Nature Trails

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Seal Rock Debris Boat. Photo by J. Chapman

Seaweeds on Japanese Tsunami Marine Debris: Were They an Invasion Risk?

Gayle Hansen

Oregon State University Department of Botany and Plant Pathology, at the US Environmental Protection Agency, Newport, Oregon

Friday, 16 February 2018, 7:30pm, Room 100 Willamette Hall, UO Campus

Gayle Hansen, also called the seaweed lady, is pictured here in her element. How she came to this spot, which some aficionados among us will recognize as Cape Arago, is a convoluted tale, full of intrigue, harrowing adventures and narrow escapes—the normal sort of life for a research phycologist. Hansen was born in Virginia and grew up in suburban Washington, D.C. As a child she loved her family outings to beaches in South Carolina, where she fell in love with seaweed. She attended eastern schools for her education, getting her Bachelor's from the University of Connecticut, her Master's from the University of Vermont, and her Ph.D. from the University of North Carolina – all in botany. Her doctoral thesis was on a new species of red algae, *Cirrulicarpus carolinensis*, which she discovered during diving expeditions on the North Carolina coast. After post-doctoral positions at Harvard and the University of Massachusetts, she made a continental shift, moving to the Pacific Northwest. She then conducted research at the University of British Columbia for seven years and taught algal courses and worked at the marine laboratories in Bamfield (Vancouver Island), Friday Harbor (U. of Washington), and Shannon Point (Western Washington U.). During that time, she also taught at Simon Fraser University, another first-rate educational institution in British Columbia.

In the wake of the Exxon Valdez oil spill, Hansen's expertise was sought out by the state of Alaska. She worked for three years as algal taxonomist for the state research teams studying the 1989 spill. This is where the intrigue and harrowing adventure comes. First, the intrigue. Her work was part of Alaska's effort to establish the magnitude of the disaster. Several of her colleagues from UBC were employed by Exxon, and their *raison d'etre* was entirely different. The two sides worked sometimes in the same areas, but, since a lawsuit was involved, they could not exchange information or even discuss their projects. Second, the harrowing adventure. During the spill, there were 3 main study areas where the state research boats were deployed: Prince William Sound, Kodiak Island, and the Alaska Peninsula. During the summers, Hansen was transferred every other week between the boats by floatplane. She said the pilots called her a "white knuckle" flyer because she hung on to the planes so tightly during the often-bumpy flights. Her work involved both cataloging the native algae, about which not much was known at the time, and training the University of Alaska field research teams. After her impact study, she continued to research the aftermath of the spill up to 1998.

Hansen set up her laboratory at the Hatfield Marine Science Center in Newport, Oregon, in 1989, where her position is Associate Professor (Senior Research), OSU Department of Botany and Plant Pathology at the US Environmental Protection Agency. Her interests span a variety of algal topics but center on the taxonomy and biogeography of the seaweeds. Although her career is heavily tilted toward research, Hansen has also been a teacher, both formally and informally. She has given seminars on various aspects of marine phycology all over the country, and, here in Oregon, she has taught intensive courses on algae at the Hatfield Marine Science Center and the Oregon Institute of Marine Biology in Charleston. Her Oregon projects have included a checklist of the seaweeds, Oregon's rare seaweeds, seaweeds of the subtidal reserves, and, most recently, a study of the seaweeds arriving on Japanese tsunami marine debris.

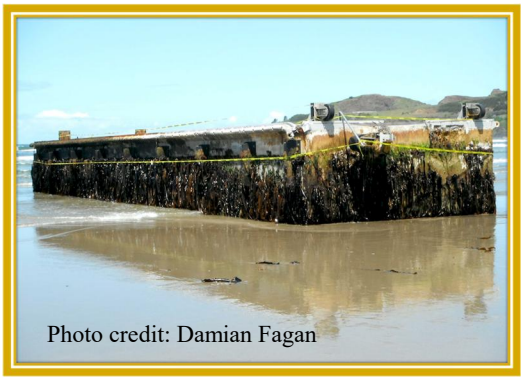


Photo credit: Damian Fagan

A little over a year after the devastating Tohoku earthquake and tsunami in 2011, a large derelict dock came ashore on Agate Beach in Newport. The dock was found to carry a wide variety of Asian species and it became clear that it was the first of the debris items from the Japanese tsunami to land on our shores. Concern mounted that the alien flora and fauna borne by these debris items might colonize our shores and become invasive in their new surroundings. Out on a low-tide collecting trip in the early morning after the dock arrived, Hansen was one of the first scientists to visit the debris dock and immediately recognized the presence of abundant quantities of *Undaria pinnatifida*, one of the most invasive seaweeds worldwide. As an expert on Oregon's seaweeds, she also was concerned that this and other Japanese species might escape the debris and colonize our shores. Thus, she began a 4-year study of the debris algal species supported by Oregon

