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Ronnie: It's with great pleasure I introduce Dr. Mark Myers. (All applaud)

Dr. Myers: Thanks Ronnie for that very kind introduction. Uh, it's just great to be here. First of all, I'd like to complement Lynn on her talk. Uh, we kind of forget. I haven't ever seen, Jen … uh, Lynn's to-do list or her requirements as Deputy Secretary but Interior manages 20 percent of the U.S. landscape. She has a role with all that management action, all the regulatory action, all the scientific action. Yet, she can come here and give a scientific explanation of the major issues of the Everglades. So that's pretty spectacular to have a senior policy maker to be able to not only describe the science but integrate that into policy and in every scientific discussion we've had with her, she is equally prepared. She also does a lot better than I do. I …I need to rely on the crutch of PowerPoints to paint my pictures. She paints her canvas with words. So, again, this is real complementary for an extraordinary talk, your call to action, uh, from a … from a senior policymaker on what you know is very controversial issues. So I just really appreciate that myself and it's an honor to work for folks of her caliber. Uh, myself, uh, I also was in Alaska last week and I want to link that into I guess my core, uh, point here is as a scientist … I am a scientist, uh, what we mu … I … what we must do is the science we must do must matter to people. That's kind of a … the short synopsis. Uh, I'll give you an example. Last week I took my first vacation since I've been on the job, and I went up to Alaska and I went up to a friend's homestead. I spent 20 some years up there and, uh … a friend's homestead on the Yetna River. It was about equal distance away in the traveling distance from, uh, Fort Lauderdale to here and last week I made the trip up there. The only way you can get there was by jet boat on the river. The … the trip was … was hours long. The river had no navigation markers. It's constantly … it's one of … it's through a series of rivers that are very braided. The banks are collapsing. They change on a daily basis. Folks that live on the homestead there have to time everything because there's seasons where you have to bring all your supplies up. There's no grocery stores. There's no, uh, uh, gas stations. You have to bring your gas with you for the boat. You have to make an assumption about how long the breakup seasons are on both sides. When you form ice in the winter, there's a period where you can't get out there by snow machine and yet you can't travel by boat. There's a long breakup season where it's unstable ice for travel on a snow machine and you can only … and … but you can't get a boat to work. So they have these big periods where they're totally isolated and independents. Folks up there and my … my experience of going up there in … in … in a …in a jet boat by ourselves, you see hardly any people. The experience is you've got to know nature. You've got to understand that river system. The bars are constant, it's a braided system, it's murky, it's depending on glacier feed as well as rain water. You have to understand the depths of the water. You have to understand how the bars change. You have to understand the seasons and you have to know …you'll recognize your livelihood, your survival, is dependent on that natural environment. You pay attention. So, it was a great trip up there. It got me back to a landscape where you're kinda small and … and it really kind of put me back into the perspective that I appreciated so much with doing field work in Alaska is you are small in the landscape. Contrast that trip to my trip here. I … I left work. I … I left work at about 1:30, drove to Dulles Airport, got on an airplane and I flew on a new startup airplane. It's a relatively new startup airline. I sat in my seat, uh, totally full airplane and I had a TV screen in front me. It was really nice. I had 27 cable TV channels to watch. So as we … and it was on the whole time, taxi and take-off landing, except for the safety announcements. So, I was able and we were cloud covered … I was able to watch National Geographic and the Discovery Channel while flying over in my airplane. As we broke out of the clouds coming into Orlando, I got to see this massive city sitting there. We landed at the Orlando Airport and I went out of the airport and got my rental car and started to drive here. My major concerns about getting here were how was the traffic and will I get my rental car on time and would the airline fly on time. That whole structure … and then I drove across on, uh, on the interstate across here. I drove across the northern part of the Everglades, uh, Big Cypress but I drove across an area with a giant fence both sides of me on an elevated road. Was there any risk of me not getting here short of a flat tire or running out of gas? Not really. Uh, was I dependent on the natural system? Did I really have to understand anything about the natural system to be able to get here? Not really. I stayed in my aluminum tube getting there. I got in my rental car, and I drove and the biggest concerns I had were human-induced conditions. So what was my connection back to the natural environment? I wasn't dependent on that and I think all us folks that live in Florida, the 6 million people largely in urbanized areas in Southern Florida, think about the, uh, the folks that go to Disneyland