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Sustainability in a Time of Climate Change: Keynote Address and Conference Charge

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CHAPTER 5

PLENARY TALKS

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Keynote Address and Conference Charge

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I want to thank everybody for being here today, and I really want to extend my gratitude to the University of Nebraska and the people of the state of Nebraska. I used to work for an oil company over in Rock Springs, Wyo., many, many years ago, before I got smart and went to college. Nebraska was always that thing in my rear view mirror when I was going from the East Coast to Wyoming, and I never really got to see the state. I probably fly a lot more than Prem, which is hard to believe. And from the air, you don't get an appreciation for the Nebraska landscape. I have to say in the trip that we took here last fall and then this trip, I've been just absolutely blown away by the landscape, the cultural and the natural diversity of this state.

Tom Armstrong

But along with that diversity comes the issue of sensitivity. In the world we live in today, I can tell you that the Nebraska landscape is a sensitive landscape. I'm not here to try to convince you today that climate change is real. That's for you to decide. But I will tell you my own opinion on this as a scientist and as a manager of the U.S. Climate Change Science Program, a 13-federal-agency consortium that spends about $2.2 billion a year on science and assessing the state of science regarding climate change. For many years this program has really dealt with the issue: Is climate change real or not?

We're beyond that now. Climate change is real. It's no longer a question of who's responsible or is it real. It's a question of what are we going to do about it. What can we do about climate change in order to mitigate the effects of climate change and atmospheric greenhouse gases? And what can we do to adapt to an evolving landscape and waterscape? Those are challenging questions.

A couple of facts that I can tell you are: number one, long-term investment in mitigation strategy is noble. It's something for our children and our children's children. But regardless again of who is to blame for the greenhouse gas concentrations we see in the atmosphere today, whether they are natural or human induced, to change the course of climate, which is like a freight train, will take 40, 50 or 100 years. That means if we were to take measures today to suck CO_2 out of the atmosphere, for example, it will be 40, 50 or even 100 years down the road before we see a positive result in temperature change due to that mitigation strategy.

Again regardless of whether or not you think mitigation is something we need to do – and there are debates about that and there are different opinions – we need to adapt to a changing landscape, and the landscape is already changing in places like Nebraska, Alaska, California, Georgia, the Everglades of Florida. Changes

have been detected and they are occurring.

So, I would ask you not to think about or argue whether climate change is real. Instead, think about what effects are we seeing on the landscape that may be related to climate change and what we are going to do about them.

That's my first story. I want to now tell a second story, and that's about what we've done at USGS and the Department of the Interior to handle specific examples of changing climate and its impact on trust resources. For those of you who don't know, I work directly for our director, Mark Myers. We are one Bureau. We are the Science Bureau of the Department of the Interior. There are seven land resource management Bureaus, including the Bureau of Reclamation. Curt Brown, who is here today, is one of our panelists and a member of the Bureau of Reclamation. We have trust resources on one out of every five acres of the United States. We have more landholdings than any other federal agency in this country. The federal land managers are responsible for these trust resources – the natural, physical and biological as well as hydrological resources.

Two years ago, the day after Christmas, my director called me. I was new on the job, working as a senior adviser, and he asked me what I knew about polar bears. I said, they're white and have big claws and people think they're cute. He said what about climate change and polar bears? I said, I really don't know a lot about it. He said, well, what we're finding right now is that the Fish and Wildlife Service is proposing to evaluate listing the polar bear as a threatened species. Is there a linkage between climate change and polar bear habitat or polar bear survival?

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As we went down this course with scientists from USGS, some of whom are here today, and with scientists from Fish and Wildlife Service, NOAA, National Science Foundation, Canada, across the international community, what we found was this: There was a linkage between future polar bear survival and sea ice because they live about 95 percent of their time on sea ice, hunting, foraging, breeding, denning, surviving. With climate change, the models being run out of NOAA, NCAR, NSF and others are showing that the forecast for sea ice in the future is bad and that there are going to be dramatic declines of sea ice in the Arctic Basin due to global warming.

To cut to the chase, we've developed a set of scientific reports that directly link climate change to sea ice decline, to polar bear habitat and, therefore, to polar bear survival for the future. I won't go into the details of the reports, but I'm sure you've seen some of this on the news lately, that the Fish and Wildlife Service and the Secretary of the Interior have listed the polar bear as a threatened species. Right now, polar bear populations are as high as they've ever been. It seems that everything is going great. It's not the projection of where they've been to where they are today. It's the forecast through the modeling and the science, integrating the modeling and the science of where they're going tomorrow that leads to the listing of the polar bear as a threatened species – the first terrestrial species whose survival has been linked to climate change and its effects.

