

“Fostering the Next Generation of Science – and Scientists – to Meet Societal Challenges”

10th Annual CREST Day

Keynote Speech

City College of New York

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As delivered

New York, NY

April 15, 2011

Thank you for inviting me to be here today at the 10th annual CREST Day. Thank you to Dr. Lisa Staiano-Coico, Dr. Gillian Small, Dr. Juan Carlos Mercado, and Dr. Reza Khanbilvardi for supporting and leading CREST and to Dr. Shakila Merchant and the NOAA-CREST family for putting together this event. And I would like to acknowledge the NOAA folks here with me today: Dr. Audrey Trotman, Director of NOAA’s Educational Partnership Program, and also to Mary Kicza, Assistant Administrator of NOAA’s Satellite and Information Service.

It is a real pleasure for me to have a chance to talk with so many faculty and current and future scientists. I’d like to mention that it is also National Environmental Education Week, so it’s particularly timely for me to be here today.

I will focus my remarks here today on a scientist’s career path by telling you one person’s story – of how scientists get to where they are.

Being a scientist brings me great joy. I delight in the process of scientific discovery. I was attracted to biology, specifically ecology, because I love the fun of solving mysteries and figuring out how the world works. Asking questions, posing hypotheses, and devising experiments to separate correlation from causation is just downright fun. ‘Why do plants and animals live where they do and not elsewhere?’ ‘Why are some places more diverse than others?’ These are not unlike the questions that you are asking today – How will a storm surge impact a Chesapeake Bay coastline versus a Florida coastline? Or how does dust travel from Asia to New York through the atmosphere?

For many years, I was fully immersed in teaching and satisfying my curiosity, using rocky seashores as a model to understand the basic workings of ecosystems. Along the way, the ocean ecosystems I was studying began to change dramatically. The once pristine, productive coastal ocean off Oregon and Washington is now a dead zone every summer, most likely as a result of climate change.

Rich Arctic ecosystems are changing rapidly and radically, presenting a serious threat to ice-dependent species. All of this disruption and depletion – from the tropics to the poles – is due to the unintended -- but nevertheless very real -- consequences of a variety of human activities.

Because I observed these changes in the ecosystems I was studying, I broadened my research efforts to include a strong focus on solutions -- how to reduce and adapt to the impacts of climate change; how to recover the lost bounty and health of oceans.

I also realized decisions made by citizens, businesses and governments are all-too-often not informed

by relevant scientific information. And so I began to work toward changing the culture of academia to encourage scientists to share their knowledge broadly and to give them the skills, awareness and opportunities to become effective communicators to the public in ways that are understandable and relevant to decision-making. I consider the sharing of knowledge with the public to be part of the 'social contract' that we scientists have with society.

My career has evolved through time from my earlier role as a scientist and teacher to being appointed as NOAA Administrator by President Obama, where now a significant part of my time is spent promoting, enabling and communicating science.

In fact, many times throughout the year, I've been asked to testify on Capitol Hill before members of Congress about the importance of NOAA's mission – how the services and science that we provide are so critical to our Nation's safety, resilience, and prosperity – in order to justify our budget requests. Of particular interest to many members of Congress are NOAA's satellite programs, specifically the next generation environmental satellites – also known as the Joint Polar Satellite System, or JPSS, and the GOES-R program.

Because our NOAA satellites represent a large percentage of our overall NOAA budget, I am often asked questions about why we need these assets. The most effective approach seems to be to connect satellites to the benefits people understand – to connect the dots for them, specifically to focus on impacts to the business, communities, and users of our satellite information. For example, NOAA's National Weather Service ran a numerical weather prediction model with all of the satellite data available today and compared the resulting forecasts to a model result without NOAA's polar-orbiting satellite data for the infamous snow storm of February 2010 – what the DC metro area referred to as "Snowmageddon." The result was astounding. Not only did the models erroneously predict the path of the winter storm– but they also under-predicted the snowfall by more than 10 inches! These types of errors in forecasts would have severely impacted airlines' attempts at rerouting flights away from the appropriate airports, and would have falsely conveyed the expected level of danger on our roads.

