

NEAR-Lab

Northwest Electromagnetics &
Acoustics Research

The Columbia River (CR) Basin Sustainable Water Resources, Energy and Climate Initiative

This project is funded by
The James F. and Marion L. Miller Foundation



Lead PI:

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CO-PIs:

Lisa Zurk (ECE)

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William Lang (History)

Chris Mooers (CEE)

Hamid Moradkhani (CEE)

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Peter J. Paquet (ELI)

Kristin Tufte (CEE & CS)

Scott Wells (CEE)

James Woods (Econ)

Edward Zaron (CEE)

Data and Information:

Tufte (leader), Zaron, Mooers

Transportation and Infrastructure

Figliozzi (leader), Woods, Jay

Biology, Water Quality and River-Oceans Interactions

Granek (leader), Zaron, Sytsma, Ma, Wells, Butler, Mooers

IOOS, Models and Sensors (Environmental Information Systems)

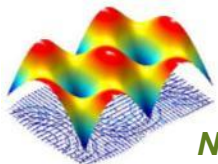
Mooers (leader), Jay, Zurk, Ma, Wells

Water Resources/Climate/hydropower

Jay (leader), Moradkhani, Paquet, Woods

Policy and Governance

Paquet (leader), Lang, Butler, Jay



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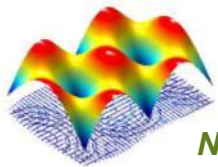
Acoustic Monitoring of the Columbia River Basin

NEAR-Lab is participating the joint project in establishing the Columbia River Observatory to monitor, model and understand system processes, especially human-river system interactions, locally and throughout the basin. The focus of our participation is to use acoustic method to monitor the Columbia River basin with the following aims:

- **Establish the ambient noise baseline**
- **Classify the noise sources**
- **Assess the anthropogenic impact**
- **Study the sustainability factors**

