CEETEP
Cascadia EarthScope Earthquake and Tsunami Education Program

Bob Butler
University of Portland

Nancy Hunter
Bob Lillie
Oregon State University

Beth Pratt-Sitaula
Central Washington University

Professional development workshops for coastal teachers, interpreters, and emergency management educators.
Introductions

- CEETEP
- Instructors
- Participants
- EarthScope
Primary Aim: Improve disaster resilience through educator professional development

Goals – Participants will:

- **Learn Geoscience** and be able to communicate about earthquake and tsunami science and research
- **Understand Risk** and be able to communicate about Cascadia geohazards
- **Take Action** and be able to work with learners to improve preparedness
- **Exchange Pedagogy** on how to teach about EarthScope, hazards/risk, and preparedness
“The same geological processes that threaten our lives with earthquakes and tsunamis also nourish our spirits by creating the spectacular headlands and beaches of the Pacific Northwest.” – Dr. “Ranger” Bob Lillie
CEETEP Precursors


EarthScope Education and Outreach Workshops for Interpretive Professionals in Parks and Museums (2008 - Present)
Rethinking the View

**Science** (EarthScope, Cascadia)

Not: “Dumbing It Down”

Meanings (Geoscience, Hazards, Preparedness)

Formal Learning

Free-Choice Learning

Scientists

Students

The Public
Greater resilience in Cascadia & America
Meanings (Geoscience, Hazards, Preparedness)

Students

The Public

Instead: “Storying It Up” 😊

Scientists

Formal Learning

Free-Choice Learning

Science (EarthScope, Cascadia)

Partner organizations & further dissemination
Greater resilience in Cascadia & America
Partner organizations & further dissemination

Meanings (Geoscience, Hazards, Preparedness)

Students

The Public

Emergency Management Educators

K-12 Educators

Park Interpreters

Scientists

Formal Learning

Free-Choice Learning

Science (EarthScope, Cascadia)

Joint professional development in coastal communities
Galvanizing change in preparedness

- Research on behavioral change (Wood 2012; Mileti 2011)
  - Simple consistent messaging on what TO DO
  - From many trusted sources
  - For a long long time
  - Seeing others take preparedness steps

- FEMA (2010) suggests that science classrooms are under-utilized for hazard and preparedness connections


Mileti and colleagues (National Hazards Center, University of Colorado) http://www.colorado.edu/hazards/

Workshops on Cascadia Science and Preparedness:

- N. Olympic Peninsula, October 2013
- Grays Harbor, Washington, August 2014
- Astoria, Oregon, October 2013
- Newport, Oregon, August 2013
- Coos Bay & NoCal, 2015
ONRC workshop space

- Hemlock Forest Room – Main room
- Social Hall – Breakfast (8:15-8:30 start) & lunch
- Foyer – snacks
- Water fountain & restrooms – in the hallway
- Library & classroom – breakout sessions, team planning space
CEETEP Binder

- OSU forms
- Feedback (white, front pocket)
- Agenda
- Contact lists
- Resources (thick section in the middle)
- Post-it notes (use them for questions)

Cascadia EarthScope Earthquake & Tsunami Education Program (CEETEP)

Workshops for K-12 Teachers, Park/Museum Interpreters, and Emergency Management Educators
Aberdeen, Washington, August 11-14, 2014
Forks, Washington, October 10-13, 2014

Instructors:
- Bob Butler, University of Portland
- Nancee Huner, OSU Hatfield Marine Science Center
- Bob Lillie, Oregon State University
- Beth Pratt-Sitaula, Central Washington University

Co-Instructors:
- Brian Atwater, U. S. Geological Survey
- Bob de Groot, Southern California Earthquake Center
- Roger Groom, Mt. Tabor Middle School
- Bonnie Magura, Portland Public Schools (Retired)
- Brynné Walker, Washington Emergency Management Division

Instructors:

Co-Instructors:

