

In Situ Activated Carbon Amendment for Sediment and Soil Mercury Remediation


Cynthia Gilmour & Upal Ghosh –1

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for Sediment and Soil Mercury
Remediation**

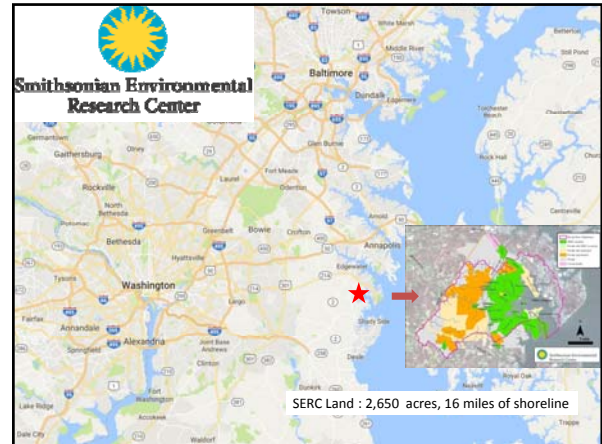

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Nov. 8, 2017

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(Smithsonian Environmental Research Center, Edgewater, MD,
USA)

Prof. Upal Ghosh
(University of Maryland Baltimore County)



**Smithsonian Environmental
Research Center**

Smithsonian Environmental Research Center

Ecology, biodiversity, conservation, restoration

Fisheries

Molecular ecology

Biogeochemistry and microbial ecology

Invasions biology

Plant and forest ecology

20 labs, ~100 employees, >40 summer interns



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In-situ Sorbent Amendments: A New Direction in Contaminated Sediment Management†

Upal Ghosh*

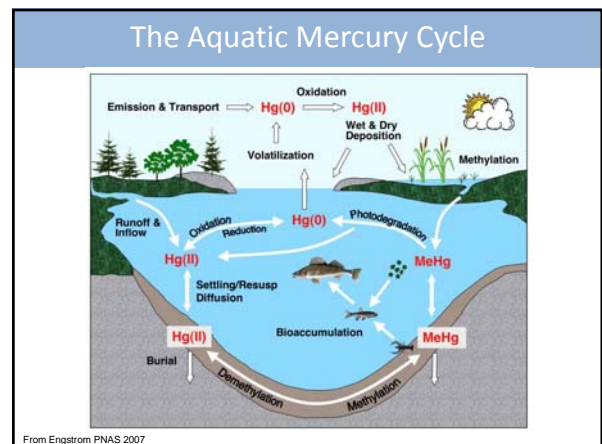
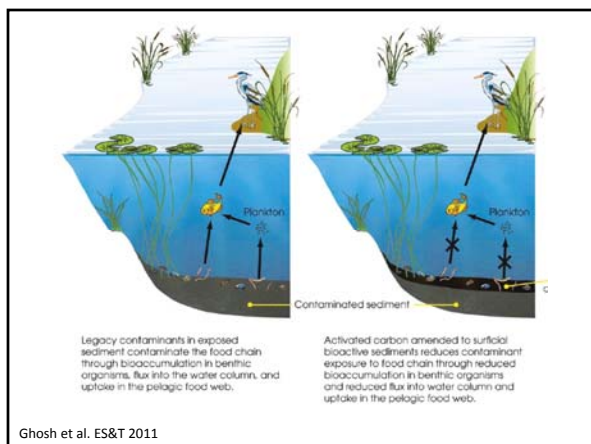
University of Maryland Baltimore County, Baltimore, Maryland 21250, United States

Richard G. Luthy
Stanford University, Stanford, California, United States

Gerard Cornelissen
Norwegian Geotechnical Institute, Oslo, Norway; University of Life Sciences, Ås, Norway; Stockholm University, Stockholm, Sweden

