[LR455]

The Special Committee on Climate Change met at 9:00 a.m. on Friday, November 10, 2016, in Room 1525 of the State Capitol, Lincoln, Nebraska, for the purpose of conducting a public hearing on LR455. Senators present: Ken Haar, Chairman; Tyson Larson, Vice Chairman; Ken Schilz; and Patty Pansing Brooks. Senators absent: Heath Mello; John Stinner; and John Kuehn.

SENATOR HAAR: Okay. Well, we're going to get started here. Thank you very much for being here. I don't chair committees all that often, so if I screw up you have to let me know. Please turn off your cell phones or just turn them to vibrate. And just a couple of housekeeping items: I guess we're going to start with introductions here, and so we'll start at my left.

SENATOR LARSON: That's you.

SENATOR HAAR: That's you.

SENATOR SCHILZ: Senator Schilz from Ogallala.

SENATOR LARSON: Tyson Larson, District 40, cochair of the committee.

SENATOR HAAR: Ken Haar, District 21.

SENATOR STINNER: John Stinner, District 48.

SENATOR HAAR: And my LA, Ken Winston, just sat down. And, Aaron, do you want to introduce yourself?

AARON BOS: Aaron Bos, committee clerk.

SENATOR HAAR: (Exhibit 1) Okay. Good. Thank you. Yeah, and Brenda from Wakefield is our page today. Thank you very much, Brenda, for being here. There's a sign-in sheet. If you're going to testify, we'd ask you to fill out one of the sign-in sheets just so we get everything right when

the transcripts come out. And as you testify, if you'll give it to the committee clerk, we'd appreciate that. When you come up to testify, please speak clearly into the microphone. Please tell us your name and spell your first name and your last name and tell us who you're representing, if anyone. Turn off your cell phones as we said. And the hearing today is LR455. This committee...the purpose of this committee is to present an outline or a framework that will be presented to next year's Legislature for putting together a climate action plan. Before we start, I handed out a survey and I want to just start with that because climate change is about science. You know these start with, I believe, I believe, but the science tells us that actually the climate doesn't care who got elected a few days ago. The climate change will continue on. And last week I gave a talk at Lincoln High School to a group of students and this was a survey that they filled out at the beginning, no name on it, they just handed it in and then we tallied it at the end. And there are two things I want to tell you about this. First of all, on the first one, "I believe climate change is due to human activities and we can stop if we take effective action," the national polling showed 13 percent responded to that. But in the Lincoln High School class, 56 percent of the students responded to the first item. That gives me hope. The second item, "I believe it's due to climate...to human activities," the survey called this the "persuadables." Nationally that was 77 percent; in this class that was 33 percent. And then those who just...the deniers, I guess, nationally was 10 percent and in this class was 11 percent. But the thing that gives me hope is 56 percent of the students in that class, at the beginning of the class before I talked about climate change, said that they believe it's due to human action and we can do something about it. And then there was the Nebraska rural poll from 2015 that showed that 61 percent of rural Nebraskans said that they either approved or strongly approved of the statement that Nebraska should have a climate action plan. So I have hope for the future that we're going...we know what the...pretty much what the climate is going to do, but I have hope for the future that we're going to do something to mitigate and adapt to that. So our agenda for today: we have sent out a letter, inquiries, and phone calls to really all the postsecondary education players in Nebraska. That includes community colleges, of course a lot of departments at UNL and UNO and so on, the private colleges and the state colleges. And the committee each has a notebook with the responses we got and we'll be hearing from many of those people today. And we're not handing out a notebook to everybody, but we'll have a PDF that you could request so that anyone who wants to see this can have all of these responses. We hope it demonstrates that there's a lot going on in terms of educating, research, education, and outreach when it comes to climate change in

postsecondary education. But also we hope that the work that we've done will be a source of networking among people who are doing lots of things. So with that, we're going to start with Ronnie Green's testimony. And Michelle Waite, the assistant to Ronnie Green, is going to give that testimony. Ronnie had to be at a funeral. And just since at least some people will be watching, Ronnie Green, who is now the chancellor of UNL, was formerly in the School of Natural Resources and that whole wing and really he's the person who made the decision to go ahead with the climate study that we saw in 2015 that was released. I asked Ronnie if he ever thought there could be political implications and he said, yes, I thought about that. And I said, did you get any pushback? And he said, never. So, part of what we're talking about today, a lot is going on and we need to keep that work going on. So, Michelle, if you'd spell your name and so on. [LR455]