The moral of the story I want to leave you with is that it took a team of people in academia, the federal sector, the state sector and the private sector, working across modeling communities and polar bear habitat communities, wildlife biologists and remote sensors with satellites. It took a very integrated and well-defined team that shared goals to finally come to a really good set of scientific conclusions that will stand the test of time and, in my opinion, stand the test of litigation. That's

why we're here today. It's to develop those kinds of collaborative efforts related to the effects of climate change on the landscape across the academic, federal and state and private communities.

The bottom line with this meeting is that we need your help because we're all in this together. What I'd like to do is just show you a few slides on what we've done at the Department of the Interior. I don't want to sell the Department of the Interior to you. That's not the point of my message. My message is really to talk to you about what we're doing at the Department of the Interior. And regardless of who is responsible for climate change, to talk to you a little bit about what we've done as we've observed these impacts related to climate change and what we're doing about it. I think the kind of model we've developed for the Department of the Interior in moving forward with a plan, a science plan and an action plan, is one that could be embraced by your community and our cooperative community together.

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To start with, a lot of people always ask the question, what is the federal niche in science related to climate change? I put the slide up here to just give you some of the bullets or the highlights of why we come to the table as a federal community. A lot of it has to do with the fact that we have significant scientific capabilities within the federal sector, not just at USGS or the Department of the Interior, but across the entire federal community. We have long-term monitoring records from ice cores in Greenland and Antarctica or alpine glaciers, all the way to remotely sensed information from satellites.

We have a multidisciplinary team. We are biologists, geologists, geographers, hydrologists and social scientists. In some cases, we are managers, we are policymakers, we are lawyers. We are a host of different disciplines all trying to work together for the same outcome. How do we deal with the effects of climate change, not just today but those future effects that we may be able to detect early on before they are catastrophic and we can't do anything significant to mitigate or adapt to them?

We have the capability to assess prehistoric, historic and current climate effects. One of the problems of climate change is that you can't just look at the last 10 years, 100 or even 1,000 years. You've got to go back. You've got to see the whole picture of cycles and patterns and anomalies in order to understand not only what the past was, but whether or not the past is the key to the future. Does the past give us insight into processes that may be occurring today that were analogous to something that occurred 10,000 or 10 million years ago but hasn't occurred since? By having that record of the past, we gain a better perspective of where we're going in the future or what's different about the future compared to the processes of the past. But you have to start with that paleo-record. And we have the capabilities to do so, not just in the academic sector, but in the federal and state sectors, as well.

And we have the ability to integrate these broad arrays and types of information for effective decision-making. I will be the first to tell you as a director of science advisers on global change that we are not doing science for science's sake. We are not. And you are not going to just do a peer-reviewed journal article or write a professional paper and throw it over to the people in this room whom we call stakeholders. We have got to be willing to go the distance to give them the "so what?" of the science and how that "so what?" impacts their issues. And in order to do that, we have to listen to everyone's issues and understand them. Conversely,

the onus of responsibility on the stakeholders is to understand our strengths and limitations and to be able to articulate your management and resource issues in a way that the scientists can actually understand, so they can provide you with the right kinds of products that will help enhance your decision-making.

One thing we do know, in my experience and our scientists' experience, is that decision-making goes on with or without the most up-to-date science. So, part of this presentation is also to talk about how we rapidly disseminate and provide you with that information so that it's timely and effective for your near-term decision-making.

The Secretary of the Interior put together a 100-person climate change task force in 2007. I was the chair of the science committee. There were also committees on legal and policy issues and land and water management issues. Across the 100-person task force, we came up with a multitude of resource, management, and legal and policy issues. They were boiled down into these major issues and challenges. Water availability, water quality, increased flood risk, species migration and habitat change, threatened and endangered species, even wildland fire and outbreaks of pest-invasive species and diseases – those transcend animals and people and also impact flora, including agriculture.

Tom Armstrong and conference attendees

These are issues I think resonate with you because I've heard about them over the last two days on our field trip. These major issues come up time and time again, whether it's within the Department of the Interior task force or the state of Nebraska Department of Natural Resources. We need to address the issues with the science and develop a coherent, integrated science plan that addresses them. Whatever the local issue may be, it falls under some of these categories.