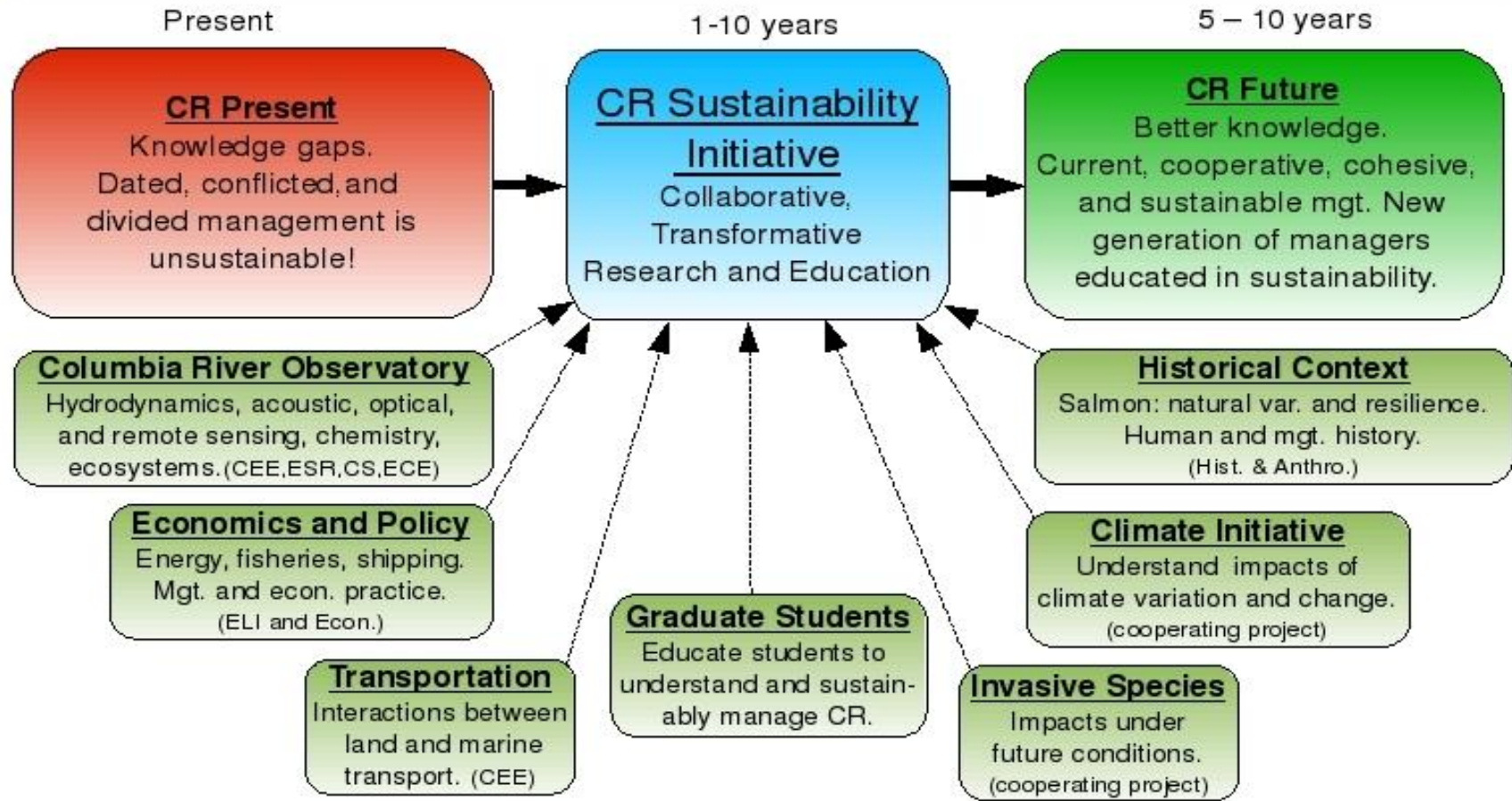


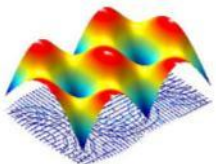
The first phase of this project is to develop underwater acoustic sensors for long-term monitoring with initial funding for sensor development of \$60k.



Where Have We Been, Where Are We Now, and What Are Our Best Options for the Future?

The Columbia River Basin Sustainable Water Resources, Energy, and Climate Initiative

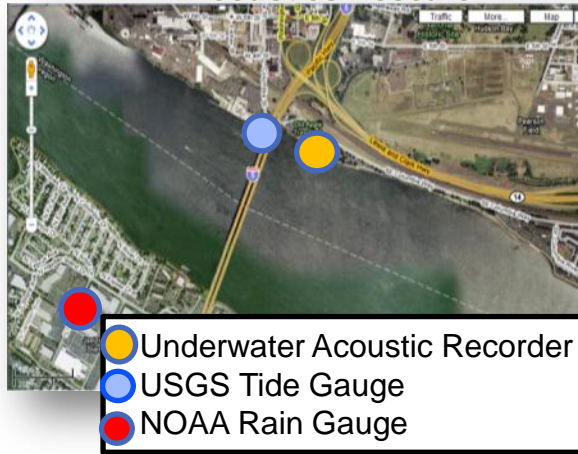




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What Are the Sources of Underwater Noise?

