

Bioremediation's Integral Role in Ecosystem Restoration and Rehabilitation

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Environmental Remediation

Removal of pollution or contaminants from soil, groundwater, sediment, or surface water for the general protection of human health and the environment



Restoration & Rehabilitation

Manipulation of the system's key components to achieve a composition, structure, and function similar to the pre-disturbed condition

Soil Sediment Water chemistry Biotic assemblage

Conventional remediation technologies for *in situ* and *ex situ* remediation of contaminated sediments and soils are expensive and potentially destructive prior to the recovery period.

Conventional Technologies

Excavation/retrieval

Landfill/disposal

Solidification and stabilization

Chemical reduction/oxidation

Low temperature thermal desorption Soil

Flushing & washing

Vitrification

Electrokinetics

Pneumatic fracturing

Incineration

Objective

Discuss the current and future roles of bioremediation in the integrated management and reclamation/rehabilitation of contaminated project sites.

Examples

- ✓ Introduction of wild plants to metalliferous soils
- ✓ Genetic engineering of plants for enhanced synthesis and exudation of natural chelators into the rhizosphere
- ✓ Use for serpentine soils and mine tailings stabilization and uptake
- ✓ Emergent macrophytes used in constructed wetland systems for treatment of nutrients, BOD, divalent metals, and/or various organic contaminants in industrial and municipal effluents
- ✓ Flora and microbial community are not mutually exclusive and provide an environment within the rhizosphere for preferential microbial interaction(s) and subsequent contaminant transfers and transformations.



Bioremediation

An integrated management of polluted ecosystem where different organisms are employed which catalyze the natural processes in the polluted or contaminated ecosystem (aquatic or terrestrial).

Why Bio-based remediation?

- Safe to Users
- Safe to Ecosystem
- Natural Treatment
- Benign waste products that can be easily managed
- No secondary problems or risks
- Low impact application and implementation

Bioaugmentation

Introduction of a group of natural microbial strains or a genetically engineered variant to treat contaminated soil or water.

- **Study the indigenous varieties present in the current footprint to determine if biostimulation is possible.**
- **If the indigenous variety do not have the metabolic capability to perform, exogenous varieties with enhanced pathways are introduced.**

Suitable Applications

- ❖ **Municipal waste treatment**
- ❖ **Agricultural waste treatment**
- ❖ **Industrial waste treatment**
- ❖ **Oil spill remediation**
- ❖ **Airport deicing fluid management**
- ❖ **Habitat restoration/rehabilitation**
- ❖ **Water quality/beneficial use**

Simply adding microbes is NOT a sound bio-based environmental strategy.

The Woodland Lake, TX Case Study

- 700 acre lake
- Blue green algae bloom
- Odor problem
- Aesthetic issue
- Fish kill prevention