I'm not going to go over the science issues in detail, like with the polar bear, which raised some very interesting issues about our laws and our policies. One of the major ones is the National Environmental Policy Act. The other is the Endangered Species Act. They were raised by the legal and policy committee of the DOI climate change task force. I won't go over these in detail, but again they resonate and have intersection with some of the critical species here in Nebraska, like the sandhill cranes or snow geese on the Platte River. But there are a multitude of species beyond those that are endangered or threatened, and we need to deal with them in a critical manner.

So, as I said before, it's not enough just to do science and to do science over five or 10 years and to write a thesis or a journal article and send a copy to Prem or to you. We need to understand that science needs to be provided in an effective medium and in a timely manner. This has really become a new paradigm for management decision-making, not just at USGS but also at the Department

of the Interior and the resource management bureaus. How do we take into consideration the dynamic nature of climate change and its impacts? We need data-appropriate scales, from local to regional. Decision-making is not only local. It can be regional. It can be national. But we need scalable information that is seamless in that scalability. We need data and resultant information in a timely manner, as I said before. It's not enough to say it will be here two years from now. I know and you know you're going to make decisions tomorrow with or without that most up-to-date science, with or without this potentially critical information for your decision-making.

One of the major things we realized in putting this task force together is we have resources already on the ground in terms of monitoring and science and adaptive management that we didn't need to build from scratch. And part of the reason we're here today is to recognize that we can't do it alone. We don't have the resources to put together even a DOI-wide climate change system on our own, let alone one for the nation. We need people like you, working with us hand-in-hand, who already have the long-term data records, the scientific studies, the observations and the issues, in order to make this work.

One of the major things we're doing now is looking across the country scientifically at a gap analysis – where are our strengths across academia, across state, local and federal levels? And where are the gaps? Where do we need to apply the resources that we get tomorrow for the problems of today?

As I said before, at DOI one of our major tenets is adaptive management – the recognition that we never necessarily get it right the first time. But whatever our decision-making is and the science that's put into that decision-making, we need to analyze the performance of those decisions and see whether or not we can tweak them or modify the management plan to make it better. And that, in essence, is adaptive management. A big part of what we're doing is trying to provide field management-level input capability. We want managers to be informed of the "so what?" of the science. Some managers may be very technically inclined, others will not be. But we've got to find a level of information that's effective for all field-level people.

We need a flexible and rapidly responsive information framework. It's not enough to say the science has been done. We need to make the investment in those information management systems, in whose development and utilization we all need to share. It's got to work for all of us.

One of the major things you'll hear about later today from my director of the Climate Effects Network, Pete Murdoch, is the development of a national monitoring network for climate effects. We are talking about putting together, in essence, a national climate early warning system – not to tell us about when the signal of climate is changing, but to track – through monitoring and observations – the kinds of changes occurring in the physical and biological systems, and asking whether they are related to climate change. Ultimately, what we want to provide is a national network that will detect early-on changes related to climate change. The reason for this is that up until this point, like with the polar bear and other issues, we've detected the change very late in the game, which makes management, adaptation or mitigation very difficult to do. And in some cases, by the time we detect change out in the field in a nonscientific way, the system may be so far gone that we will not have an effective management solution either for adaptation or mitigation.

The idea is to get out in front of these changes in a proactive way, to understand the physical and biological processes and to come back with an observation network across the country to detect changes early so useful management reactions can occur. Effective ones. And as I said before, rapid information acquisition and dissemination is a top priority.

Pete Murdoch will talk later about our vision and the proposed science needs, and not just for the DOI task force. I think that these science needs transcend anything we do in the field of climate change in understanding the effects of climate on people, wildlife, agriculture, energy; you name it, across the board.

So, ultimately, we have this vision of a truly integrated National Climate Effects Network at a range of time and spatial scales. We want to be able to understand the paleo-history of climate, as I said before, all the way up to forecasting what the future will look like at the local level, the regional level and the national level – a huge challenge but one that's necessary in order to make effective decisions.

We need a scientific team focused on early detection and scientific analysis in support of adaptation or mitigation strategies and that team needs to include people from the states, academia and the federal sector, as well as nonprofits and the private sector. Part of my challenge to you over the next few days is to think about your role in such a team – not just a scientific team but a collaborative team, a community team that can work together in order to provide solutions to some of the major challenges facing us with climate change and its effects.