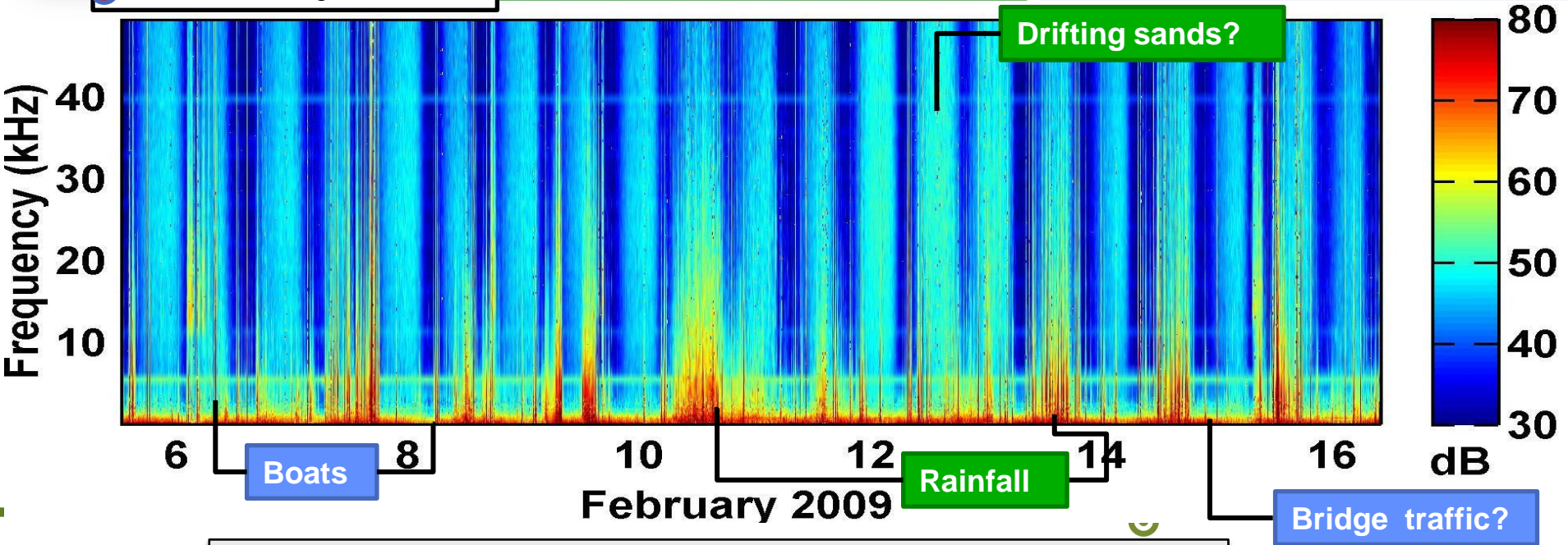


Nature

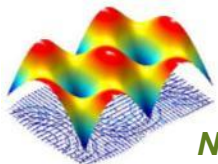
- Wind
- Rain
- River Flow
- Drifting sands (pebbles)
- Biology (fish)
- Breaking waves

Human

- Boats (shipping)
- Bridge traffic
- Construction (pile driving)
- Factory (discharge)
- Dam (generator)
- Navy sonar

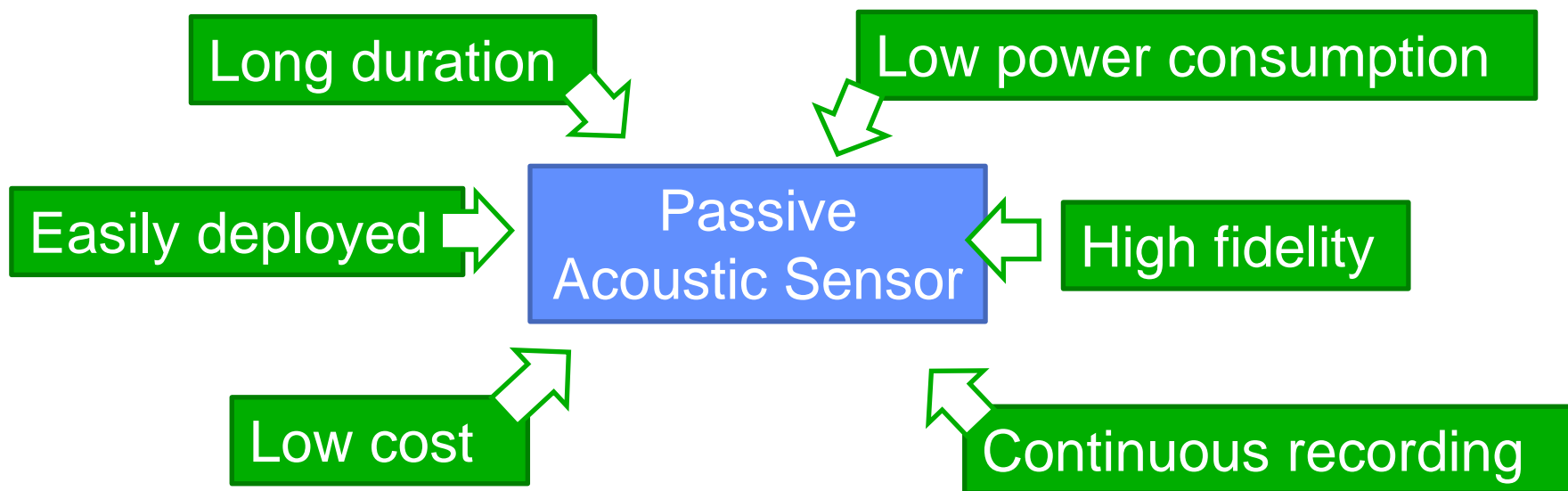


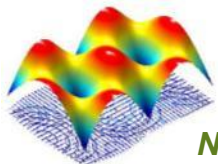
Ambient noise spectra near the I-5 bridge crossing