Woodland Lake – Treatment

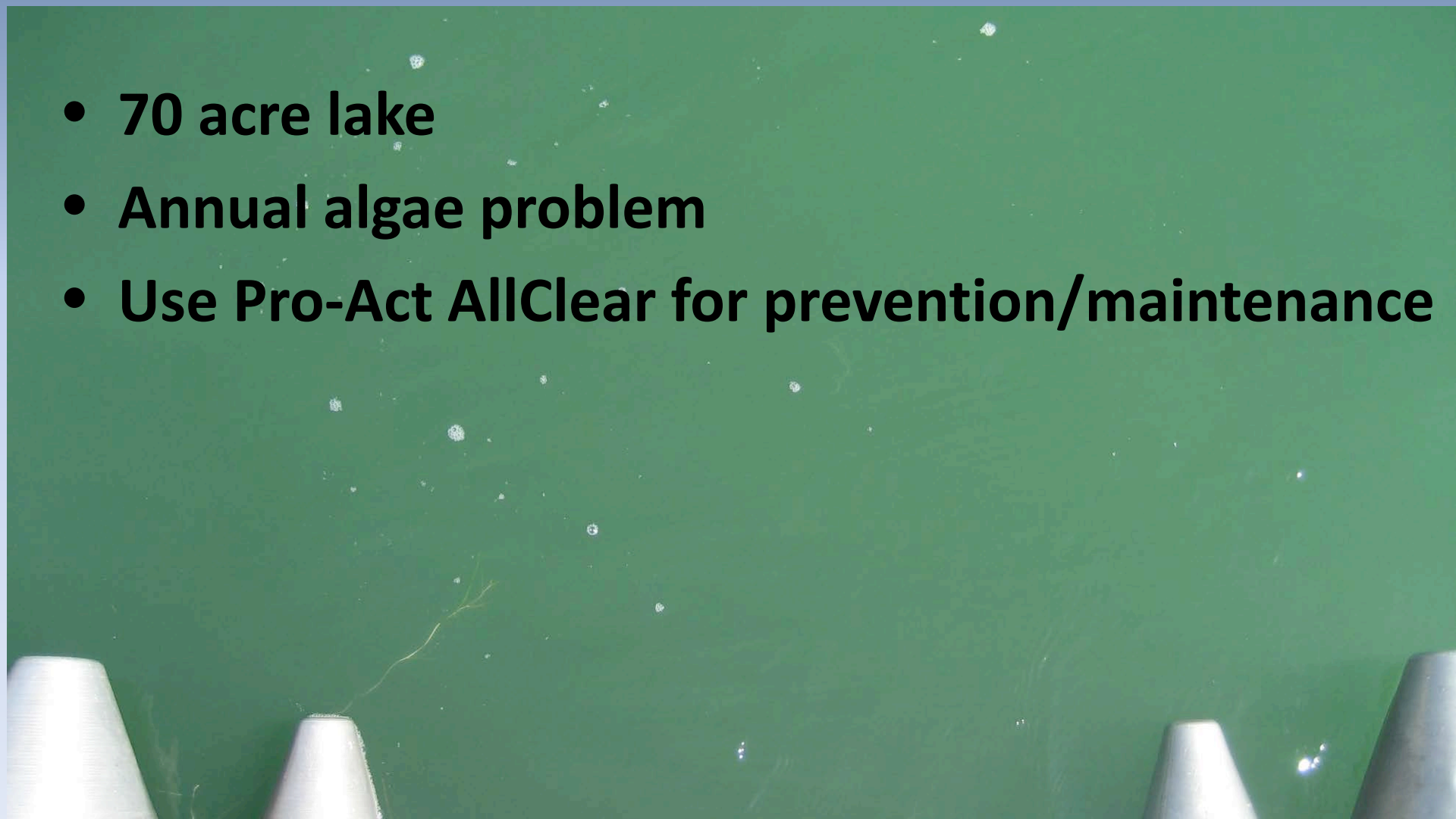


Results

- **Odor started to diminish in 2 days.**
- **No fish kill.**
- **Three weeks later, kayakers returned.**



Santa Fe Dam Recreational Area, LA County - Case Study #2

- **70 acre lake**
 - **Annual algae problem**
 - **Use Pro-Act AllClear for prevention/maintenance**
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Santa Fe Dam Recreational Area, LA County



Santa Fe Dam Recreational Area, LA County Post-treatment



Remember: It is just the first step....

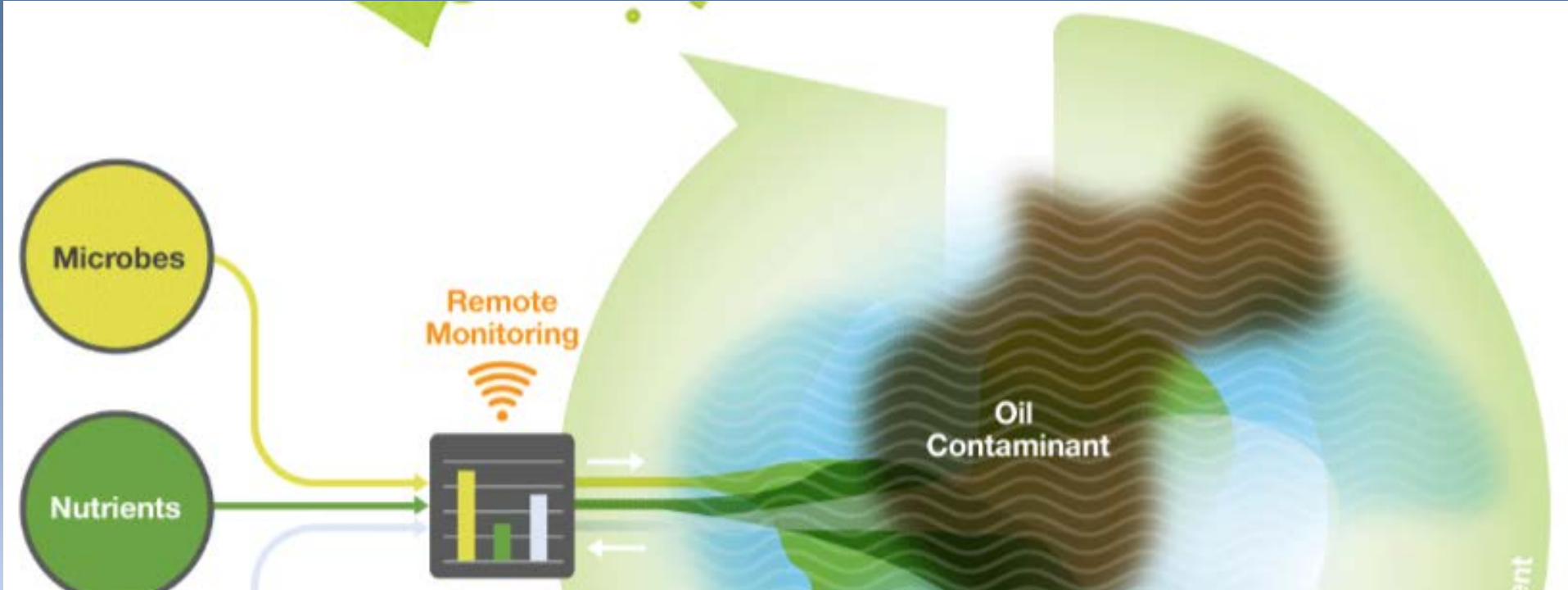
- **Microbial degradation releases nutrients that need to be managed/removed from the system OR**
- **Aquatic plants thrive afterwards.**

Bioremediation Agent OilClean™

- Listed in EPA's NCP product schedule
- Effective against petroleum hydrocarbon
- Also known as Pro-Act, OilClean w/ activator
- <http://www.epa.gov/osweroe1/content/ncp/products/proact.htm>

Listed on EPA's National Contingency Plan Product Schedule.





Questions??





The Trusted Integrator for Sustainable Solutions

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Giving Mother Nature
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