and never leave Orlando. Does the science your doing, does the Everglades matter other than on the TV when they … when you watch it on National Geographic? And the answer is, of course it does. But we must be able to understand and explain our science to those folks why it's important, why their society depends on it, why their drinking water depends on the … the very nature of those ecosystems effectively. Our … our science, if it can't be explained to those people will never attract the attention and the investment that's necessary. We'll never attract as much policy attention as you might … as we would like. So … so that's how I want to start my talk out is, as a scientist, how do we make our science relevant? For the USGS, uh, on the on … on the onset, you know, we have a little easier time than do the management agencies in that we are fact-finding, we're objective, we don't advocate. So we have a luxury of being able to do purely objective science through a peer review, independent review process. Many scientists working in other agencies have management responsibilities, regulatory constraints, or they work in organizations that are fundamentally advocacy organizations. Uh, so we have … I … again, I just want to set that apart. The nature of the USGS is we do have that, uh, what I would consider an advantage and we … we in fact are fact-finding and not advocacy. Uh, we don't have the management responsibilities. Our science is designed to support the other bureaus as well within DOI. The key to success of our science, though, doesn't just rely on our own internal capacity. It relies on the partnerships. You see there are over 2,000 partnership agencies with the way we do science with our agency. So, it's rather extraordinary. We cannot do the kind of science necessary on the projects we've worked on without these partnerships. We simply don't have … even though we have large depth and breath, we don't have sufficiency. So as is a testimony in this room, is that these partnerships that make our science work and hopefully make our science also valuable to our partners. I mentioned before, that science has to matter. Why believe it has to matter is that science can be and should be the bridge to rational solutions. We face huge issues worldwide, not just here in the Everglades, as you know. Concerning competition for and natural threats and … to natural resources; threats of national hazards; wildlife diseases such as Avian Influenza, West Nile and other human health; as … as was mentioned by Lynn invasive species being a significant issue; availability of water for people and ecosystems; uh, the effects of climate change on land, water, habitat, ecosystems and public health are just to name a few. The public's searching for answers for these questions on different scales on different issues. You know, obviously these are all big-deal issues here. The question is can we effectively provide science that's meaningful in the context and are … are we doing it or are there better ways in the … in the future to do that. I'm gonna show you a little bit about how we at the USGS are attempting to do it through our … through our national science strategy and why that's relevant to the Everglades, will … will come back into the equation. I think the other really important thing is finding that balance. You know, we'd all like a 100 percent win/win solution. Most … most decisions have to be made in a balanced nature, winners … winners and losers. Uh, to the extent we can mitigate that, science needs to be used effectively. But we need to understand the consequences of our actions and we'll talk about the necessary layering and integration of science necessary to do that and the decision-support tools that Lynn was mentioning that are necessary for folks to understand, not only those tradeoffs, but also the consequences. Uh, there needs to be, in this process, objectivity and transparency. Uh, the other part is man is part of the environment, but we're a big part. Anthropogenic forces are significant and in fact, in many cases, they're more significant than natural processes. I'm a sedimentologist by training so I study the … studied the movement of sand grains, the forms of depositional environments. The fact is … and I've studied … studied, uh, literally a billion years of geologic history over time and the formation and prediction of … of processes that take tens of millions of years or tens of thousands of years. The fact is today the best testaments are we move ten times as much sediment on the earth's surface as do the natural processes, ten times, most through agricultural and, uh, manmade, uh, alteration of the surface. Seven billion people can do a lot of alteration. We are the significant driving force with the movement of sediment on the surface. Secondly, water. With seven billion people on this earth, use approximately 54 percent of the available fresh water and as population increases, those pressures and demands are going to increase. So finding that balance is a challenge because there's less resiliency in the system and more demand for the supply of the resources. Uh, we have to recognize that and provide the science to help folks to understand the tradeoffs and … and relieve the initial … the effects and how we do integrate in the environment and how anthropogenic change, uh, affects. So, in order to provide that sort of science, it needs to be very well integrated. It needs to be focused to