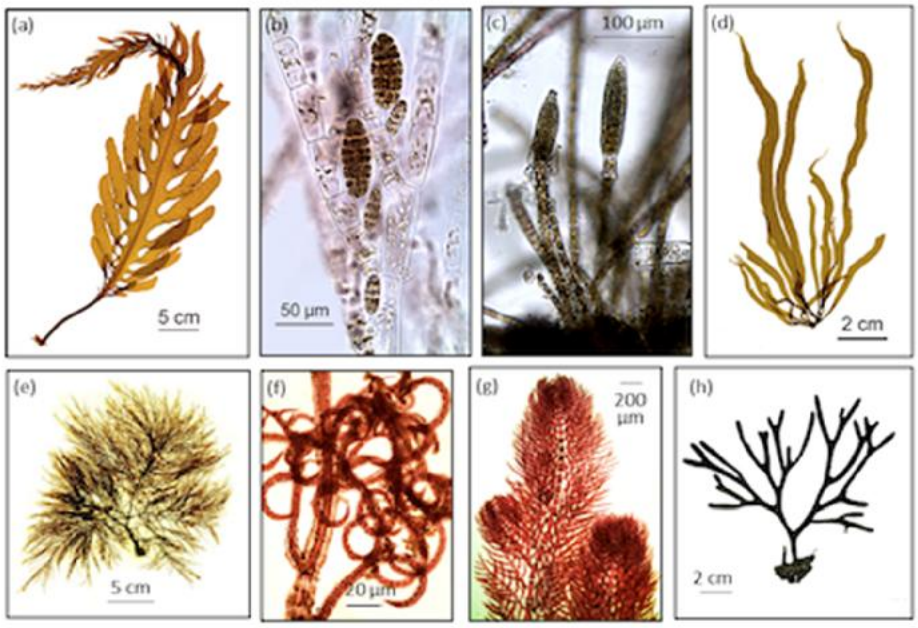
Sea Grant Program and the Japanese Ministry of the Environment awarded through the North Pacific Marine Science Organization. As a part of her project, she was able to invite several of her Japanese colleagues, specialists in molecular biology, to join her in the study of the debris algae.

When Hansen first got on top of the huge dock that had made it from Japan to Oregon she immediately recognized and called attention to the edible but extremely hazardous invader *Undaria pinnatifida*. But, similar to most of us, the press was more interested in invasive animals—mussels, snails and the like—than in algae. Called Wakame in Japan, *U. pinnatifida* is prized for its flavor and relished as an edible seaweed. But it has been listed by the Invasive Species Specialist Group as one of the world's 100 most invasive species, so she was rightfully alarmed that a live specimen—already sporulating—was here on our shores.

Having studied the taxonomy and biogeography of west coast seaweeds for nearly 40 years, Hansen clearly knows her stuff. Her talk for us will cover the 80+ seaweeds she has found on the debris from Japan and the features that enabled them to survive the long journey across the Pacific—and, theoretically, also to colonize our shores. Not surprisingly, more than 60% of the species had been reported to occur here before the tsunami. However, comparative sequencing of these species has revealed a slightly different story. Please come to room 100 Willamette Hall on the UO campus at 7:30pm on 16 February to hear Dr. Gayle Hansen's talk, Seaweeds on Japanese Tsunami Marine Debris: Were They an Invasion Risk? There will be cookies, as usual.

John Carter

Some Marine Algae on Japanese Tsunami Marine Debris



(a) *Undaria pinnatifida*, (b) *Feldmannia mitchelliae*, (c) *Ectocarpus siliculosus* var. *parvus*, (d) *Petalonia fascia*, (e) *Desmarestia viridis*, (f) *Polysiphonia morrowii*, (g) *Antithamnion nipponicum*, (h) *Codium fragile* subsp. *fragile*

Acid Test by Reida Kimmel

Our Northwest American coast is peculiarly rich in its abundant and diverse marine life. Native Americans harvested a tiny portion of this wealth of food and marine products for centuries. Today, in Washington alone, we draw amounts from the sea worth upwards of $270,000,000 in economic activity annually. Few waters on the planet are so rich. The cause is the nature of the ocean currents and nutrient-rich upwelling along our coast. Seawater near Japan sinks into deep dark depths and travels to North America. Along the way bacteria feed on dead and decaying debris that sinks from the upper water levels. This feeding and digesting causes the water to become acidic. When the current's water reaches us, it wells up seasonally, providing an incredibly rich feast.

