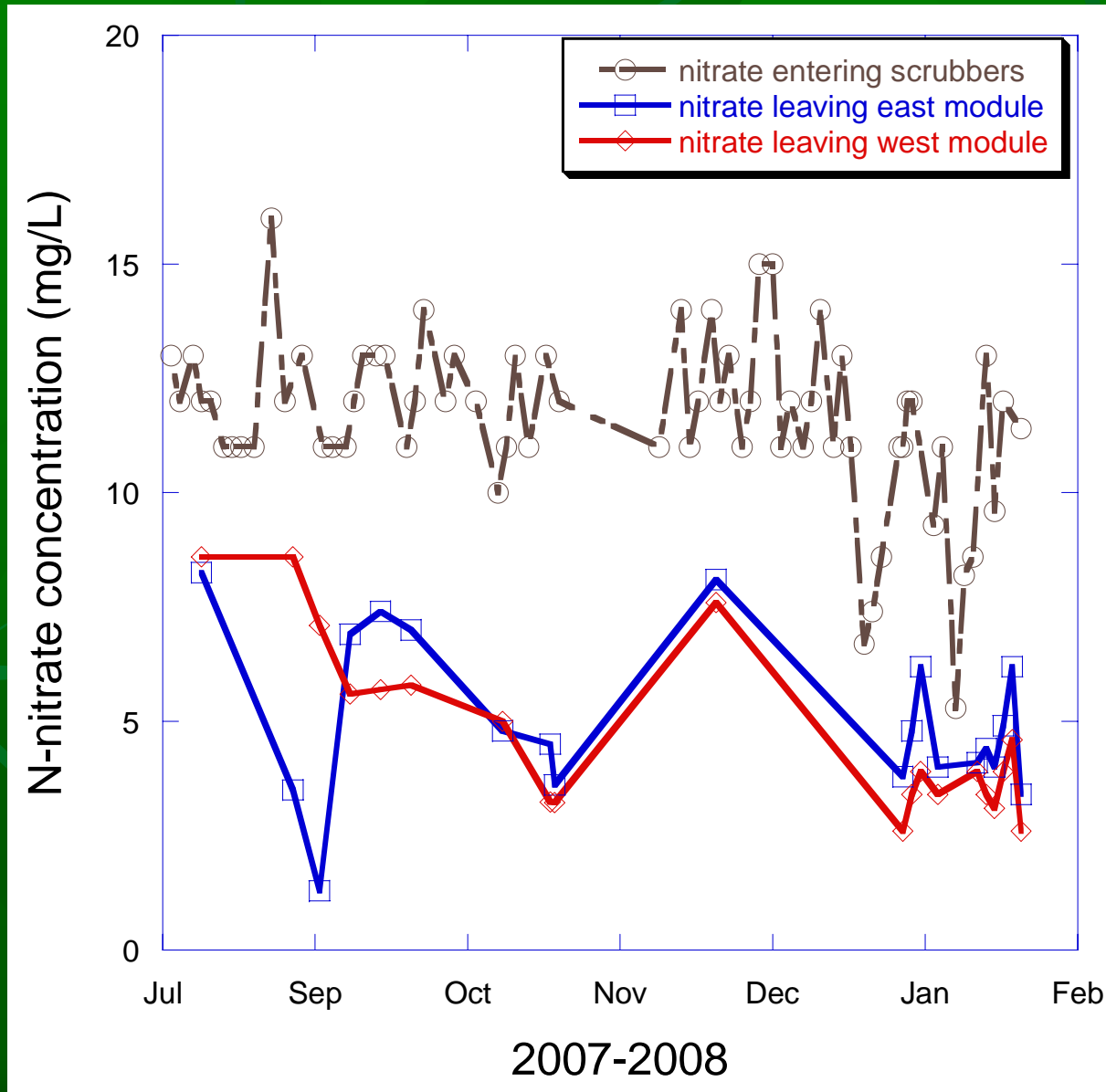
Pilot CAS system at the Laguna Treatment Plant



