GLOBAL LEADERSHIP DIALOGUES
Insights and Inspirations from Change Leaders

Sea Change Scholar

SUSAN AVERY

In 2008, Susan Avery became the first atmospheric scientist and the first woman to hold the position of president and director of the Woods Hole Oceanographic Institution (WHOI). The world-renowned oceanographic research institution has aided in the exploration and discovery of many facets of the ocean, from hydrothermal vents to the wreckage of the Titanic. *As president and director, Avery has promoted the institution as a global authority on the impact of climate change on the atmosphere and the ocean.*

Avery is active in a number of scientific institutions, serving as a member of the Director-General's Science Advisory Committee for the United Nations Educational, Scientific and Cultural Organization (UNESCO); on the advisory committee for Environmental Research and Education for the National Science Foundation; and as a chair on the Science Advisory Board for the National Oceanic and Atmospheric Administration (NOAA). In addition, in 2013, she was appointed to the UN Scientific Advisory Board, which provides advice to the UN Secretary-General on science, technology, and innovation for sustainable development.

Avery received a master's degree in physics and a PhD in atmospheric science at the University of Illinois, where she served as assistant professor from 1978 to 1982. She then joined the Cooperative Institute for Research in Environmental Sciences at the University of Colorado Boulder, working in roles including director, interim provost and executive vice chancellor for academic affairs, interim vice chancellor for research and dean of the graduate school, and her current post as a professor emeritus.

In November 2014, Avery was a guest speaker for the interdisciplinary Coasts and Communities graduate program at the University of Massachusetts Boston. She sat down with Maria Ivanova, associate professor of global governance and co-director for the Center for Governance and Sustainability, for an interview for the Global Leadership Dialogues.

Volume 2, Issue 2

CENTER FOR GOVERNANCE AND SUSTAINABILITY
JOHN W. McCORMACK GRADUATE SCHOOL OF POLICY AND GLOBAL STUDIES
UNIVERSITY OF MASSACHUSETTS BOSTON
www.umb.edu/cgs

UMASS BOSTON

You are an accomplished scientist who has also contributed to and engaged in policymaking at the local and global levels. What do you consider to be major milestones in your career?

I have indeed had a great career as a scientist, particularly studying the environment, in this case the atmosphere as well as the ocean. It has been a truly exciting opportunity. I think getting my PhD would be my first milestone. That was probably the milestone that set me onto this career path, since qualifying as a PhD candidate requires a lot of preliminary education and experience.

I think another milestone was when I started doing interdisciplinary work at the University of Colorado in an institute called the Cooperative Institute for Research and Environmental Sciences. It was a joint collaboration between the University of Colorado Boulder and NOAA, the National Oceanic and Atmospheric Administration. That was an opportunity to really see science from a more interdisciplinary point of view and also science that is fundamental research, while having mission-oriented research in working with NOAA.

Then I would say the next milestone was taking on leadership positions in areas such as science management and scientific programmatic development. With the Cooperative Institute, I aided in pulling people together, developing new ideas and new programs. I also worked as a vice-chancellor for research at the University of Colorado at Boulder and now as president and director at the Woods Hole Oceanographic Institution. It has been a great career working with students, working with post-docs and faculty, working with the broader scientific community, and eventually being really cognizant of the interface between science and decision making more broadly.

We now hear more often about the science-policy interface. The Center for Governance and Sustainability at UMass Boston is working on developing a research initiative around the science-policy-society interface. What do you mean when you say the science–decision-making interface?

The science-policy interface is often mistaken for the science-*politics* interface. Sometimes people don't just talk about the science-policy interface, but the science–decision-making interface. Policy can be defined pretty narrowly as something like legislative or regulatory frameworks for action to occur. But there are tremendous benefits to introducing science to a broad range of decision makers—coastal communities, water managers, the energy industry. Scientific evidence and information is helpful for decision making in a variety of contexts.

In 2012, Susan Avery delivered the Graduate Commencement Address at the University of Massachusetts Dartmouth.

Scientific evidence and information is helpful for decision making in a variety of contexts.

So how does the Woods Hole Oceanographic Institution fit within this nexus?