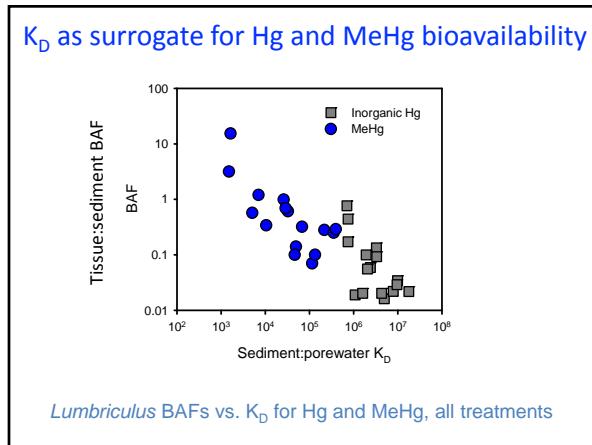
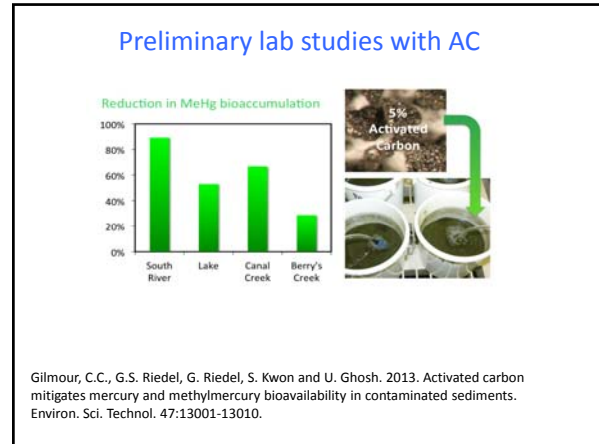
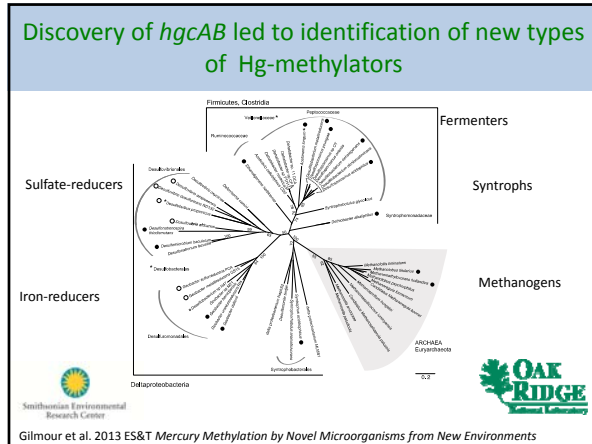
David Werner
Newcastle University, Newcastle upon Tyne, United Kingdom

Charles A. Menzie
Exponent, Alexandria, Virginia, United States

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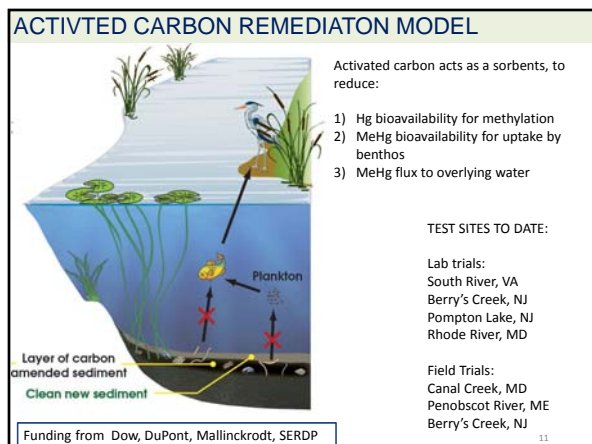


DEVELOPMENT OF *IN-SITU* MERCURY REMEDIATION APPROACHES BASED ON METHYLMERCURY BIOAVAILABILITY

Upal Ghosh and James Sanders
 Department of Chemical, Biochemical, and Environmental Engineering, UMBC
 Cynthia Gilmour
 Smithsonian Environmental Research Center
 Dwayne Elias
 University of Tennessee/ Oak Ridge National Laboratory