http://ceetep.oregonstate.edu
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Coffee, tea, juice, snacks for those who arrive early</td>
</tr>
<tr>
<td>9:00</td>
<td>Introductions: CEETEP, EarthScope, Participants, Instructors</td>
</tr>
<tr>
<td></td>
<td>Please sit with your Action Team</td>
</tr>
<tr>
<td>10:15</td>
<td><strong>Break (Coffee, tea, juice, snacks)</strong></td>
</tr>
<tr>
<td>10:30</td>
<td>Beauty and the Beast: Plate Tectonics and Geological Hazards of the Pacific Northwest</td>
</tr>
<tr>
<td>12:00</td>
<td>Thoughts/questions/reflection</td>
</tr>
<tr>
<td>12:15</td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>1:00</td>
<td>Basics of Earthquake and Tsunami Science and Hazards and Related Teaching Activities</td>
</tr>
<tr>
<td>3:15</td>
<td><strong>Break (Coffee, tea, juice, snacks)</strong></td>
</tr>
<tr>
<td>3:30</td>
<td>Surviving a Cascadia Subduction Zone Earthquake</td>
</tr>
<tr>
<td>4:30</td>
<td>Forms: Reimbursements; Stipends; Photo Permissions; Logistics for Day 2 Field Trip</td>
</tr>
<tr>
<td>4:45</td>
<td>Reflection, Questions, Implications</td>
</tr>
<tr>
<td>5:30</td>
<td>Adjourn</td>
</tr>
</tbody>
</table>
# Agenda Day 2 - Field Trip

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>7:30</td>
<td><strong>Coffee, tea, juice, snacks for those who arrive early</strong></td>
</tr>
<tr>
<td>8:00</td>
<td><strong>Depart</strong></td>
</tr>
<tr>
<td>9:30</td>
<td><strong>Stop 1:</strong> Waatch Prairie Tsunami Geology</td>
</tr>
<tr>
<td>11:00</td>
<td><strong>Stop 2:</strong> Tsunami Evacuation Walk</td>
</tr>
<tr>
<td>12:30</td>
<td><strong>Lunch &amp; Stop 3</strong> at Makah Research &amp; Cultural Center (packed lunches)</td>
</tr>
<tr>
<td>3:20</td>
<td><strong>Stop 4:</strong> Quillayute Airport GPS Station</td>
</tr>
<tr>
<td>4:30</td>
<td><strong>Adjourn</strong></td>
</tr>
</tbody>
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### Agenda Day 3 – Cascadia

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Coffee, tea, juice, snacks for those who arrive early</td>
</tr>
<tr>
<td>9:00</td>
<td>Cascadia Earthquakes and Tsunami and Related Teaching Activities</td>
</tr>
<tr>
<td>10:30</td>
<td><strong>Break (Coffee, tea, juice, snacks)</strong></td>
</tr>
<tr>
<td>10:45</td>
<td>Cascadia Earthquakes and Tsunami and Related Teaching Activities</td>
</tr>
<tr>
<td>12:00</td>
<td>Thoughts/questions/reflection</td>
</tr>
<tr>
<td>12:15</td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>1:00</td>
<td>Tsunami: Are You Ready?</td>
</tr>
<tr>
<td>1:45</td>
<td>Native American Oral Histories</td>
</tr>
<tr>
<td>2:30</td>
<td>Science Storytelling through Interpretation</td>
</tr>
<tr>
<td>2:45</td>
<td>Birds-of-a-Feather Breakout Session</td>
</tr>
<tr>
<td>3:30</td>
<td><strong>Break (Coffee, tea, juice, snacks)</strong></td>
</tr>
<tr>
<td>3:45</td>
<td>Exchange of Pedagogies: Working together in Coastal Cascadia to engage students, visitors, and residents</td>
</tr>
<tr>
<td>4:15</td>
<td>Action Teams: Action Plan Development. Teams work on post-workshop plans (also prep 10-minute presentation for Day 4)</td>
</tr>
<tr>
<td>5:30</td>
<td><strong>Adjourn</strong></td>
</tr>
</tbody>
</table>
## Agenda Day 4 – Bringing it together

**Monday, October 13**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:30</td>
<td>Coffee, tea, juice, snacks for those who arrive early</td>
</tr>
<tr>
<td>9:00</td>
<td>Digital Resources</td>
</tr>
<tr>
<td>9:55</td>
<td>Preparedness for Post-event Personal and Community Survival</td>
</tr>
<tr>
<td>10:40</td>
<td><strong>Break (Coffee, tea, juice, snacks)</strong></td>
</tr>
</tbody>
</table>
| 10:55 | Break Out Sessions  
|       | Tsunami Vertical Evacuation Structures  
|       | Teachers  
|       | Hazard Inventory Interpreters & EM Educators                           |
| 11:45 | Break Out Sessions  
|       | Tsunami Vertical Evacuation Structures  
|       | Interpreters & EM Educators  
|       | Hazard Inventory Teachers                                              |
| 12:30 | **Lunch**                                                              |
| 1:15  | Action Teams: Final preparations for Action Plan and 10-minute presentation |
| 2:30  | Action Teams: Presentations of plans                                   |
| 3:45  | **Break (Coffee, tea, juice, snacks)**                                  |
| 4:15  | Post-Workshop Assessment. Survey and focus groups.                     |
| 5:30  | **Adjourn**                                                            |
CEETEP Principle Investigators and Instructors
1. Bob Butler, University of Portland, Portland
2. Nancee Hunter, OSU Hatfield Marine Science Center, Newport
3. Beth Pratt-Sitaula, Central Washington University, Ellensburg & UNAVCO, Boulder, CO