The Woods Hole Oceanographic Institution is primarily a fundamental research organization. But we also have roots in applying that knowledge to various cases, and we have a long history of responding in times of crisis. Our scientists have been involved with Deepwater Horizon,[1] and we were quite active in looking at the results of the Fukushima meltdown in Japan. We have had scientists pair

[1]Editor's note: On April 20, 2010, approximately 42 miles off the coast of Louisiana, the BP-operated Deepwater Horizon oil rig suffered an explosion and eventually sank. The pipe associated with the oil rig leaked for 87 days, releasing close to 3.2 million barrels of oil into the Gulf of Mexico. New studies indicate that more than 1,200 square miles of the ocean floor remain littered with oil droplets. http://ocean.si.edu/gulf-oil-spill; http://www.usnews.com/news/articles/2014/10/27/oil-fallout-from-bp-deepwater-horizon-spill-coats-miles-of-gulf-floor-study-says

up with governments, as well as environmental nonprofits that appreciate the scientific knowledge that is needed to manage a protected area, looking at coral reef resilience, for example, and helping to make decisions about which part of coral reef systems to prioritize and which parts may not be able to survive no matter what you do.

Then we have a lot of our scientists who have worked on the Intergovernmental Panel on Climate Change reports—the IPCC reports. We also had some of our scientists work on the National Climate Assessment here in the United States, and our scientists have provided testimony in congressional debates. We are also working at a more local level. Our scientists are working with stakeholders on Cape Cod, for example, looking at how to restore the Waquoit Bay.

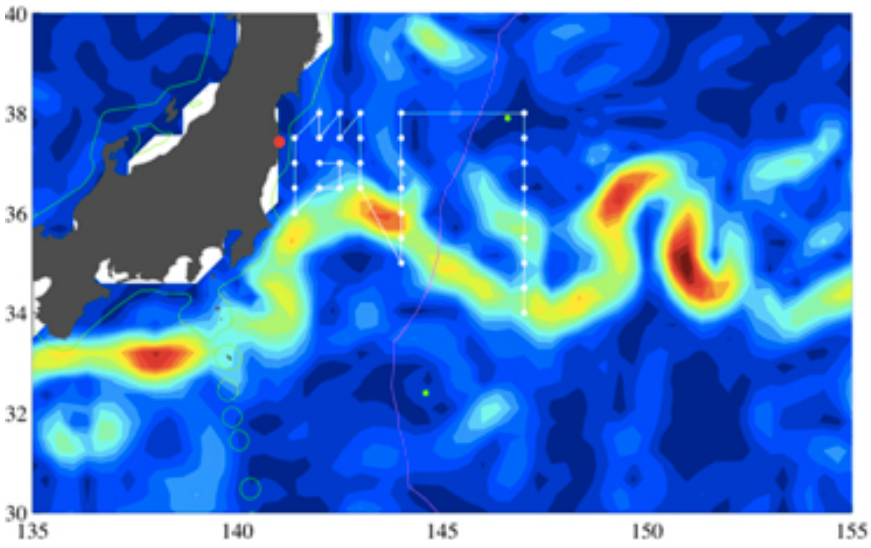
So the institution is evolving so that it is not just pure fundamental research any more. We are working on how that research gets out into decision-making communities and context. We are also enhancing our public outreach, both in our exhibits and through special events where we address current hot topics. We had one on ocean acidification, for instance. At that particular event we had a tent with hands-on experiments, so we had kids coming through. It was fantastic to showcase all of the research discoveries that the research vessel, the *Knorr,* participated in. So these have been well received and very well attended.

The United Nations Scientific Advisory Board on which we both serve is a unique policy platform that gathers 26 scientists from around the world. It is an example of one kind of a science-policy interface. What do you think we can do to make it effective?

The Woods Hole Oceanographic Institution is primarily a fundamental research organization, but we also have roots in applying that knowledge to various cases and we have a long history of responding in times of crisis.

Photo: Georgia Department of Natural Resources

Scientist Mark Dodd, pictured here, from the Georgia Department of Natural Resources, analyzed the impacts on different aquatic species after the Deepwater Horizon oil spill.



Scientists at WHOI recorded radiation levels within the Pacific Ocean in 2011, after the Fukushima nuclear power plant meltdown, to better understand the local and global impacts of this disaster.

The Knorr *research vessel was retired in 2014 after clocking over 1.3 million miles on more than 300 scientific voyages during its 44-year career with WHOI.*

We have to get organized. So that we have a better way of creating that learning environment that we were just talking about while also being able to pick a problem and work through it. I think we can provide advice on the scientific feasibility of some of the new Sustainable Development Goals and explain what the metrics are. I think that in a way we are science ambassadors, and we should really be engaging in science diplomacy because science is a great avenue for diplomacy, because all of us in science really want to reach out to others in the world to do that science. And in doing so and having that interaction with other countries, it really not only enhances the science, but it allows us to get to know each other as human beings and better understand what the problems are in different countries and how they are being approached differently, and what kind of advice or what kind of science would be helpful to policymakers and to communities. So it is a heavy responsibility. The other thing we could do is to find enough time to put into this effort because it is truly a rare opportunity.