that question of why does it matter? So, for the survey in our large that we selected a science strategy that picks six societal benefit areas for why … and … and those areas as you can see on this chart are ecosystems and ecosystem change, energy and minerals, natural hazards, risks and resilience, uh, the role of, uh, environment and wildlife and human health, water … water availability, water quality, climate change and climate variability and actually the big gorilla in the room, how do you integrate data to get to these kinds of questions and how … how do you link it together? How do you scale it? How do you get sufficient repeatability of data? So if I … if I look at the basic premise behind the science strategy and behind the effects is we have to see the whole elephant, that means understanding the inner relationship of these resources. And that's … that's a big challenge. That's a big challenge not only because science disc …. scientific disciplines have historically been compartmentalized, uh, and because we work on different scales, both in temporal and spatial, uh, and because the data sets are very, very commonly apples and oranges, not apples and apples. Uh, secondly, the baseline, these earth systems are now being affected by these large anthropogenic and, uh, and … and other changes that are occurring. So we have enough problems with either one of these issues, with increase in demand and competition, but then you put changes of availability due to climate change on top of that and it makes the problem much more difficult, much more unpredictable. And as you all well know, these … these changes are not nice linear changes. These variables are not always, uh, independent. So it's very difficult to do the kind of predictive science in a … in a changing world let alone doing it, uh, doing it well with … with confidence in the prediction. But clearly any attempt to do this now needs to be interdisciplinary and it needs to be very well integrated which is what this conference is really about in my mind. Uh, so the baseline structure for that is, uh, is obvious to this group and I saw many, many papers and discussions on it, is … is the ecosystem itself. You have got to look at the entire ecosystem to understand the interrelated effects, uh, and to be able to try to manage that. If you look at this chart, you ought to be scratching your head a little bit because the pictures on the left don't align with the, uh, diagram on the right. The reason for that is that interrelationship is very complex. If I look at the bedrock here in … in Florida, uh, and look at your major components, they're biogenic in nature because they're fairly recent carbonate platform rocks formed largely by, uh, biogenic organism, reef builders. Uh, elevation control … if you look at the Everglades, the changes in a few centimeters in elevation makes a big difference, uh, on the pattern. Uh, flip it the other way, the soils themselves are highly dependent on … on the … and the types and amount of soils are highly dependent on climate conditions. So you cannot think again in a straight linear pattern. You have to think of those interrelationships. They're very complex, interactive, uh, both in time and place. So, after you've figured out where your basic ecosystem components are and you've sort of got an idea, you've got to be able to spatially map them and integrate them into some consistent framework, and so how do you develop an integrated, in … interdisciplinary, uh, standardized ecosystem series of maps. And again I saw some early … early … I won't say early, but good attempts to do that, uh, in the poster sessions and I also saw that when we did the terrestrial stuff. We weren't doing the near-shore and the reef … uh, reefal environments offshore. So even when we do this as a country, we're still doing it in parts and chunks or in the large scale we're … we're doing it, uh, at very core scales. So the big … one of the big challenges this ecosystem mapping that then can lead you to analysis of ecosystem change. Also, along with that, is … is the need to be able to not just map the current ecosystem but historical ecosystems so we can actually start looking at rates of changes. So you need historical as well as, uh, as well as current data and that's often a challenge. So where does that take us? To the next step and I believe, personally believe, this is a big deal, is the quantification and the understanding of ecosystems services. And very simply put, uh, the millennium ecosystem assessment, the report that was sponsored by the United Nations and The World Bank to find four categories of ecosystem services resulting from natural systems, provisioning such as food, fiber, water; regulated service such as water purification and storm protection; cultural services as recreation and natural beauty; and finally, supporting services such as nutrient cycling and soil formation. So … so there are discreet important entities that say why this should matter to people. These ecosystems services really do matter to people. The challenge that we have is how do you value these ecosystem services? And we do not right now have a lot of agreement in the world community or nationally or even within agencies how to value ecosystem services. And that's one of the great frontiers, uh, for us. Not only that, but one of the challenges is the places where the services are provided are not necessarily where the ecosystem, uh, values are