MICHELLE WAITE: (Exhibit 2) Absolutely. Good morning, Senators, and thank you for letting me testify today, especially Senators Haar and Larson, cochairs of the committee. My name is Michelle Waite, M-i-c-h-e-l-l-e W-a-i-t-e, and I serve as assistant to the chancellor of community relations and I'm here to testify on behalf of Chancellor Ronnie Green with the University of Nebraska-Lincoln. Chancellor Green sends his apologies for not being here himself. As the senator indicated, he's attending a funeral this morning. I'd like to thank you for the opportunity to testify today regarding LR455 exploring the important issues surrounding climate change and it's potential impact on our state. I'd like to commend the Unicameral for its foresight in tasking the special committee to review various public policies, data, and resources available in order to create a framework for a climate action plan. At least 34 states have developed such plans. In 2014, the University of Nebraska-Lincoln was pleased to be able to produce the report "Understanding and Assessing Climate Change: Implications for Nebraska," and in 2015, participate in many of the subsequent round-table discussions. Professor Emeritus, Dr. Don Wilhite, with Doctors Clint Rowe and Bob Oglesby, led that effort. As you may know, the university has a variety of expertise on our campus that has earned national and international recognition to include everything from water law and water sustainability through our College of Law, as well as embedding the principles of sustainability and resiliency into the curriculum within the Landscape Architecture program. Research in plant breeding and soil carbon sequestration projects in the Department of Agronomy and Horticulture both address a future changed climate. Our Department of Earth and Atmospheric Sciences, as you will hear, has

extensive experience in global climate models and atmospheric processes. The High Plains Regional Climate Center, Drought Mitigation Center, and the State Climate Office are all affiliated with our School of Natural Resources where the study of climate change and related environmental research is prevalent. Many of our colleges and departments work in an interdisciplinary nature to study the causes and effects of climate change in our everyday life. It's my understanding that you will be hearing from a number of faculty members within our various colleges on specific research that has a direct impact on this issue. The university has made a concerted effort and investment in this important area of study. While most of this research has direct connections to state resources, we also receive federal funding from various sources and funding from the Nebraska Environmental Trust Fund. It is important to note that the current trust fund report notes a total of ten university projects totaling more than $950,000 in support of those projects. One of the specific projects highlighted in the report involves controlling methane emissions, a major contributor to air quality. Through development of strategies to control the diet in cattle while improving their performance, the Nebraska Environmental Trust is an important partner with the university that's made research in this area possible. In closing, we believe we are a leader in the broader area of issues related to climate change and, coupled with our expertise in agriculture, we have a greater understanding of the implications to our state. At the University of Nebraska we are pleased to be able to continue research in this important area that has far-reaching consequences. I'd be happy to attempt to answer any questions at this time. [LR455]

SENATOR HAAR: Okay. Anyone have any questions for Michelle? We will, just for the committee members, at the very front of your notebook is a...shows what all these tabs are and we'll collect those at the end of today and then include all the testimony in this notebook so that each of the committee members will have this broad scope of the testimony that we're getting today. And, Michelle, I'm sure you'll take the message back to Chancellor Green that we certainly look to the university as continuing to be a leader in this discussion going on in our state. All right. Yeah. [LR455]

SENATOR PANSING BROOKS: I have a question. [LR455]

SENATOR HAAR: Okay. [LR455]

SENATOR PANSING BROOKS: I'm sorry to have come in, in the middle... [LR455]

MICHELLE WAITE: That's okay. [LR455]

SENATOR PANSING BROOKS: ...or towards the end of your testimony so I don't know if you addressed this. But at our last hearing, Michelle, there was a discussion about the group that works...I guess they use some of the space at the university and so they cannot take a stand. That was....and I'm sorry, my computer is being brought in here as we speak because I took notes, but... [LR455]

SENATOR LARSON: It was Forestry. [LR455]

SENATOR PANSING BROOKS: Huh? [LR455]

SENATOR LARSON: Forestry. [LR455]

SENATOR PANSING BROOKS: It was Forestry who cannot take a stand because they're leasing space from the university. And meanwhile we have a giant bit of information coming from the university. I think the university is a leader in climate change and here is a group that cannot even take a stand on whether or not we should have a climate change plan. So could you speak to that a little bit because I don't understand that. [LR455]

MICHELLE WAITE: Sure. No, I'm happy to because I sort of clarified this with the chancellor after the fact when I heard about this issue. Typically when the university is asked to testify on an issue... [LR455]

SENATOR PANSING BROOKS: I understand that. [LR455]

