

Remedial Options Program

SRST Meeting

May 29, 2014



SRST ROPs Work Group

- Co-Leads:
 - Robert Brent
 - Nancy Grosso
- Task Team Leads:
 - Nancy Grosso & Robert Brent
 - Scott Brooks & Rich Landis
 - Robert Brent & Jim Dyer

- Work Group – More than 40 members representing
 - VADEQ
 - USEPA
 - US FWS
 - USACE
 - ORNL
 - DuPont
 - University of DE
 - Texas Tech
 - Virginia Institute of Marine Sciences
 - CSU
 - U Waterloo
 - URS
 - Anchor QEA



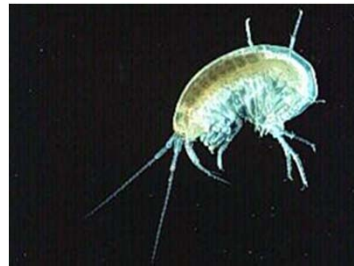
2014 ROPs Activities

- **Three Field Pilots**
 - Planned or ongoing monitoring
- **Six University Studies**
 - Hg cycling
 - Conceptual Model and mass loading refinement
 - Pot'l adverse impacts of carbon amendment on biota
 - Remedial Technologies
- **Interim Measures Studies / Tasks**



ROPs Meetings April 28 & May 28, 2014

- **Field Pilots**
 - **Floodplain Soil Pilot Part 1: Effects of biochar on toxicity and mercury uptake from floodplain soil in terrestrial invertebrates and plants (JR Flanders, URS)**
- **University Studies**
 - **Effect of carbon amendments on aquatic invertebrate feeding (Mike Newman, Virginia Institute for Marine Science)**



- **Preparation for Phase 1 Interim Measures (AOC 4)**
 - **Workshop: carbon amended to bank stabilization treatments**



Pilot Study of Floodplain Soil Amendment with Biochar: Study Objectives

- Assess the effects of biochar on mortality, growth, and reproduction of earthworms (*Eisenia fetida*)
- Assess the effect of biochar on seed germination and shoot production in plants
- Evaluate the potential of biochar to reduce mercury uptake from floodplain soil by earthworms and plants



Floodplain Lab Study Design - Overview

- Two soils:
 - Background (THg: **0.05 mg/kg**)
 - Augusta Forestry Center RRM 11.8 (THg: **57 mg/kg**)
- Three biochar treatments: 0% (Control), 5% and 10% by dry weight
- Toxicity endpoints:
 - **Earthworms:**
 - 4 weeks: **Adult mortality and weight change**
 - 8 weeks: **Reproduction (number of cocoons and juveniles produced)**
 - **Plants:**
 - 3 weeks: **Seedling emergence, biomass and height**
- **Efficacy:** Analyses of THg and methylmercury (MeHg) in earthworm and plant tissues and soils



Floodplain Laboratory Study for Field Pilot

- **Results**

- No toxic effects of biochar on earthworms or plants
- Addition of biochar (5%) reduced toxicity to earthworms (possibly due to sorption of other metals such as Mn)
- Addition of biochar (5%) reduced MeHg concentrations in juvenile earthworms, but not in adults
- No effect on THg concentrations



Detrital processing and Hg bioaccumulation by biota exposed to unamended and amended sediments:

Study Objectives:

- Evaluate the effect of carbon amendment additions to detrital processing
- Evaluate the efficacy of the sorbent in reducing bioaccumulation in amphipods



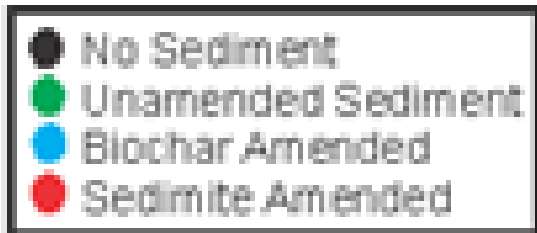
Experimental Treatments

- **Background Sediment** (0.038 mg Hg/kg dw)
 - Unamended Sediment (n=30)
 - Biochar Amended Sediment 11% (n=30)
 - Sedimite® Amended Sediment 11% (n=30)
- **Dooms Crossing** (8.1 mg Hg/kg dw)
 - Unamended Sediment (n=30)
 - Biochar Amended Sediment 11% (n=30)
 - Sedimite® Amended Sediment 11% (n=30)
- **Assay Negative Control** (leaf disk only, n=30)
 - Quantify change in weight of leaf disk due to leaching for 10 days
- **Assay Positive Control** (amphipod and leaf disk, n=30)