Master Teachers and Co-Instructors
4. Roger Groom, Mt. Tabor Middle School, Portland
5. Bonnie Magura, Portland Public Schools (retired), Portland
8. Ken Austin, UNAVCO, Ellensburg
9. Paul Gleason
10. David Yamaguchi, Seattle
CEETEP
Forks, WA
October 10-13, 2014

CEETEP Partner Organizations
11. Bob de Groot, Southern California Earthquake Center, Los Angeles, CA

External Evaluator
12. Michael Coe, Cedar Lake Research, Portland

Animator/Videographer
13. Jenda Johnson, Portland

Student Assistant
14. Lisa Akers, Oregon State University, Corvallis
Action Team 1

20-second Intro
1. Who are you?
2. Your organization and/or educational setting?

Optional:
3. What you particularly hope to get from CEETEP?

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Location</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12 Teacher</td>
<td>Sheri Crippen</td>
<td>LaPush</td>
<td>Quileute Tribal School</td>
</tr>
<tr>
<td>Park/Museum Interpreter</td>
<td>Raena Parsons</td>
<td>San Juan Is.</td>
<td>San Juan Island National Historical Park</td>
</tr>
<tr>
<td></td>
<td>Steven Ray</td>
<td>San Juan Is.</td>
<td>San Juan Island National Historical Park</td>
</tr>
<tr>
<td>Emergency Management Educator</td>
<td>Ben Marple</td>
<td>Seattle</td>
<td>American Red Cross</td>
</tr>
</tbody>
</table>
# Action Team 2 – Neah Bay

## 20-second Intro
1. **Who are you?**
2. **Your organization and/or educational setting?**

Optional:
3. **What you particularly hope to get from CEETEP?**

### Map of Neah Bay Area

### Team Members

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Location</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12 Teacher</td>
<td>Krystal Russell</td>
<td>Neah Bay</td>
<td>Neah Bay Middle School</td>
</tr>
<tr>
<td></td>
<td>Mike Schermer</td>
<td>Joyce</td>
<td>Crescent School</td>
</tr>
<tr>
<td>Park/Museum Interpreter</td>
<td>Polly DeBari</td>
<td>Neah Bay</td>
<td>Makah Cultural &amp; Research Center</td>
</tr>
</tbody>
</table>
**Action Team 3 – Port Angeles-Sequim**

**20-second Intro**
1. Who are you?
2. Your organization and/or educational setting?

Optional:
3. What you particularly hope to get from CEETEP?

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>City</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12 Teacher</td>
<td>Kat Dadd</td>
<td>Port Angeles</td>
<td>Stevens Middle School</td>
</tr>
<tr>
<td></td>
<td>John Gallagher</td>
<td>Port Angeles</td>
<td>Port Angeles High School</td>
</tr>
<tr>
<td></td>
<td>John Henry</td>
<td>Port Angeles</td>
<td>Port Angeles High School</td>
</tr>
<tr>
<td></td>
<td>Brenda Manson</td>
<td>Port Angeles</td>
<td>Stevens Middle School</td>
</tr>
<tr>
<td>Park/Museum Interpreter</td>
<td>Nicole Harris</td>
<td>Port Angeles</td>
<td>Olympic Coast Nat. Marine Sanct.</td>
</tr>
<tr>
<td>Emergency Management Educator</td>
<td>Sterling Epps</td>
<td>Sequim</td>
<td>Clallam County CERT</td>
</tr>
</tbody>
</table>
Action Team 4 – Forks

20-second Intro
1. Who are you?
2. Your organization and/or educational setting?

Optional:
3. What you particularly hope to get from CEETEP?

K-12 Teacher
John Hunter Forks Forks High School
Stephanie Miller Forks Forks Middle School
Megan Raines Forks Forks High School
Cari Rohrer Forks Forks Middle School

Park/Museum Interpreter
Judy Lively Forks Olympic National Park

Emergency Management Educator
Jayme Wisecup Clallam Clallam County Emergency Man.
20-second Intro
1. Who are you?
2. Your organization and/or educational setting?

Optional:
3. What you particularly hope to get from CEETEP?