Building the Passive Acoustic Sensors

- Long-term continuous recording is needed for studying the underwater environment.
- Instrument with low power consumption, long duration and easily deployed is essential to this practice.





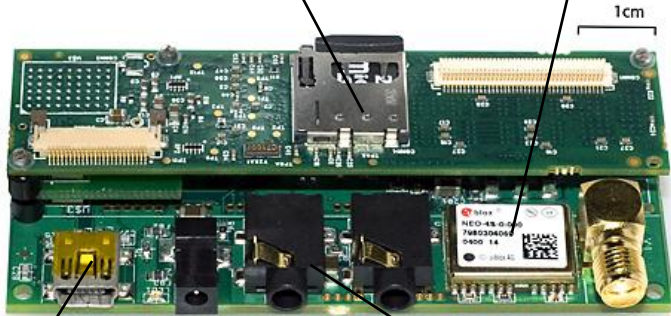
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Passive Acoustic Single Sensor Development

SD/MMC programming
allows rapid development.

GPS for time-stamp
and deployment
position.



USB Host support for
storage.

Analog A/D Converter
16bits @ 48000hz
2 Channels

Unit Cost

Gumstix Board: \$250

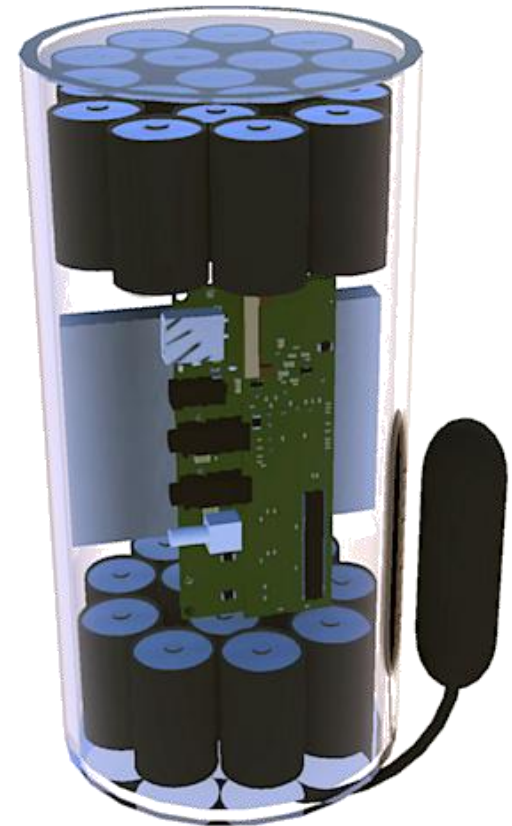
Hydrophone: ~\$200

Batteries: (\$100-200)

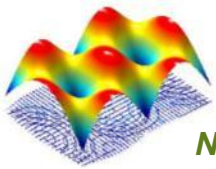
Enclosure: (\$300)

Total: under \$1000

Prototype



Passive sensor development at Portland State (Gumstix Approach)