Sea creatures evolved to be able to cope with this degree of ocean acidification, but in a little less than two hundred years the ocean's chemical composition has been changing, and that change is accelerating alarmingly. Since the Industrial Revolution, there has been a thirty percent increase in acidity of surface waters. By 2100 that increase is expected to double. For close to two centuries, our new furnaces, factories and cement plants pumped out CO2. The world's oceans absorbed much of this, increasing their acidity in the process. Wetlands, eelgrass, and seaside forests helped to buffer the acidic onslaught, but the destruction of wetland ecosystems, of the forests and the soils that separated the land from the sea, put an end to this protection. The change in the oceans' pH will not go away even if we shut down all our power plants today and never drive another mile. The current rate of acidification is ten to one hundred times faster than it has been in the last fifty million years, a time that, we may add, saw the Paleocene-Eocene mass extinction. It will be hundreds, more

likely thousands of years before our type of 'normal' pH is restored to the earth's waters.

We do not expect, at least not in our lifetimes, surface waters to become so acidic that they are deadly, but the change in ocean chemistry will affect cold water areas with upwelling currents worldwide: waters near the poles, along continental shelves, and coastal regions receiving lots of fresh water, the very waters that humans, seabirds, and all marine creatures find so rich. Additionally, waters surrounding heavily urbanized or industrialized areas, like Puget Sound, are especially vulnerable due to surges of land-based CO2 pollution.

What exactly do we mean by changes in seawater brought on by 'acidity'? Simply put, there is an increase in dissolved carbon dioxide, hydrogen ions, and bicarbonate ions, and a decrease in carbonate ions in seawater. That decrease in carbonate ions is critically dangerous for marine organisms. Low carbonate levels are destructive to shelled marine organisms like oysters, clams, crabs, sea urchins, reef-forming corals and many other families that are calcifiers—animals that use aragonite, a form of calcium carbonate, to form their shells and hard body parts. The damage starts with the first day of life for oysters. The larvae struggle to get enough carbonate out of the acidified seawater. In just a couple of days they wear out from the effort and die of starvation. Pteropods, tiny marine snails, cannot build their lovely ribs-within-ribs body structures, collapse, die and sink. We know less about the effects of acidification on vertebrates, but Australian researchers have observed juvenile fish and noted that a neuroreceptor sensitive to carbon dioxide levels and found in all vertebrates, functions poorly in acidified water. The fish are less able to smell food and so eat less. They can lose their homing behavior in coral reef habitats.

Not all species will be so affected that they fail to grow or reproduce and perhaps become extinct. Some groups like jellies and squid seem to be thriving in our new environment. Large and robust populations of some species may be able to adapt to changed conditions and thrive again after initial setbacks. Species already in decline are far more likely to disappear. Looking ahead over several centuries, our descendants may live in a world with fewer species composed of fewer individuals. The evolution of entirely new species tolerant of acidic waters will take much longer, but it will happen.

Is this a time to despair, to let the worst happen because there isn't anything else to do? The State of Washington does not think so, nor do many of the world's nations and non-governmental organizations. Nations, but not the United States, participate in conferences, publish work sheets, and host many websites chronicling accumulating scientific findings dealing with the daunting problems that this new research field presents. The International Ocean Carbon and Biogeochemistry Project's "20 Facts about Ocean Acidification" is a little gem of information.

The Washington Ocean Acidification Center, headed by University of Washington faculty members Terrie Klinger and Jan Newton, studies acidification in Puget Sound. During WOAC's three-times-a-year cruises, researchers collect data about acidification and water quality, drag plankton nets, and try to sample every possible living organism in the water column. Of course, water temperature and oxygen levels also have roles to play in producing or mitigating the effects of acid waters. In the lab, WOAC researchers are doing experiments to study the effects of acidification on Washington species like salmon, black cod, copepods, and oysters.

Commercial shellfish farmers, informed concerning the cause of the problems their larvae face, now feed special diets that make carbonate available. Luckily for shellfish species like oysters, geoducks and mussels in the Sound, once the larvae grow older and are well started on building their calcified shells, survival is the likely outcome. This, however, may not always be the case. Increased acidification may adversely affect the later life stages as well. Perhaps there are already hidden deleterious effects. Growers are experimenting with breeding strains that are more tolerant of acidic waters.