K-12 Teacher
Michael Kenney
Amanda Park
Lake Quinault School

Park/Museum Interpreter
Tami Pokorny
Jefferson County
N Pacific Coast Marine Reserve
Jon Preston
Hoh Visitor Center
Olympic National Park

Emergency Management Educator
David Shannon
Seattle
American Red Cross
Get to know your team

• Several minute intro – Each member of the team should share a little more details about their:
  • Teaching setting and audience
  • Existing strengths or experience with geoscience and preparedness
  • Goals for gaining knowledge and abilities in teaching tsunami and earthquake education
A National Science Foundation (NSF) effort to ..... 
- Explore the structure and evolution of North American continent
- Study processes that cause earthquakes and volcanic eruptions

EarthScope has three main “observatories”
EarthScope Observatories

USArray
Seismometers

Geodetic Instruments

PBO

Deep Drillhole

Plate Boundary Observatory

SAFOD
San Andreas Fault Observatory at Depth
“Like a **Hubble Telescope** aimed into the Earth”
1. USArray

- Includes 400 Transportable Seismometers
- Each station occupies a site for 1½ to 2 years
- 10 years to leap-frog across the country

http://anf.ucsd.edu/stations/deployment_history.php
Seismic Waves Moving Across USArray

China, 2008

Bob Woodward - IRIS

Animation of Wenchuan China Earthquake

Robert Woodward
IRIS

www.earthscape.org
2. PBO
Plate Boundary Observatory

- High precision GPS
- Strainmeters
2. PBO
Plate Boundary Observatory

EarthScope GPS Stations

- Backbone Network
- Subduction Cluster
- Volcanic Cluster
- Transform Cluster
- Extension Cluster
2. PBO
Plate Boundary Observatory

Jump to local map
Wegener's Dream

"This [direct measurement of continental drift] **must be left to the geodesists.** I have no doubt that in the not too distant future we will be successful in making a precise measurement of the drift of North America relative to Europe." -- Alfred Wegener, 1929

200 million years ago all of the present-day continents combined to form a single supercontinent called Pangaea.
Geologically-measured spreading rates

20-30 kilometers/million years
20-30 millimeters/year
~1 inch/year
GPS Measurements:
Motion of North America relative to Europe. 
Wegener’s Dream come true!

~1 inch/year
Quillayut, Washington GPS Station
Yearly Movement, 2005 - 2014
(Referenced to Stable North America)
EarthScope Station Status
September 2014

http://www.earthscope.org/current_status
Cascadia Initiative

New seismometers being deployed offshore and onshore to complement existing onshore seismometers and GPS instruments

Four year project:
2011 - 2014

Onshore:
232 GPS stations
27 seismometers

Offshore:
60 ocean-floor seismometers
EarthScope Cheat Sheet

EarthScope is a ~15 year long geophysics initiative to study the crust of North America – what it is made of, how it was assembled, and the geohazards it has. Funded by National Science Foundation.

EarthScope Facility has 3 Parts

- **Plate Boundary Observatory (PBO)** – >1100 GPS stations and strainmeters to measure crustal movements
- **USArray** – 400 Transportable Array seismic stations that have been stepping across lower-48 and now Alaska for last 10 years.
- **San Andreas Fault Observatory at Depth (SAFOD)** – drilling to San Andreas fault at 3-4 km

**UNAVCO** (NSF’s Geodetic Facility) runs PBO

**IRIS** (NSF’s Seismic Facility) runs USArray

**EarthScope also funds science and education projects like CEETEP**

Cascadia EarthScope Earthquake and Tsunami Education Program has 3 collaborating universities:
- Oregon State Univ.
- Univ. of Portland
- Central WA Univ.
Education and Outreach Goals

1. Create high profile **EarthScope identity**
2. Promote science literacy through **informal education**
3. Advance **formal education** in the classroom
4. Foster use of **data, discoveries, technology**
5. Establish sense of **community ownership**
Earth Science Literacy Principles

Big Ideas:

1. Earth scientists use repeatable observations and testable ideas to understand and explain our planet.

2. Earth is 4.6 billion years old.

3. Earth is a complex system of interacting rock, water, air, and life.

4. Earth is continuously changing.

5. Earth is the water planet.

6. Life evolves on a dynamic Earth and continuously modifies Earth.

7. Humans depend on Earth for resources.

8. Natural hazards pose risks to humans.

9. Humans significantly alter the Earth.
Sense of Place ..... 

• Our hometowns and other special places are part of exciting new exploration and discovery.
• Our communities are not standing still—they are moving!

Drillhole across San Andreas Fault
875 GPS Instruments
175 Borehole Strainmeters
5 Long-Baseline Laser Strainmeters
400 Seismometers at 2,000 sites
100 Permanent Seismometers