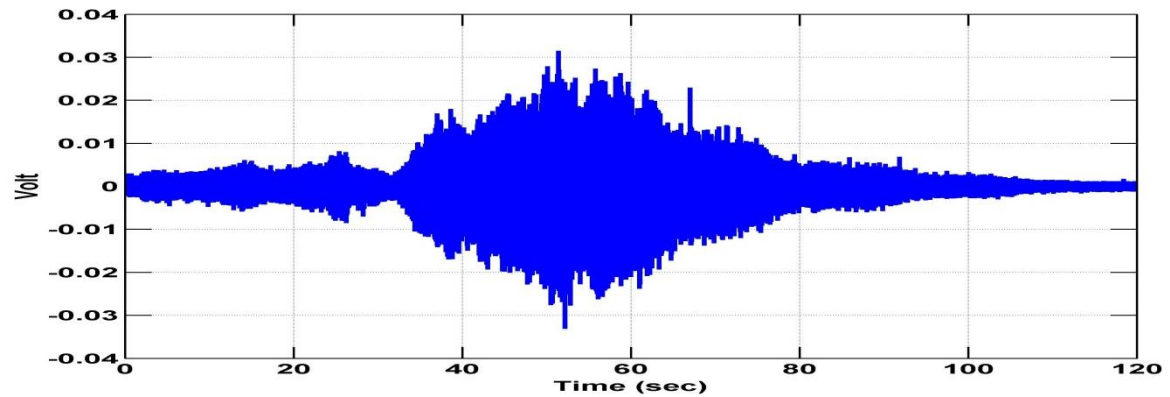
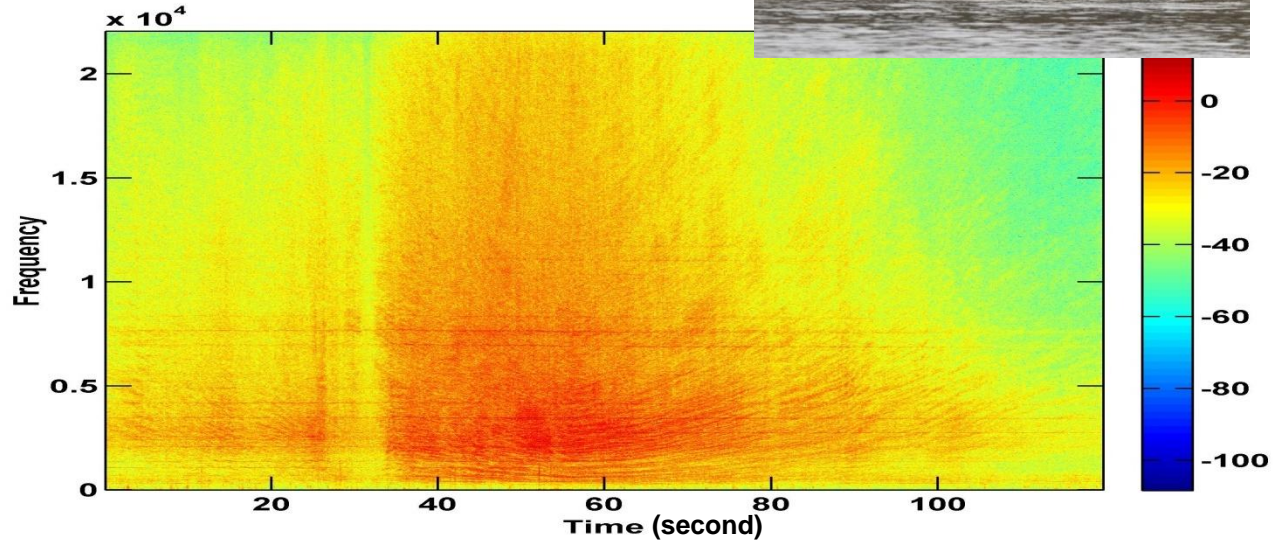
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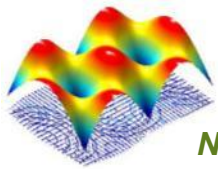
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Field Test with Gumstix Prototype at Willamette River - Feb, 27, 2009



Acoustic signatures of
small craft






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Global Warming and Global Noising








How we impact our environment through creation and distribution of noise?

- **Conservation Technology Initiative (CTI)** is an integrated effort with The Nature Conservancy which is aimed in applying the latest sensing techniques for the environmental conservation.
- **Sonar sensing for underwater habitats** is one of the current tasks.



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Integrated Sensing for The Nature Conservancy Habitats

	Coral Reefs		Islands		Forests
	Marine Ecosystems				Rainforests
	Freshwater Ecosystems				
	Great Rivers				

Near-term CTI Focus: sonar sensing for underwater habitats

- Covers 5 of 7 TNC habitats
- Difficult sensing challenge

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