WOAC and the Washington Marine Resources Advisory Council have come up with a long list of planned strategies to combat accelerated acidification. Reducing carbon emissions is first on the list. Second, surprisingly, is exploring the use of sea grasses to remove carbon dioxide from the water. As always, preventing the pollution from land-based activities from getting into the sea is vital. Monitoring the water quality of the Sound should produce findings that will help structure coastal ecosystem management plans and make water-quality criteria sufficiently stringent to protect Puget Sound's marine life. I wonder what Oregon is doing to match this undertaking. Perhaps we can all unite to stave off disaster for a few generations.


Mt. Rainier. Photo by D. Walton

Traveling by Dean Walton

For me, traveling and natural history go hand in hand. I cannot go anywhere without noticing and wondering what is different about where I am from where I had been. This last summer took me the northwest coast of Washington, then inland to the base of Mount Rainier, and natural history was always on my mind.

Olympic National Park

The dominant features of the Olympic Peninsula are Mount Olympus, which stands 7,980 feet, and the Olympic range, which drives the weather patterns in the area. Now, in my ignorance, I always thought that Mt. Olympus, like Rainier, was of volcanic origin. I mean all of those big peaks are volcanoes aren't they? So, Mt. Olympus must be one too. Wrong. Without traveling to the Olympic Peninsula I might not have ever learned that this mountain is one big pushed-up accretion wedge of ocean floor. It's like the wrinkle in a carpet when your feet shift the rug forward, all 8000 feet of it. This mountain and the prevailing coastal winds create the rainiest place in the continental United States, with the water draining off the western slope into the Hoh River and through what is known as the Hoh River temperate rain forest. This area receives an average of 137 inches of rain a year. That's 11 feet of rain! While just to the northwest, the town of Sequim receives almost 90% less because of the rain-shadow effect of the mountains. Such extremes can create profound differences in plant communities. Like rainfall, with the change of elevation I observed dramatic differences in species composition. Nearing the alpine areas, as the trees fall away the sun supports a series of high-elevation specialists. In all, there are at least eight herbaceous species endemic to the Peninsula area with some occurring in the rain forest and others in the alpine areas of these high peaks like Olympic rockmat (*Petrophytum hendersonii*)—and six more, including Piper's bellflower (*Campanula piperi*), if one expands the boundary to include just a few more mountains to the south and north.

Not unexpectedly, on our visit to the Hoh temperate rain forest in early August a light rain kept the area moist. Like many nearby areas, the trees here are big and dominated by Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), and western hemlock (*Tsuga heterophylla*). Interestingly, noble fir (*Abies procera*), which makes frequent appearances elsewhere in Washington, is absent from the area. It is important to remember, however, that few species of trees, if any, were here 7,000 years ago as the area poked its head out from a long glacial slumber. The first forests to grow back appeared to be lodgepole pines (*Pinus contorta*), with an understory of bracken fern (*Pteridium aquilinum*), indicative of an active fire season. Soon, though, the rain forest set in.

It is a wonderful experience to walk through the damp forests of the Hoh with its Isothecium moss draping across every branch. On this trip we walked past a small herd of elk, ignoring us as they have become so used to humans. I was thankful not to be accosted by these massive cervids looking for handouts. I have been stopped on the trails and been practically mugged by deer in parks in the eastern United States.

Mount Rainier National Park

Upon leaving the Olympic Peninsula, we began traveling southeast to the actual big volcano. Rainier stands out as another notable peak in Western Washington. Here, forests cover almost 60% of its flanks within the park—and, like the Olympics, Douglas-fir, western hemlock, and western red cedar (*Thuja plicata*) dominate the forest. As one moves up the slope the composition changes to one with more Pacific silver fir (*Abies amabilis*), Alaska yellow cedar (*Cupressus nootkatensis*), western white pine (*Pinus monticola*), and now noble fir growing in places above 4,600 feet. At this elevation, Alaska yellow cedar continues to grow and is joined by subalpine fir (*Abies lasiocarpa*), and mountain hemlock (*Tsuga mertensiana*). Whitebark pine (*Pinus albicaulis*) and Engelmann spruce (*Picea*

engelmannii) make an appearance on the drier east side reaching up to the end of the tree line.