MICHELLE WAITE: ...that we have not made an official position on, we...and especially if we think it's going to have fiscal implications, we will testify in a neutral capacity. I always advise...our faculty members call me all the time because they're a resource to the Unicameral and to the state, and they always inform me if they're going to testify, they ask me if they can be

a proponent, opponent. And it depends on the issue but I've always said, you know as long as you testify, give your credentials because it lends credibility to your testimony. I don't always necessarily say yes or no to an issue, especially if they're testifying in their professional capacity but not necessarily as a representative of the university. In this case, I clarified with Ronnie that we should indeed be probably a proponent testimony. I think just the general message that we've sent some of our university departments depending on the issue, typically we suggest that they testify in a neutral capacity if the university hasn't taken a stand on that. Does that help answer your question? [LR455]

SENATOR PANSING BROOKS: It does. I would just say that... [LR455]

MICHELLE WAITE: And in their case, they're funded a little bit differently so they've got federal funding, they've got state funding,... [LR455]

SENATOR PANSING BROOKS: Right. [LR455]

MICHELLE WAITE: ...and that's always a little bit of a tricky issue when it comes to those. [LR455]

SENATOR PANSING BROOKS: Okay. So I...when I think about it, UNMC does not come forward and say, we're going to be neutral on whether you have a cancer plan or not. [LR455]

MICHELLE WAITE: I understand totally. [LR455]

SENATOR PANSING BROOKS: So, you know, to...we're not even asking them to take a stand. This isn't even a stand of a direction to go. It's a stand about whether or not we have a climate change plan. [LR455]

MICHELLE WAITE: I agree. [LR455]

SENATOR PANSING BROOKS: And they could not take that stand, they felt, because of the university. [LR455]

MICHELLE WAITE: No, I agree and the Chancellor does too. [LR455]

SENATOR PANSING BROOKS: Okay. [LR455]

MICHELLE WAITE: I think just because of what we have typically done with legislation that's come up, that's been our sort of modus operandi. [LR455]

SENATOR PANSING BROOKS: Yeah, I can see on some things but... [LR455]

MICHELLE WAITE: In this case, we, yeah, we've...we are taking a proponent position on that. [LR455]

SENATOR PANSING BROOKS: You have done more than take a stand on this as the university. [LR455]

MICHELLE WAITE: Yeah. Well, and my testimony sort of indicates that. [LR455]

SENATOR PANSING BROOKS: Perfect. Okay. [LR455]

MICHELLE WAITE: Does that help? [LR455]

SENATOR PANSING BROOKS: Well, thank you for your input and for clarifying that issue for us. [LR455]

MICHELLE WAITE: Great. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

MICHELLE WAITE: Thank you. [LR455]

SENATOR HAAR: Okay, and be a good shepherd for Chancellor Green. And you had a question, Senator? [LR455]

SENATOR STINNER: I did not. I was pointing at Patty. [LR455]

SENATOR HAAR: Oh, pointing to her. Okay. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR HAAR: Okay. Thank you very much. [LR455]

MICHELLE WAITE: I have copies of my testimony. [LR455]

SENATOR HAAR: Yes. The way we're going to pretty much go from here on, with the exception of Dr. Wilhite, is after Dr. Wilhite, about ten minutes, five minutes for testimony, and then five minutes for Q and A would be our plan. So, Dr. Wilhite. [LR455]

DON WILHITE: (Exhibit 3) Good morning to the committee. My name is Don Wilhite, D-o-n W-i-l-h-i-t-e. I'm testifying today as a private citizen, but I think all of you know that I'm a professor emeritus from the University of Nebraska, spent about 40 years on the faculty at the university as a climate scientist and administrator and so on. My testimony today, you can see from the title there, is focusing specifically on the role of higher education in terms of fostering awareness and understanding of the issue of climate change. Obviously, the university, but higher education in general, really has a very important role to play which I hope to point out today. The first slide in the presentation is focusing on some of the facts associated with climate change, and Senator Haar already spoke to that a bit: that climate change is real and that humans are the primary drivers of these changes; secondly, that climate change will have profound impacts on all Nebraskans and so both as individuals, but if you look at all the sectors of the state, whether it's agriculture, water resources, energy, and so on, it's going to have tremendous impacts across the state. Senator Haar also already mentioned that 61 percent of rural Nebraskans supported the development of a climate action plan. These are rural Nebraskans so that's a very important percentage. But I would add the next bullet there, but the level of understanding of climate change is quite low. And I don't think people fully comprehend the urgency of trying to deal with this issue now and not waiting. You know, sometimes we hear remarks when people say, well, there's uncertainty so why don't we wait until there's no uncertainty? Well, there's always going