Specific Aim 1: Develop *in situ* remediation tools for Hg and MeHg impacted sediments
Specific Aim 2: Fill key knowledge gaps needed to develop a biogeochemical model for MeHg production and degradation in contaminated sediments and soils

NIH National Institute of Environmental Health Sciences




- ### Approach to evaluating AC as a tools for Hg risk remediation in sediments and soils
- Lab studies to evaluate efficacy across soil types
 - Small-scale field trials
 - Penobscot River, ME
 - Berry's Creek, NJ
 - Lab work to examine mechanisms and parameterize models


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Mendell Marsh, Penobscot River, ME



Contamination source:
HoltraChem chloralkali facility

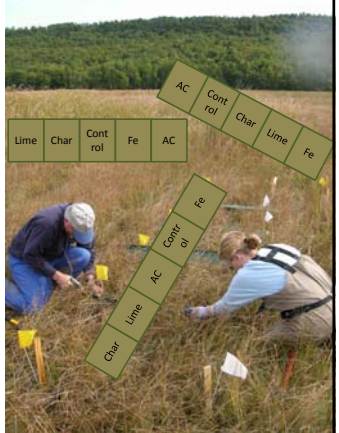
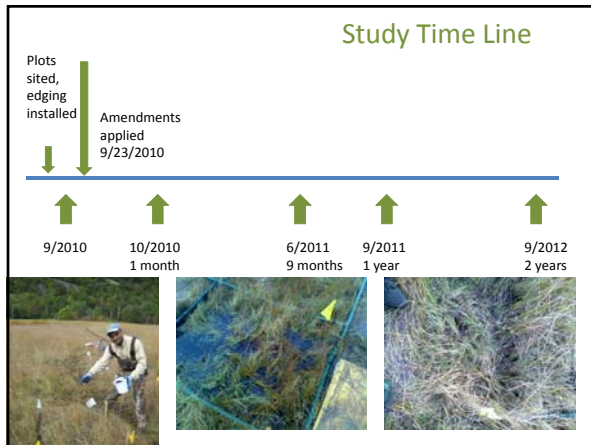


Supported by: Penobscot River Study/Mallinckrodt Chemical

Design

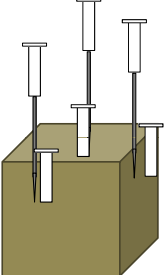
- 15 plots per site; 5 treatments,
- 3 plots per treatment
- Loading: 5% by dry weight of soil, based on top 10 cm of soil

Treatment	Loading (kg/m ²)
Control	None
FeCl ₂ · 4H ₂ O	2.3
Lime	0.5
Biochar – Pine Dust	1
SediMite (coconut shell PAC 50%)	2.3

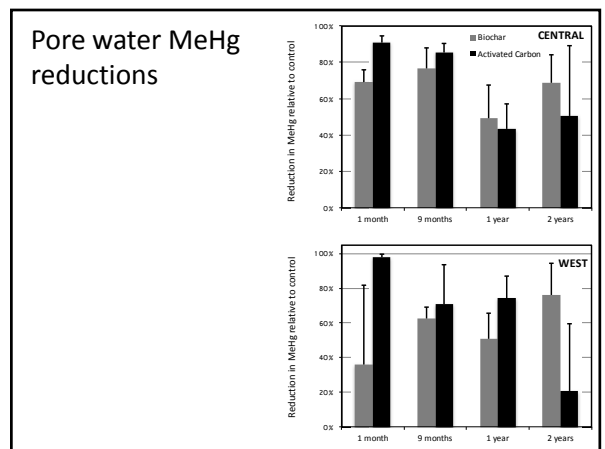
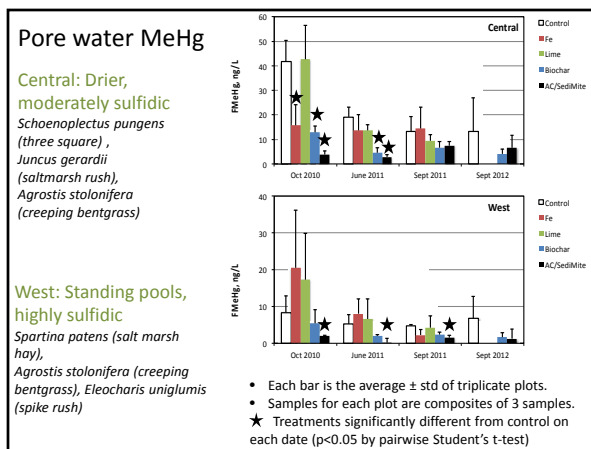