In stark contrast to Mt. Olympus, Rainier is that "classic" solo volcanic peak and is the tallest of the Cascades at 14,140 feet. The subduction zone that drives the volcanoes in the PNW has been fueling Rainier's fire for 36 million years, but the volcano's most recent form dates back only a mere 500,000 years. Analysis of the layered output of the volcano since the last major glaciation of the volcano 11,000 years ago reveals about 30 eruptions with 10 or so occurring in the last 2,500 years. However, the last noted big eruption was only 1,100 years ago. So, it seems, when things get active, they stay active for some time. There have been two minor eruptions since the 1820s.

On its south flank is the drainage of the Paradise River, a tributary to the bigger Nisqually. In the August heat you can walk up the wide gravel channel of the Paradise and note how big the river could and would be during the spring thaw; but now it seems somewhat quiet, although warning signs mention paying attention to rumbling ground and quickly rising water indicative of ice dam bursts that could at any moment bring the river to capacity. In this quiet stage, the river was not as clear as I would have expected of one fed by melting ice. Instead, it was quite milky because of the thousands upon thousands of basalt cobbles grinding upon each other, wearing themselves down into much smaller cobbles. Climbing out of the channel and moving up to the open meadows nearing the tree line one could still find a multitude of flowers blooming as though it was spring at a much lower elevation. Most striking of all of these were the Western anemones (*Anemone occidentalis*) known as hippy head for its long, hair-covered seeds peeking out from brilliant red Indian paintbrush (*Castilleja* sp) or purple fleabane (*Erigeron* sp.).

In my view, every travel allows a person to explore a bit of natural history. Whether I am in a city looking at what is growing between the cracks of a sidewalk or in the lush rain forest of Western Washington, the stories to be discovered of climate change and biogeography are but a road trip away.

Events of Interest in the Community

Oregon Humanities Center

Tuesday, 13 March, 7:30pm. "We the People": Expanding the Circle of Citizenship, by Robin Wall Kimmerer. Of European and Anishinaabe ancestry, and an enrolled member of the Citizen Potawatomi Nation, Robin Wall Kimmerer will explore facets of how respectful engagement with indigenous knowledge might re-draw the boundaries of "We, the People" as we consider our relationship to ancestral 'public' lands. 182 Lillis Hall, UO Campus.

Lane County Audubon Society

Tuesday, 27 February, 7:30pm. Wildlife That Isn't Birds with Dave Stone. Enough with the birds, already (for now, that is). In my travels over the years, I've noticed other wildlife worth photographing. As Yogi Berra says, "You can observe a lot just by watching." Everything from bugs to frogs to fish to bears and critters in between, I've photographed. This obsession keeps me out of (or into, as you will see) trouble. Most summers I spend in the great outdoors, occasionally coming into town to get supplies. As Yakov Smirnoff says, "What a country!" Join me and see what you can observe, just by watching my show. Eugene Garden Club 1645 High St., Eugene.

Saturday, 17 February. Third Saturday Bird Walk. Go to http://www.laneaudubon.org/ for location and times.

Mt. Pisgah Arboretum

Saturday, 10 February, 10am-12pm. Lichens Walk. Join Daphne Stone on this popular walk through the Arboretum exploring lichens, their habitats, and ecology. Learn a few names and enjoy the moist winter air that makes the Pacific Northwest such a great place for lichens to grow. Rain or shine. Meet at the Arboretum Visitor Center. Don't forget your parking pass. $5, members free.

Saturday, 17 February, 10am-12pm. Winter Twigs Walk. Ever wonder what plants you're looking at in winter? Join Gail Baker as we examine and learn to identify the many trees and shrubs in the Arboretum in their winter stages, and notice which ones are already breaking bud or even in flower. The two-hour walk along the river and into the woods will provide a diversity of examples of beautiful branches and bud patterns for us to enjoy. If possible bring a hand lens and *Winter Twigs* by H. Gilkey and P. Packard, although copies will be on hand to refer to. Our trip leader will also provide identification handouts. Rain or shine. Meet at the Arboretum Visitor Center. $5, members free. Co-presented by the Native Plant Society of Oregon.

Sunday, 18 February, 8-11am. Bird Walk. Join Julia Siporin and Joni Dawning for another monthly bird walk intended for people with all levels of birding experience. We'll use vocalizations, habitat, and behavior clues for identification of our winter and year-round residents. Come discover the Arboretum's avian diversity. Please bring binoculars. Option to continue the walk until noon for those who are interested. Rain or shine. Meet at the Arboretum Visitor Center. $5, members free.