to be uncertainty. There's uncertainty in everything we do, but at some point you have to make a decision and you have to move forward. Higher education institutions are critical in raising the level of understanding of this issue. Continued and enhanced leadership from UNL is critically important as the flagship institution is part of the University of Nebraska system and this is one of the primary conclusions of the eight round tables that we organized in the fall of 2015, and I'll mentioned something more about that in a few minutes. The challenge, however, within the university and across higher education in the state in general, but particularly I can speak to the University of Nebraska-Lincoln, is that how to engage and bring together and coordinate the activities of physical, biological, social scientists, medical scientists, behavioral scientists, and so on, to work together on this issue is I think what the university here in Lincoln is really lacking at the moment. There are people working on the issue of climate change in many different units, and I'll point this out in a few minutes, but trying to bring these folks together and form teams to work together, and oftentimes the social behavioral sciences are not included, but climate change is really about changing human perception and human behavior. And if we don't engage the social scientists, we're going to fall short and so it's very important that we do that. The next slide is just the cover of the 2014 report that Michelle referred to a few minutes ago. This report again was published in 2014, the fall of 2014, and really focused on not just the science of climate change and the projections of what kinds of changes we are expecting to see in Nebraska and what we've seen up to this point, but also the impacts of those changes and the implications of those changes on various sectors around the state. So this was a very comprehensive report and I think you're all familiar with that report, but it has a lot of valuable information and has been considered by many throughout the state as really a game changer in terms of our promoting our discussion about this particular issue. The next slide is showing climate change over the last 11,000 or so years. And the reason I show this is that really in the swath of sort of recent human history, the last 11,000 years, we've been living under a very stable climate. And so the development of agriculture and societies around the world have really taken place during this very stable climatic period. If you notice towards the right-hand side of this graph, however, there's a solid red line that is showing the projected changes. So we have moved from a period of stable climate to a period of a very unstable climate, and this is going to get worse as we move forward because the projected changes in climate on the state are in the order of 8 to 9 degrees Fahrenheit and this is critical for everything in the state. The next slide refers to the inevitability of climate change. So when we talk about climate change, and Senator Haar referred to this

earlier, we talked about adapting to change because we're already changing the climate, and this is demonstrated in data that's being collected all over the world. So...do you have another copy of the handout because Senator Mello is missing one. So when we talk about the inevitability of climate change, it's important that we reduce the emissions of greenhouse gases so that we can lower the projections in terms of what we expect in the future with regard to climate change. And you can see on the map in the lower right-hand corner of that particular slide, this projection of 8 to 9 degrees. This is the business as usual. This is if we continue doing what we've been doing into the future. But even if we reduce emissions, given the loading that we've had in the atmosphere in terms of carbon dioxide and other greenhouse gases, we're still going to experience a change in climate, an increase in temperatures in Nebraska of 4 to 5 degrees. So it's, you know, dealing with that requires adaptation. Reducing the amount of warming is where we're talking about reductions and emissions of greenhouse gases and, therefore, trying to lower this projected range. So as a result of the 2014 report, where we focus briefly through commentaries in that report on the implications of climate change for various key sectors in the state--agriculture, water, energy, urban systems, ecosystems and so forth--we didn't really have time or the resources in that report to really focus on the implications of those changes on those sectors in more detail. And so...and we didn't have an opportunity to really engage a lot of stakeholders in that process. So in the fall of 2015, I organized eight sector-based round tables around those key sectors in the state and we brought together stakeholders from around the state. In total there were about 350 individuals that participated in those discussions and we talked about the implications of those changes on ecosystems, the implications of those changes on energy supply and demand, on agriculture, on water resources and so forth, and produced the report that you see the cover of there. So both the 2014 report and the 2015 report, which was published in 2016, is...are both available at the URL, the Web site that you see on there. So below that, the next slide really talks about sort of the range of sectors that we were addressing in that series of round tables that we did. The next slide is referring to a study that was commissioned by the National Council on Science and Environment. When President Obama was elected, his administration requested the National Council on Science and Environment to really address the issue of climate change in higher education, what is the role of higher education, so very much what this committee is doing in this particular hearing today. And I've just pointed out three key conclusions from that study in 2008 that was presented to the Obama administration: first of all, that climate change is one of the nation's most pressing issues; secondly, the findings emphasize