This is a clear example of how NOAA's satellite data helped thousands of people be more prepared for a severe winter storm.

I'd like to give you one more example of communicating science using another one of NOAA's future satellite programs – GOES-R. Which of the following three options do you think is most effective at communicating the value of this program to lawmakers? The ABI on GOES-R will have 16 channels and produce full disk images every 15 minutes. The imager on GOES-R will have 3 times the resolution of the current GOES satellites and produce images 5 times faster. Or GOES-R will provide improved information allowing forecasters to better predict hurricanes and tropical storms, resulting in more targeted evacuation and preparations for people residing in the path of the storm – valued at \$450 million in 2015 and \$2.4 billion from 2015 to 2027.¹ The third choice clearly better communicates the importance of NOAA's data to the U.S. economy and citizens.

There is clearly a place for detailed technical and scientific discussions, but only with the right audience. It's also important to be able to explain your science and findings in ways that are understandable to decision-makers, and to a general audience. This is what I refer to as teaching scientists to become "bilingual" in both the language of science and the language of lay-people.

¹ [Centrec Consulting Group, LLC., 2007: An Investigation of the Economic and Social Value of Selected NOAA Data and Products for Geostationary Operational Environmental Satellites \(GOES\). A report submitted to NOAA's National Climatic Data Center. Centrec Consulting Group, Savoy, IL.](#)

The remote sensing science that NOAA is doing with our partners including CREST, is invaluable to helping NOAA realize one of our overarching goals of developing a weather-ready Nation.

Another example of the great collaboration between NOAA and CREST is the work you do on:

- developing new algorithms for measuring ozone and the links between climate and air pollution
- enhancing detection of harmful algal blooms in the coastal zone,
- improving precipitation estimates, and
- developing data compression algorithms to deliver data in a cost effective manner - work that was issued a patent last month

These projects support NOAA's overarching goal of adapting and mitigating climate change.

As you all know, 2010 was tied with 2005 for the warmest year on record. More and more, Americans are witnessing the impacts of climate change in their own backyards, including longer growing seasons, increases in heavy downpours, drought, earlier snowmelt, changing patterns of precipitation, and many others.

As a result of these impacts, individuals across widely diverse sectors – from agriculture, to energy, to transportation – are increasingly asking NOAA for information about climate change in order to make the best choices for their communities and businesses.

Last year, NOAA announced the intent to form a Climate Service modeled in part after NOAA's National Weather Service, to provide a single, reliable, and authoritative source for climate data, information, and decision-support services and to more effectively work with our Federal and non-Federal partners.

NOAA continues to work with our partners and stakeholders – including CREST - to provide the critical information and services that support efforts to reduce the impacts of climate change to infrastructure, ecosystems, and human health and welfare.

While I've mentioned two of NOAA's overarching goals today – Developing a weather-ready Nation and Adapting and mitigating Climate Change, I'd like to briefly mention NOAA's other goals, all of which represent a more holistic approach to tackling the Nation's environmental challenges. They are encouraging healthy oceans and increasing resiliency in coastal communities and economies.

Earth observations and increased scientific understanding are fundamental to meeting all of these goals.

President Obama, in his recent State of the Union address remarked that to win the future, America must "out-educate, out-innovate and out-build the rest the world." Remote sensing– its development, science, and applications– is part of that future. These technologies provide the information and data that will increase our understanding and improve our ability to monitor and predict changes in our environment. Not only will these new innovations improve our understanding of the environment and better inform decision-makers but also will create new jobs to grow the economy. And this is where we look to you. You are the next generation of scientists, engineers, and creative thinkers who will make a difference in the stewardship of the planet.

At NOAA, we have a number of educational opportunities for students, including internships, scholarships, and NOAA's Educational Partnership Program, which makes CREST a reality.

Later in the today's program, you will hear about some of NOAA's other programs that support educational opportunities for young scientists, and I continue to look for new ways to strengthen them.

Whether your career path takes you into Government, industry or academia, the Nation and NOAA need you.

Thank you again for your time today. Congratulations on your accomplishments and here's to another great year of collaboration and achievement between NOAA and CREST.