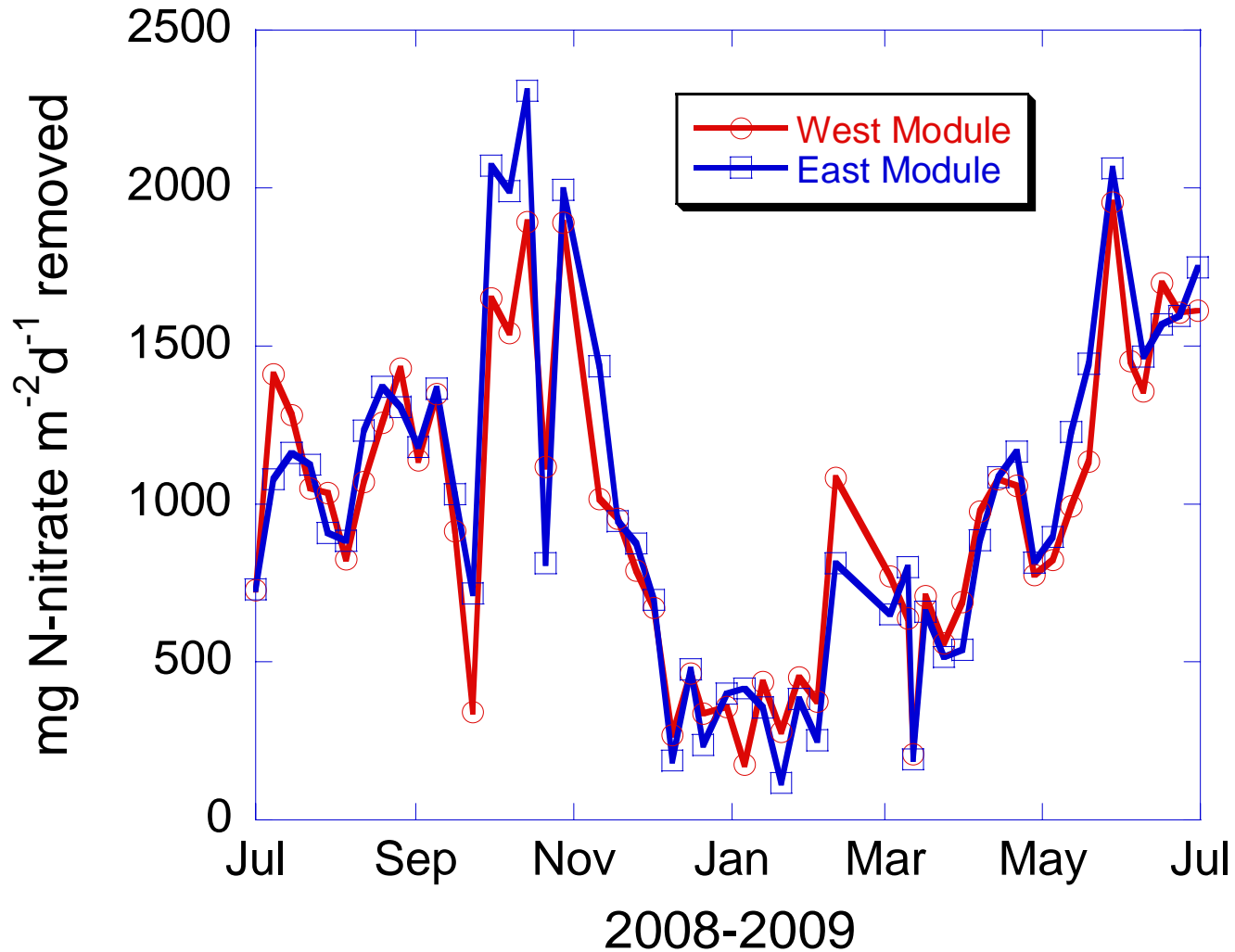
Mechanisms of nutrient removal



Nitrate removal: preliminary study



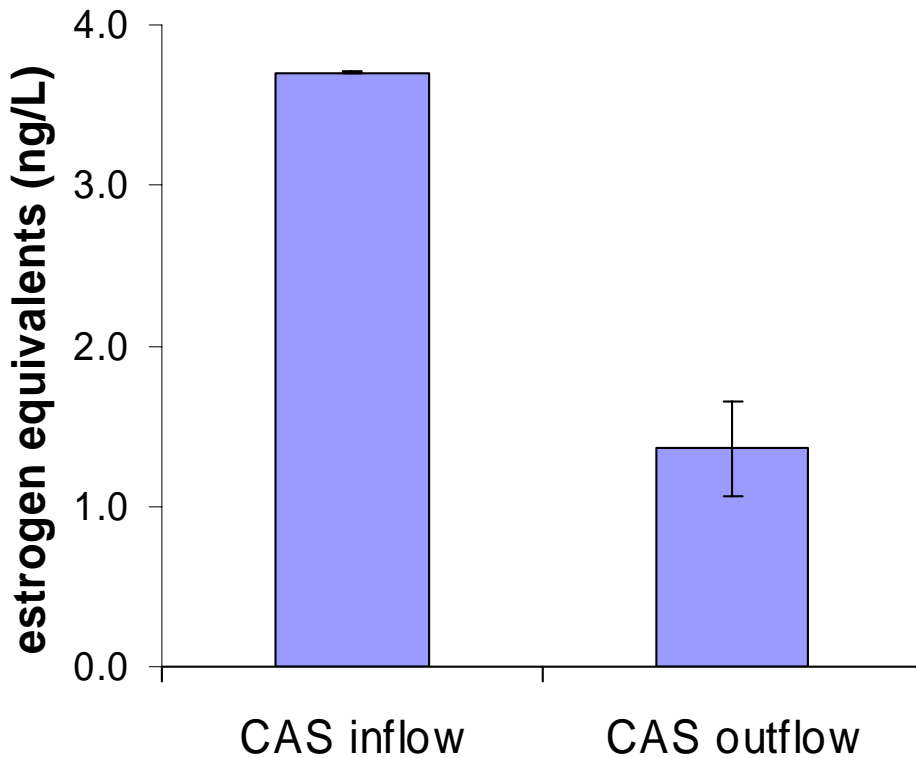
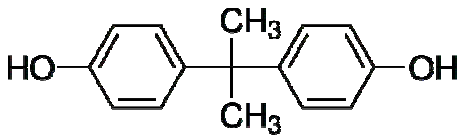
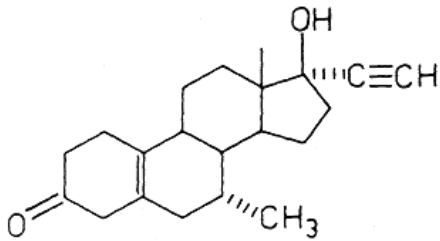
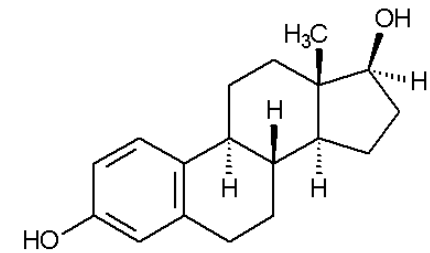
Nitrate removal efficiency