Key Endpoints/Metrics

- Amendment retention**
 - Black carbon in sediment
- Efficacy and longevity**
 - Pore water [MeHg]
 - Not evaluated: bioaccumulation
- Impacts on soil biogeochemistry**

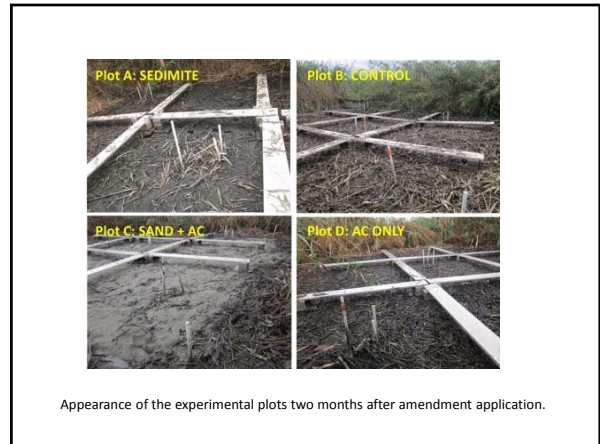
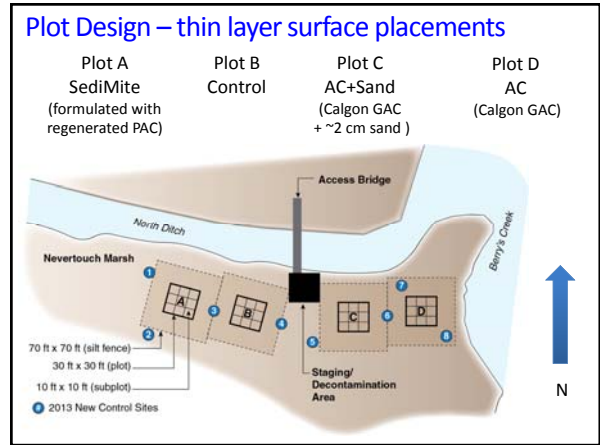
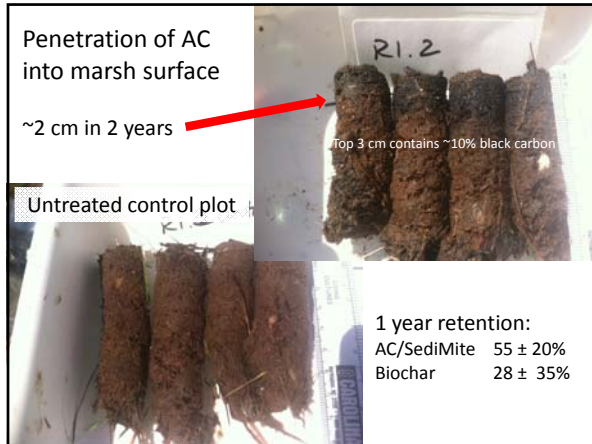