We need information dissemination of decision support systems for cost-effective and scientifically supported management and policy decisions. We need to put together a set of tools for decision-makers, not just a set of scientific reports, but a set of solutions or recommendations, things they can use in their toolbox to help them make better decisions. It's information. It's one facet of information, but it's critical information. We want you to have that.

As a scientific agency, we can no longer just pay lip service to decision support. We need to start making significant investments in this way and build the capacity for the next generation to protect and sustain our natural resources through early detection of change. Ultimately, what we're talking about here isn't what's best for us. It's what's best for our children and our children's children. We're providing the next generation with some sort of mechanism to at least be able to detect and understand the processes related to climate change and its effects. And I would state that this is bigger than just climate change. It's what we call global change, the influence of people on the landscape, on biology and on hydrology and geology as well.

So, I want to leave you with just what I thought were a couple of the major elements we saw over the last couple of days. One of the major goals of working together, as Prem described, is to develop stronger ties and a scientific research cooperative between the U.S. Geological Survey and the University of Nebraska. But I want to take that a step further and say we want to develop a closer tie with you on a whole host of issues related to climate change and global change. USGS and the Department of the Interior have a significant capacity here, not just in the state of Nebraska but across the area of the mid-continent, from Denver through Nebraska, Wyoming, Texas and Oklahoma.

Several of the issues we saw, around which we think we can help develop a

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stronger cooperative agreement or scientific collaboration, relate to management and the interaction between agriculture, energy, infrastructure and climate. One of the realities of climate change is the recognition. There are several voices out there that you hear all the time on the issue of climate change. One voice says we have to do everything to suck all the CO_2 out of the atmosphere tomorrow. And another says you're not going to hurt the economy. The reality of our situation lies somewhere in between.

As a scientist, it's not for me to tell you which voice to listen to, but to provide the scientific information about the feedback and interrelationships among energy, climate and the environment. Regardless of where we want to go with mitigation, the reality is that for the next 30, 40, 50 to 100 years, fossil fuels will be a significant part of our energy portfolio in this country as well as in the developing countries of the globe. That's a reality we have to deal with. How we deal with it is beyond the scope of my job and my pay grade, but scientifically there are realities in that situation we have to address.

We saw climate effects on water availability for human and ecological needs in the Platte River system. The Platte is a beautiful river. I wish I had been here during the time that the sandhill cranes were here. But one of the major paradigm shifts I've seen with water managers and resource managers as a whole is on human consumptive use of water and the recognition that the issue of water availability is not just for people but for ecological services as well. How much water do we need to leave in the system to retain some ecological integrity or capability for resiliency? These are big, big, challenging questions, especially in developing areas like the Everglades of Florida, where the cities of Miami, Fort Lauderdale, Tampa and St. Pete are infringing on that natural ecosystem. We have a responsibility to feed and water people as well as the ecological systems themselves.

A third issue is the impact of climate change on landscapes, biodiversity and natural resources. We saw this yesterday out in the Sand Hills. And David Loope, a geologist at the University of Nebraska, put it well. The Sand Hills look very fertile. They look very vibrant with this vegetative cover on them. I used to work in North Africa–Algeria and Morocco, and the Sand Hills remind me of the Sahara, with a very thin disguise of vegetation. That's what David called it – it's a desert in disguise. And that vegetative cover is extremely sensitive to climate change. A significant or even insignificant change of temperature may mean a significant impact on the Sand Hills region.

At one time in the geologic past, that desert was the second-largest desert behind the Gobi. The Sand Hills is a desert in disguise, and climate will have some sort of impact on it. How significant, I don't know. But science can help us understand that.

These are just a few of the issues we saw along the way that require an integrated multidisciplinary approach, but require science so broad and complex in scale and scope that no single agency can do it alone. No single university has the capacity for long-term monitoring and data required to really understand the long-term as well as the short-term changes and processes. We have to be in this together. We have to work toward a set of big, common goals, sometimes in spite of our shorter-term or local goals and requirements. I know from the people I saw from the University of Nebraska, I know from our people in the U.S. Geological Survey, I know from other folks in the federal sector who I work with on climate change that there is a growing recognition that we are all in this together. It's

time to stop talking speculatively about what's going to happen with climate and to provide you decision-makers in this room and beyond this room with real, concise, accurate and objective information about climate change and how it will impact you, our children and our children's children in the future.

I thank you for having me here today and for the whole week. It's been wonderful. I look forward to talking to you individually. I look forward to seeing what happens with the breakout groups, and I look forward to seeing where we go with this in the future. Thank you.