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

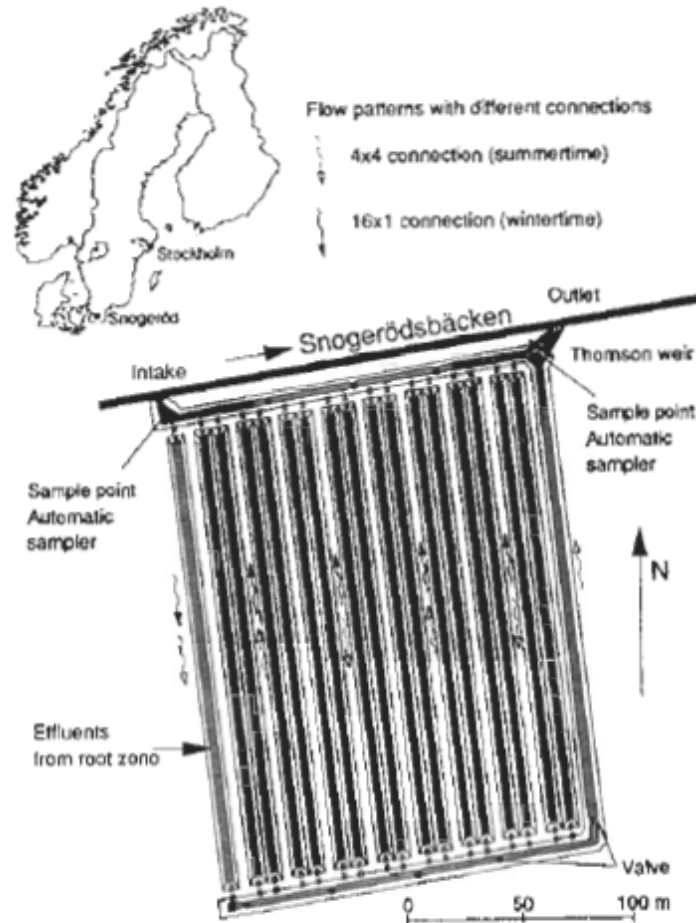
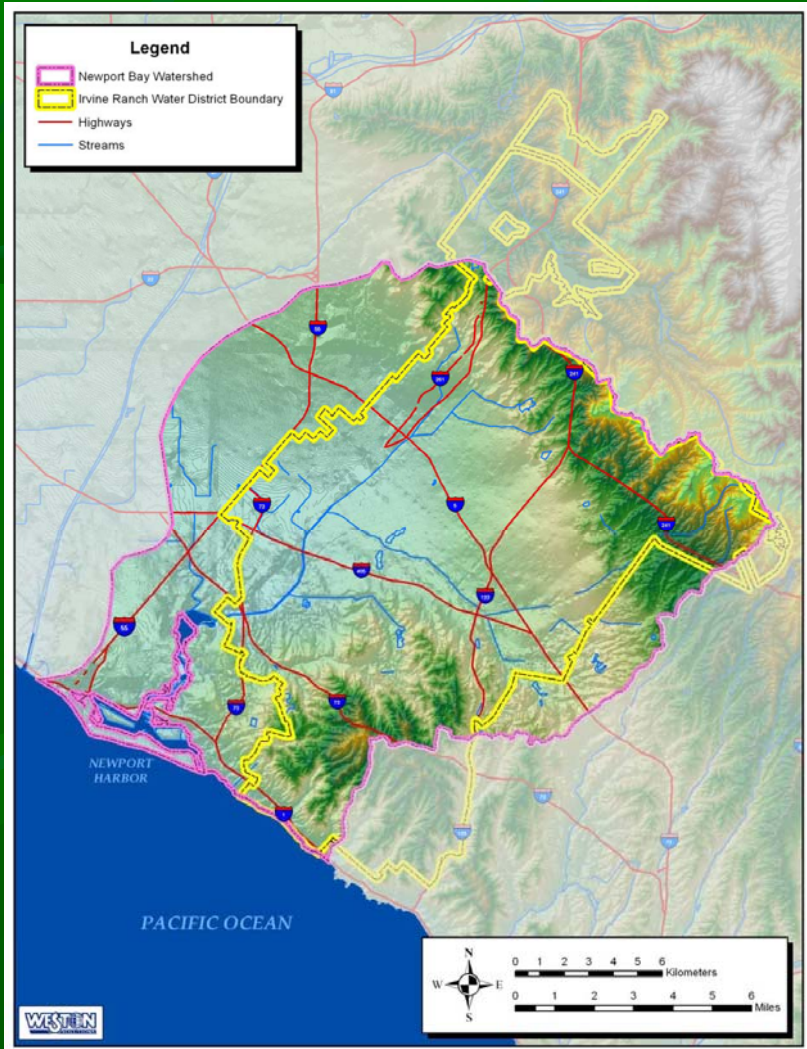


Fig. 1. Principal arrangement and location of the submersed macrophyte pond at Snogeröd, Sweden.

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 <ul style="list-style-type: none">■ GHG reduction |
| Labor | Flood control |
| Transport | Soil improvement |
| Processing | Endocrine-disruptor removal |

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