Soil and pore water sampling over time



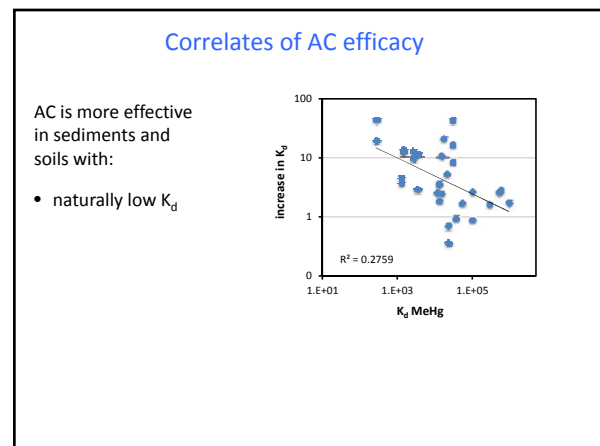
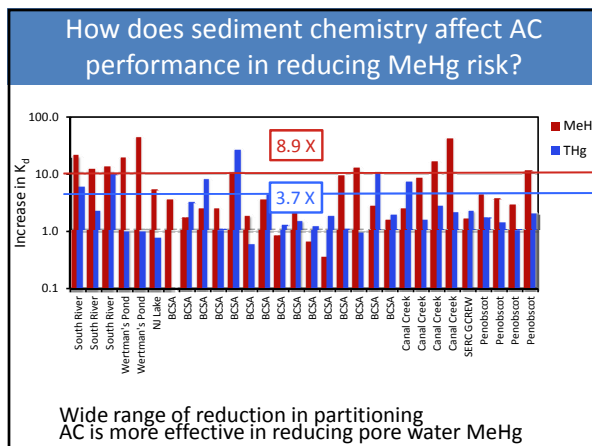
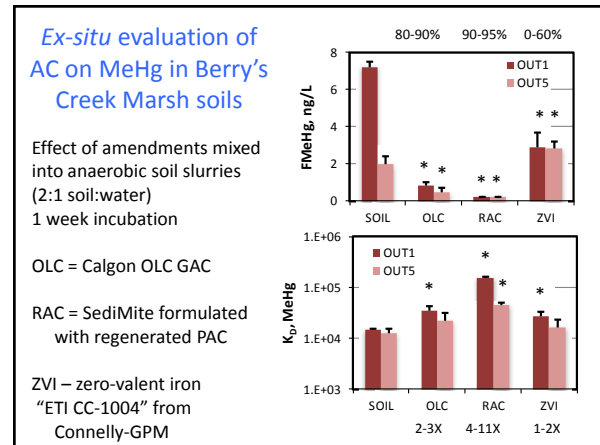
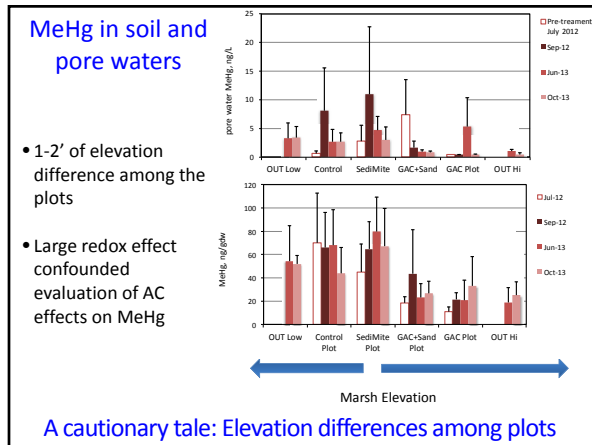
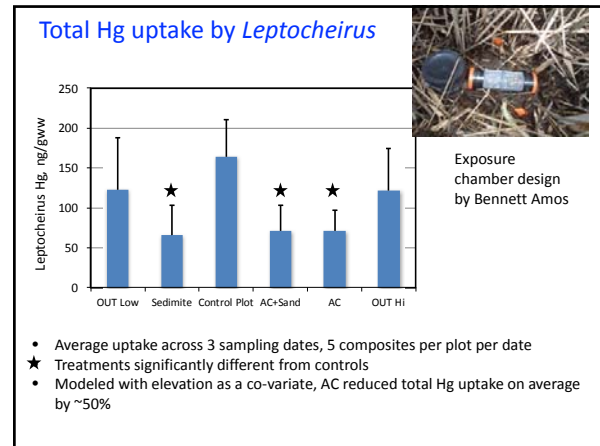
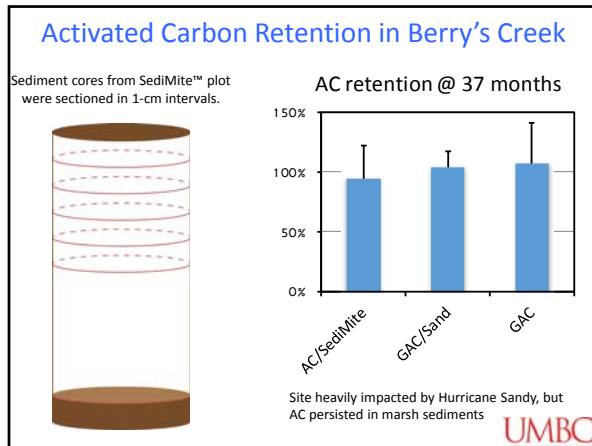
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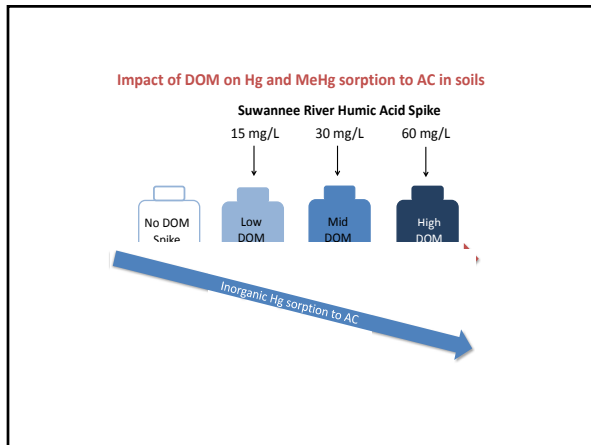
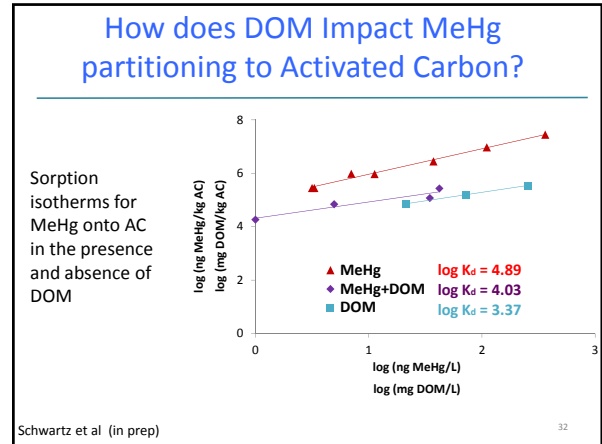
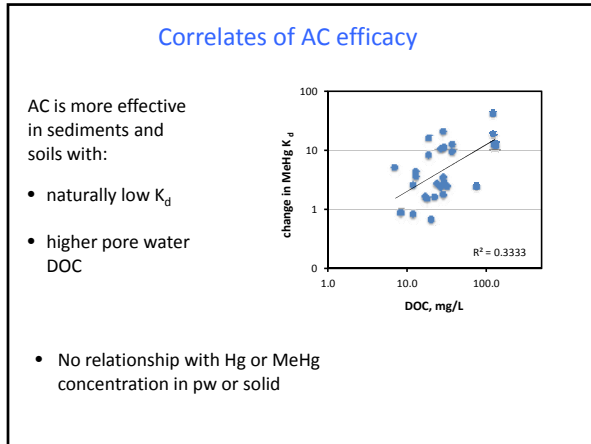
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Summary

- Activated Carbon can be an effective tool in reducing MeHg risk by reducing MeHg in pore waters
- Efficacies range from no impact to 50X increase in K_d
 - Avg pore water reduction of ~50% across all studies
- Early days for AC use in sediment/soil Hg remediation

Summary

- Activated Carbon seems most effective for MeHg in soils with natural low K_d high DOC
- AC was more effective in reducing MeHg than total Hg for most sites
- Goal: develop an empirical model to predict the potential effectiveness of AC amendments for specific sites