You mentioned that the leadership positions you held have been important milestones. Climate change now is the existential challenge of our time. What kind of leadership do you think is necessary to tackle this challenge?

I do think that we are at a critical stage. For me, personally, two things occurred this year that really made me realize that the time is now, and there is more and more urgency about dealing with climate change. One was when the atmospheric concentration hit 400 parts per million, and the second was the evidence that we are seeing now about the heat content going into the deeper parts of the ocean. The ocean is the flywheel of the climate system, and once you begin to change that, you change the entire system. So, I think the type of leadership you need in order to deal with climate change is twofold.

First, we need scientific leadership that is going to continue to explore the interdisciplinary boundaries. For the planet, climate is not just an atmospheric phenomenon. Lots of people think that way, but climate is putting all of the pieces together: the climate-ocean interface, the climate-ocean-land interface, and the climate-ocean-ice-land-

A researcher from WHOI explores the coral reefs around Phoenix Island. This marine preserve has remained relatively untouched by humans and serves as a case study for climate change scientists.

atmosphere interface. It is a planetary system of complex parts, and there is still a lot that we need to delve into in order to enhance and continue to improve the science that will help with climate adaptation.

Second, we need climate adaptation leadership, and it really has to come from the community. Indeed, states are talking about climate adaptation. Universities are talking about sustainability and climate adaptation. I see much more active leadership on the policy side in communities, states, and regions than I do in the federal government right now in the United States. I also see a lot of other countries taking leadership and really beginning to tackle some of these bigger policy questions. And climate change is a really, really tough problem. It is going to manifest itself in different ways, but it is a global issue that requires all of us to work together.

Indeed, there is no silver bullet, and there is no one person who is going to get us there. Leadership is necessary at various levels, but at the international level where do we look for it?

Well, as a governance issue, we can look to the United Nations. The Secretary-General's Scientific Advisory Board is indeed a wonderful opportunity to link the science to adaptation and decision-making strategies. With climate change, we are certainly looking at one of those areas where science is going to inform policy.

There is no silver bullet, as you said. There is not one policy for dealing with many of the grand challenges that we have today. There have to be multiple approaches. I look to several governments and regions that are truly taking leadership roles. Europe certainly has been stepping up, and Asia has been making a huge effort. What China is doing these days is amazing. Those who are taking the lead, they have their problems, but they are tackling those problems. This is very different from ignoring the problem, which so many places seem to do. I think, though, that some of the momentum comes from the local level.

Even though climate change is a global problem and international-scale leadership is needed, the solutions can and should involve those working at the local level. We're seeing communities restore coastal estuaries. We're seeing a massive effort to restore the Gulf of Mexico. We see the state of Washington's governor putting resources into dealing with ocean acidification and nonpoint source pollution. There are things that we can do in smaller communities that will reduce the stress on our planetary systems even though we may not be able to deal with the whole global problem all at once. If I take a step back and look at policies and leadership, I'd really want to focus on the water-food-energy nexus. That is what will drive the future.

Even though climate change is a global problem and international-scale leadership is needed, the solutions can and should involve those working at the local level.

I should add that science does not necessarily dictate clear paths. And, in fact, in developing policy, science is only one of the inputs. You cannot just look at the science. You have to look to what communities are saying, how we conduct business, and the way we build our cities. There are issues of economics and poverty and justice as well. At the same time, I would much prefer to at least have the scientific evidence laid out there.

Another thing to consider when developing policy is that science is constantly evolving. So there needs to be a constant dialogue back and forth between science and policy as new science emerges. One example that comes to mind is in the United States in the West, the Colorado River Law. It was basically created to allocate the water in the Colorado River and was based on 30 years of stream flow data. As it happened, those 30 years of stream flow data occurred at a time when the water flow in the Colorado River was at one of its highest points. As time went on and there was a longer record of what was happening, it became apparent that there are peaks and valleys in the volume and flow of the river, but the policy never adapted. The folks in that region have just worked around it. Out of necessity, communities are working together on water allocation. So science and policy is a wonderful interface to really connect science to people.

You mentioned that the ocean is the flywheel in the climate system. Can you explain and expand on that concept?

