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**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
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

Present
- **CR Present**
  - Knowledge gaps.
  - Dated, conflicted, and divided management is unsustainable!

1-10 years
- **CR Sustainability Initiative**
  - Collaborative, Transformative Research and Education

5 – 10 years
- **CR Future**
  - Better knowledge.
  - Current, cooperative, cohesive, and sustainable mgt. New generation of managers educated in sustainability.

**Columbia River Observatory**
- Hydrodynamics, acoustic, optical, and remote sensing, chemistry, ecosystems. (CEE, ESR, CS, ECE)

**Economics and Policy**
- Energy, fisheries, shipping. Mgt. and econ. practice. (ELI and Econ.)

**Transportation**
- Interactions between land and marine transport. (CEE)

**Graduate Students**
- Educate students to understand and sustainably manage CR.

**Invasive Species**
- Impacts under future conditions. (cooperating project)

**Climate Initiative**
- Understand impacts of climate variation and change. (cooperating project)

**Historical Context**
- Salmon: natural var. and resilience. Human and mgt. history. (Hist. & Anthro.)
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.

Passive Acoustic Sensor
- Continuous recording
- Low cost
- Easily deployed
- Low power consumption
- High fidelity
Passive Acoustic Single Sensor Development

SD/MMC programming allows rapid development.

USB Host support for storage.

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

GPS for time-stamp and deployment position.

Unit Cost
- Gumstix Board: $250
- Hydrophone: ~$200
- Batteries: ($100-200)
- Enclosure: ($300)

Total: under $1000

Passive sensor development at Portland State (Gumstix Approach)
Field Test with Gumstix Prototype at Willamette River - Feb, 27, 2009

Acoustic signatures of small craft
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.