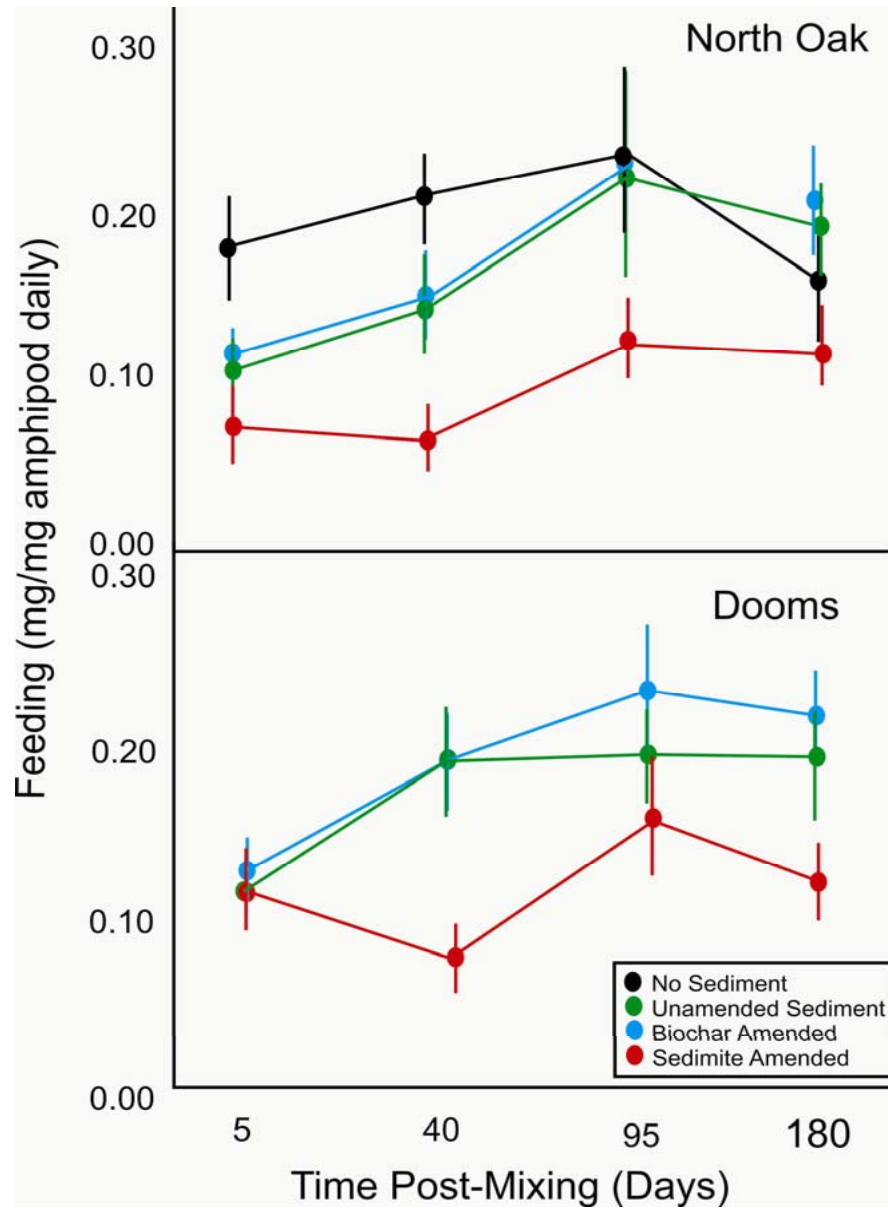


Results (Means and 95% Confidence Intervals)

**Leaf Detritus Processing
(mg/mg of amphipod daily)**



$\bar{X} \pm 95\% CI$



Results

- **Sedimite®**, but not biochar, reduced amphipod detrital processing in both the background sediments and the sediments from Dooms Crossing.
- **Sedimite® efficacy more persistent than that of biochar.**
 - 11% Sedimite® reduced THg concentrations in amphipods in Dooms Crossing sediment but not in background sediment
 - 11% biochar did not reduce THg concentrations in *amphipods* in both sediments

Questions for JR or Mike?