received. So you have geographical distinctions and issues. The water that's provided in the Everglades, again, is … is … has a pretty direct correlation to the City of Miami, but it's not necessarily 100 percent. Uh, agricultural use is the same way. Integration of service and ground water, regulated by different communities, these ecosystem services are valued differently by different communities. So I think ecosystems services, understanding, quantifying that is a big help to show how the science can put value into decision support and why it's meaningful. Uh, it takes those other steps to get an entirely integrated view of the ecosystem to really understand what those values are. And that's a big investment, but I think if we can show the value of the ecosystems services, there's gonna be much more willingness to, uh, put that sort of investment, uh, into the hands of the science community. Uh, just to let you know, there will be an ecosystems workshop here in Naples in this hotel. Uh, it's being sponsored by the EPA, U.S. Forest Service, University of Florida, USGS, uh, AAG, that's the American Association of Geographers, and it will have a specific session. It's … it's gonna be national but it will have a specific session on the Everglades itself. So I just want to invite you to that meeting, uh, if you're available. So when we look just real quick at the USGS science strategy, what really struck me is that every element of the science strategy is appropriate, uh, and I would say necessary in order to answer the kinds of questions that are being asked in the Everglades. So, if I go through those, the ecosystem is rather easy. How about the energy and minerals? Well, it's interesting with the Sunniland Oil Field being a significant component of your ecosystem, with the issues of, uh, bio-fuels, are you gonna use the sugarcane for bio-fuels or not? Uh, what about carbon sequestration? You got some … almost depleted oil fields down there. Are they going to be used in the future? So you can just see the energy part and then, of course, the carbon footprint questions itself, the questions with coal fire power plants versus nuclear plants versus bringing in more natural gas, etc. all play into the policy issues and the restoration of the ecological work. Uh, I was, uh, asked today by … by someone what did I consider three big policy issues moving into the future, uh, for the nation. And, uh, just from my limited perspective, I … I reeled off climate change, water and energy. And the answer I got back was, aren't those uncles related? I said absolutely yes. So again as we do a strategy, even though we name categories, we recognize the interrelationship that really comes down to understanding the full effects, cost benefits, societal benefit, and risks associated with these, uh, uh, with these various issues. There's no … often no silver bullet that changing energy production profile has environmental consequences that are different, uh, and may be better. They may not be better. So we have to understand, again, these tradeoffs, and the science needs to be invested in and we need to be providing the science that matters on these issues up in front of the issue.

Going back to the concept of data integration, uh, one of our challenges is mo … in the USGS is providing key underlying baseline data for the nation. Uh, we're very good at mapping urban areas in this country. We do not … haven't done a great job of mapping the country at a … at a common scale with current data throughout it and that's been one of the issues. So we're working hard on bringing the national map up in these areas. This is a provisional map, for example, you know, a part of the Everglades that combines traditional topographic mapping data, uh, with orthoimagery to overlay in an area of the Everglades. So we're trying to bring the modern data into these maps. Again, with that discussion about landscape change, you'd be surprised that the age of some of the data, elevation data, uh, transportation data, structure data, uh, that's … that's out of date on a … on all of our mapping systems. So having a front, common national framework, let's say a 1 to 24,000 that covers the nation with high resolution, high quality data serves all of the scientific community and the policy community. So there's a big opportunity for us to provide the integration. The EDEN Network was mentioned. That's a great example of integrating the latest, uh, hydrological data with elevation data and to have real-time reporting. As mapping moves forward in general, you're going to see a lot more of that interrelationship data. You're going to see the baseline, like the eight layers of the topographic map integrated with a lot more scientific data and a lot of real-time or near real-time data. So the map of the future will not be the static maps we have now but a map that actually is … has real-time updates of data and has many, many multiple layers but to do that requires an integration, common metadata standards, agreement to scales, an agreement across scientific disciplines on common standards. So Everglades specifically, uh, ever since 1882, uh, when the … the first canals were put in to drain Lake Okeechobee, uh, through … specifically through the central and … and southern Florida canal building exercise in 1948, this has been a highly-altered ecosystem. So as you look to restoration and I think Lynn said it well, you're looking at well over a 100 … what 