Friends of Buford Park and Mt. Pisgah

Monday Morning Regulars. 9am-noon. Contact volunteer@bufordpark.org for more information.
Tuesdays and Thursdays, 9am-noon. Nursery Work. Meet and work at the Native Plant Nursery at Buford Park. Enter Buford Park from Seavey Loop Road. Turn LEFT after crossing the bridge and drive 1/4 mile to the nursery.

WREN (Willamette Resources and Educational Network)
Go to **http://wewwild.blogspot.com/ f**or information on WREN upcoming events.

The University of Oregon's Museum of Natural and Cultural History
Wolves and Wild Lands in the 21st Century. How can wolves and people coexist in our modern world? From Alaska to Oregon to North Carolina, explore the epic story of North America's wolves—and the vital role humans play in shaping their future. On exhibit through 11 February 2018**.** Exhibit Hours: Tuesday through Sunday, 11am-5pm.

Native Plant Society of Oregon, Emerald Chapter
For the next NPS activity, see **http://www.npsoregon.org/calendar.html - EM**

Nearby Nature
Saturday, 17 February, 1-3pm. Rodent Roadshow Nature Quest. High in the trees, deep in the ground, under the water — rodents are everywhere! Learn all about these fascinating critters on a family-paced walk in the woods and by checking out naturalist Dave Walp's cool pelt collection. Meet outside the Nearby Nature Yurt in Alton Baker Park. Free for members, $5/family for non-members. Pre-register: 541-687-9699 or visit nearbynature.org/events.
Monday, 19 February, 8:30am-3pm. Wild Wings! No School Day Adventure. Discover who's zipping, zooming, and looming, in Alton Baker Park. Play Fill the Bill, check out our nest collection and hike to a heron rookery. Make your own bird wings and a tasty birdseed treat. $45 members/$50 non-members. Scholarships available. Ages 6-9, max 12 kids. Outdoors in Alton Baker Park and at our yurt. To register, call 541-687-9699 or visit nearbynature.org/events.

North American Butterfly Association, Oregon (Eugene/Springfield) Chapter
Monday, 12 February, 7pm social, 7:30pm presentation. Ecology of the Butterflies of the Marble Mountain Wilderness. The Marble Mountain Wilderness is a remarkably diverse part of the temperate zone of the Northern Hemisphere. Dr. Rob Fernau will introduce its environmental interactions—between land-forms, geology, hydrology, climatology, plant communities and associated butterfly communities. He'll conclude with an analysis of how butterflies are responding to climatic changes based on his > 30 years of research in the Marble Mountains. Fernau is a Research Associate in the Department of Plant Sciences at the University of California, Davis. Eugene Garden Club, 1645 High St. Free and open to all.

ENHS welcomes new members! To join, fill out the form below. Membership payments allow us to give modest honoraria to our speakers, as well as to pay for the publication and mailing of *Nature Trails*. Our web address: http://biology.uoregon.edu/enhs

MEMBERSHIP FORM

Name_____
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City_____State & Zip_____ Phone_____
E-mail (if you want to receive announcements)_____
I (we) prefer electronic copies of NT rather than paper copies. ___Yes ___No
If yes, email address (if different from the one above):_____

ANNUAL DUES: Family $25.00
Individual 15.00
Life Membership 300.00
Contribution _____

Annual dues for renewing members are payable in September. Memberships run from September to September. Generosity is encouraged and appreciated.

Make checks payable to:
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P.O. Box 5494, Eugene OR 97405

YOU CAN HELP US.
ENHS has to find dry storage for our booth and its contents, which are in well-organized containers and occupy a space the size of the bed of a small pickup (87"x60"x20"). The booth is used two days a year, once in May and once in October. If you have a dry space and are willing, please contact Dean Walton.

Eugene Natural History Society members have voiced their opinions on the Declaration on Human Rights and Climate Change. Each comment was in favor of endorsement. The Board has examined the Declaration carefully. Finding it consistent with our mission, the ENHS endorses the Declaration on Human Rights and Climate Change.

A good place to park for our meetings is the Physical Plant lot: turn north from Franklin onto Onyx, go about a block and you will be in the lot. After 6pm it's open to the public.

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Schedule of Speakers and Topics for 2017-2018

16 Feb.	Gayle Hansen	Seaweeds on Japanese Tsunami Debris: Have They Invaded Our Shores?
16 March	Leigh Torres	Insights into Whale Ecology
20 April	Fred Swanson	Humanities, Arts, Science Collide at Andrews Forest, Mount St. Helens, and Beyond
18 May	Ron Larson	The Natural History of Lake Abert, Oregon's Salt Lake

A Japanese village before and after the 2011 earthquake and tsunami