Photo: Ken Kostel

Famous director and producer James Cameron explored the depths of the Mariana Trench using the single-person submersible vehicle known as the DEEPSEA CHALLENGER *that he designed. In 2013, he gave this vehicle to WHOI to utilize in future deep-sea explorations and research initiatives.*

You cannot just look at the science. You have to look to what communities are saying, how we conduct business, and the way we build our cities.

Sure. When you look at the planet, what sets the stage for the climate change issue is the sun and the planet. The sun heats the planet and heats the equator more than the poles. That drives the rotation of the planet. It drives winds that help redistribute that heat, because there is a natural tendency to redistribute that heat, as well as the ocean currents. So the atmosphere and ocean work together with this heat. It's like a dance, the dance of the blue planet—the atmosphere and the ocean.

And the thing about this heat issue is that humans are now pumping more carbon dioxide up into the atmosphere. Part of that excess carbon dioxide will stay in the atmosphere, part of it will be absorbed by the land—the plants on land—and part will be absorbed by the ocean. But that carbon dioxide generates additional heat. So that obviously heats the surface of the planet, including the surface of the ocean. Most of that additional heat associated with the additional carbon dioxide in the atmosphere is not held in the atmosphere or the land or the ice: 90 percent of that heat is in the ocean because the ocean just has a much bigger capacity to store heat. So, in a sense, the ocean has been buffering this planet against all of the excess carbon dioxide that we have been putting into the atmosphere. It is absorbing almost all of that heat, and now it isn't just absorbing it at the surface level. It is beginning to penetrate deeper into the ocean, and this will have important consequences. All of this extra heat being stored in the ocean is stored there for a long period of time, but it is also changing just like the atmosphere is. Once that heat gets in there, the ocean doesn't readily give it up. So that is what I mean by the flywheel. It is constantly regulating. The ocean constantly regulates our climate and precipitation patterns around the world.

If we zoom in and come close to home here in the Commonwealth of Massachusetts, the economy of this state has been dependent on the ocean for a long time. That has changed, but can you talk a bit about the role of the ocean for Massachusetts as a state, and as one of the progressive states in this country?

I think there is a wonderful research and development environment here in the Commonwealth. A lot of the economy in Massachusetts has been in the burgeoning investment and output that has come out of life sciences as well as biomedical sciences: pharmaceuticals, biotech, and more. I would also include IT, informatics, and cloud computing—big data. Of course, the West Coast is important in that area, too. It is amazing to think about how Massachusetts began as a maritime economy based on shipbuilding, fishing, and shipping of goods. It was a huge maritime econo-

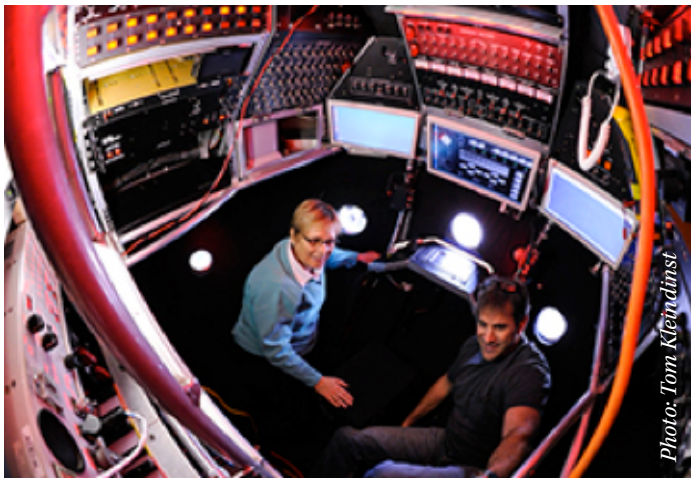
my, and there is now potential for an expansion of a lot of that economy. The Woods Hole Oceanographic Institution has spun off 14 companies. Some are associated with just basic marine technology, and others are associated with things like the blood of the horseshoe crab and how it is now used as a biotoxin lab indicator in most hospitals and in medical labs around the world.

There are great opportunities for developing the information systems that are needed for coastal restoration. There is an exciting robotics opportunity here, not only just the platforms of robots, but the sensors. There is a huge opportunity to look at sensors that expand into freshwater toxicity indicators or aquaculture. There is the idea of restoring bays or eliminating pollution with ocean techniques, the famous oyster species.

So there are pharmaceutical, bioprocessing, and bioprospecting opportunities with the marine environment. And informatics systems are needed for marine protected areas. That is a great opportunity for a business that is weather and climate sensitive because the ocean and atmosphere basically determine our weather and climate.