100 and, uh, 30 years almost, 120 some years of change. You don't … do not reverse that change or modify that system overnight. So we have to have realistic expectations. We have to recognize the changes that we're seeing took place over a period of time but that the pressures we're seeing are … are very real to the system and they're there and they're there because of … actually good intentions. Comment slide, I think there's two major points on this slide to show, you know, what the historical flow of waters is, the current flow, and then the projected, uh, future flow, what it might look like. You can see the future does not look like the present or the past. Uh, as was mentioned, we're looking at an ecosystem that's much smaller than it was, water demands for that 6 million people and agricultural uses are significant, and we will not restore this to … to the past. So we have to understand what those targets are and we have to understand the effects of that. That takes us to the next stage for ecosystems and that is we have to be able to model predictive futures and that is a very difficult proposition. The data sets I've shown you up to this point and that integration which gets us to the present, it gets us right to changes from the past, but we have to be able to predict into the future, not only predict into the future, but predict into an uncertain future with variabilities due to anthropogenic and natural change, as they are significant. So the modeling will be very difficult to be authoritative, uh, but it's absolutely necessary. Lynn mentioned she worked on polar bears. One of our goals with polar bears is do that sort of modeling for an endangered species of an unknown future, uh, with climate change being a significant issue in the loss of sea ice. How do we model it? We end up modeling it probabilistically. We didn't look at a single deterministic-type outcome approach, but we looked at a wide range of outcomes and within a range of probabilities. We very closely had to link physical, climate change modeling with sea ice activity and modeling physical science of how sea ice moves and how it's distributed and how it can change, uh, with the changes of climate change. It's biological function models. It's functional models that look at, uh, reproductive rates of the bears, uh, use of specific types of ice, and then we had to link those models together probabilistically. It was a huge effort but it did give us a range of outcomes that we think reasonably captured the future, not that any one of those outcomes was more likely than the other, but we were able to capture it probabilistically. I would suggest the model in the future needs to incorporate similar type approaches that captures the range, the ranges of probability that might be out there for the outcome. Just to get, uh, I just really commend the department and Lynn for pushing adaptive management. Uh, I think this statement here demonstrates that no one expects the … the science to be perfect. No one expects the answer to be perfect but we must be prepared and transparent in that process. We must be able to acknowledge those rates of … those changes, uh, that we're seeing could be because our analysis aren't right and we need to go from there. Uh, the an … the other choice is to be deers … deers in the headlights. The consequences, again, of the … of this sort of approach are science that can provide not only reasonable ranges of probable outcomes and … and acknowledge where our shortcomings are, but it's pre-invested to deliver the monitoring predictive capacity will play huge dividends in the future. Uh, we'd like to have the perfect answer in science. We also know the scientific process doesn't allow that. We typically disprove things rather than prove things. We limit uncertainty in our processes. We very seldom find a single perfect answer, a scientific fit as you know. It's not the way science works. It's messy. We need to be honest of that to the decision-makers but then provide decision support tools that adequate … adequately look at those ranges of uncertainty. This is a great guide. Uh, I think everyone in DOI probably knows … knows it and knows it well but for those outside, this is a great attempt to really describe how adaptive management can … can work and some examples of decision support and stakeholder processes that can be very effective. So I just commend it to you if you're … if you're not familiar with it. So as we as scientists, try to do our part to manage, I think it's important that, again, if we want to play a role, the science, we must demonstrate it matters. We must work across our traditional discipline boundaries. We must agree to commonality of scale, repeatability. We must develop a more standardized tool box for ecosystem services, and we, uh, we must not, uh, be afraid of what that science is telling us. Uh, so again I … I just really, again, appreciate and I'm honored … I know I'm sort of preaching to the choir here. You guys are … are well ahead of me in understanding a lot of these issues. Uh, the point I'm trying to make is that we really need to do a better job of explaining our science. As policymakers, we need to do a better job of investing in that science. We know … we know what a lot of the questions are. We need to make the investments in the kind of science that helps answer it and … and again, we need all the partnerships, uh, working together effectively. Thank you. (All applaud)