The other big part of our economy here is academia. We have a concentration of academic institutions in the Greater Boston area that is perhaps the largest in the world. How do you see the role of academia in the environmental science–decision-making interface as we try to foster interdisciplinarity and are bringing up a new generation of scholars, and frankly, also decision makers?

I think academia is going into a new era. It has the value of interdisciplinary studies, particularly at the graduate level. We're seeing a lot more programs and faculty interested in those interfaces in many ways, and that's where the new ideas are being spun off. At the Woods Hole Oceanographic Institution, I am so pleased by the interdisciplinary connectivity that we have from our biologists, physicists, chemists, geologists, and those in policy. It's becoming much more natural. The questions that are out there to be solved require that approach. I think what academia can do best is create the learning environments. You still have to have experts in biology. You still have to have experts in policy. You have to have experts in business. You have to have experts in chemistry and physics. But putting that expertise in a learning environment, with seminars and problem-solving debates, is critical. There are new opportunities to exchange and to learn and to do research even though you may still be doing only the biology piece of your research. Creating a broader problem context and encouraging collaboration with others who have different disciplines is where academia could really help.



Susan Avery sits alongside Bruce Strickrott in the Alvin*, a human-occupied vessel (HOV), which now operates at the WHOI.*

A team of explorers from WHOI were among the first to discover the wreckage of the Titanic *in 1985.*

What would your advice be to young people today who want to launch a career path as rewarding and fascinating as yours?

Go where your passion is. See those opportunities beyond your immediate discipline. Stick with it even though it may be difficult and challenging. I think the reason why my career has been so successful is because I've been able to do what I love to do.

About the University

With a growing reputation for innovative research addressing complex urban issues, the University of Massachusetts Boston, metropolitan Boston's only public university, offers its diverse student population both an intimate learning environment and the rich experience of a great American city. UMass Boston's 11 colleges and graduate schools serve more than 16,000 students while engaging local, national, and international constituents through academic programs, research centers, and public service activities.

Part of the five-campus University of Massachusetts system, UMass Boston is located on a peninsula in Boston Harbor, near the John F. Kennedy Library and Museum and the Massachusetts State Archives and Museum. To learn more about UMass Boston, visit www.umb.edu.

About the John W. McCormack Graduate School of Policy and Global Studies

Named in honor of U.S. House of Representatives Speaker John W. McCormack, the McCormack Graduate School was founded in 2003 as an academic and research center in policy studies at the University of Massachusetts Boston. It is the go-to school for a world-class interdisciplinary education and values-driven research that seeks to explain and offer remedies for some of the most important social, political, economic, and environmental issues of our time. A dynamic institution with a teaching soul, the school trains the next generation of local and global leaders in conflict resolution, gerontology, global governance and human security, international relations, public affairs, and public policy.

UMASS BOSTON

UNIVERSITY OF MASSACHUSETTS BOSTON
50 Years

About This Series

Based on in-person interchanges, the stories told in the Global Leadership Dialogues Series offer insights into the professional work and personal experiences of notable professionals in the global governance field. The series provides in-depth perspectives on what these leaders think about key issues in global governance, what inspires them, and how they imagine the future.

Citation Information

Please use the following citation for this brief:
Global Leadership Dialogues, Volume 2, Issue 2: "Sea Change Scholar: Susan Avery." 2015. Center for Governance and Sustainability, University of Massachusetts Boston.

This publication is made possible by the support of the School for the Environment at the University of Massachusetts Boston.

Center for Governance and Sustainability

The Center for Governance and Sustainability seeks to bring academic rigor to real-world policy challenges in environment, development, and sustainability governance. It serves as information hub, analyst, and honest broker among scholars, students, and practitioners. Opinions expressed in the Global Leadership Dialogues Series are solely those of the interviewees and do not necessarily represent the views of the Center for Governance and Sustainability or the University of Massachusetts Boston.

All issues are available for download at **www.umb.edu/cgs/publications** and **www.environmentalgovernance.org/publications.**

Center for Governance and Sustainability
Maria Ivanova and Craig Murphy, Co-directors

John W. McCormack Graduate School of Policy
and Global Studies
University of Massachusetts Boston
100 Morrissey Boulevard
Boston, MA 02125
cgs@umb.edu
www.umb.edu/cgs
www.environmentalgovernance.org

Global Leadership Dialogues Series
Series Editor: Prof. Maria Ivanova
maria.ivanova@umb.edu

A copy of this publication is available in alternative format upon request. Please go to www.ada.umb.edu.

15.544SK