the need for interdisciplinary coordination and end-to-end thinking at the university level; and finally, that the report recommended that universities and government should establish research centers to support and integrate natural science and social science research on the impacts of climate change. So this really reinforces, I think, my testimony today and my feeling with regards to the role of higher education. The federal government has followed the recommendations of the National Council on Science and Environment by establishing climate hubs around the country associated with the U.S. Department of Agriculture. The U.S. Geological Survey, through the Department of Interior, have established climate change science centers around the country. So once again there's been sort of a coalescing of federal agencies working on the issue of climate change, trying to move the discussion forward and enhance the resiliency of various communities on this issue. The next slide is referring to a climate change research and education program. Following that 2008 study that I was just referring to that was commissioned at the national level by the Obama administration, the vice chancellor for research at UNL asked me to lead an effort to assess the expertise at the University of Nebraska-Lincoln and how the University of Nebraska-Lincoln might move forward on this issue. So we did that. I formed an advisory committee that helped me along the way. You'll hear from Bob Oglesby later this morning who was a member of that advisory committee. The key findings...some of the key findings from our particular study: first of all, that current projected changes in Nebraska's climate will have significant repercussions on the region's water resources and will affect the sustainability of agriculture and other activities; universities are playing and will continue to play an enormous role in conducting research on all aspects of climate change; the education, research, and service mission of the universities provide both the intellectual leadership and the capacity to conduct research to facilitate adaptation to projected changes and actions to reduce emissions of greenhouse gases. So there we're talking about mitigation strategies. And as a part of our study at the University of Nebraska-Lincoln, we looked at...across the country at other universities to see how many other universities had established some sort of a research/outreach program focusing on climate change. And in 2009, we found 39 universities that had done that, 5 within the Big 12, for example, which we were still part of, and multiple institutions also within the Big 10. So all of these institutions have formed some sort of a mechanism to provide coordination on climate change research and education activities across the university campus and so on. Continue with the findings: We did a survey of faculty at the University of Nebraska-Lincoln to find out which faculty were doing research, were teaching about climate change, were

involved in service activities, and we found in 2009, 156 faculty from very diverse units and centers and departments across the campus that were working in these areas. So there were three notable conclusions from our report that was commissioned by the UNL vice chancellor for research: UNL faculty have the expertise to conduct end-to-end research on climate change education impacts and adaptation of mitigation actions; UNL's expertise is fragmented across campus, requires leadership, coordination, and collaboration; and a recommendation was that we establish some sort of an umbrella entity at UNL to coordinate climate change research action and service activities. So this was in 2009, so it was way ahead of discussion at this particular hearing today. The next slide provides a bit of a graphic. Some of the information here will be provided by other people testifying this morning. So what we were proposing is an umbrella organization, again at UNL, to provide this coordination across units, across disciplines, and so forth. There are a lot of climate-related resources available at UNL and you'll hear from a number of them today--the Nebraska State Climate Office; the National Drought Mitigation Center; the High Plains Regional Climate Center--Michelle referred to these; the applied climate science faculty within the School of Natural Resources; and also the faculty at the Department of Earth and Atmospheric Sciences. And then in the lower right-hand corner I sort of identified there we had...based on the survey that we did of faculty in departments across campus, there were 62 different departments, units, or centers at the university that were engaged in some form of activity related to climate change. But once again, this is not being coordinated. We're not bringing together the teams that we need. One hundred fifty-six faculty were engaged. Expertise extends across many departments at the university. To give an example, the next slide shows climate change expertise in the School of Natural Resources. And so we hear about the National Drought Mitigation Center, we hear about the High Plains Regional Climate Center, the State Climate Office and so on, but the interest in research capacity and educational program capacity within the School of Natural Resources much broader than just within these particular groups. Each of those groups--the Drought Mitigation Center, High Plains Regional Climate Center, State Climate Office--does work in climate, but their principal mission is really not in the area of climate change. It's kind of...it's a part of their mission, but it's not central. And that's why it's important to bring together these groups across campus with a more focused emphasis on climate change. But within the School of Natural Resources there are different mission areas, and whether it's in the area of climate or in the area of applied ecology or environmental science, many of these faculty have training and understanding and expertise in climate change. So it's

much broader than just within the climate community, once again emphasizing the interdisciplinary nature. There are a number of centers that I've listed here and we've talked about those already. There are also units within the School of Natural Resources. In addition to the State Climate Office, Conservation Survey Division is tasked with monitoring water supplies across the state and the geology of the state and so on, so they have a lot of expertise. The Fish and Wildlife Research Unit, which is actually funded through the U.S. Geological Survey, is based within the school. And there's also a Long-Term Agroecosystem Research Network again focused on climate change and how it's affecting agroecosystems. So in conclusion, the last two slides are really looking at what we saw, based on this 2009 study, as the vision for this Climate Change Research and Education Center at the university if it were formed: first of all, to harness and augment the talents of faculty and other resources to investigate complex research, education, and service-related issues associated with climate change; secondly, to enhance collaboration with faculty at other institutions of higher education in Nebraska; and finally, to foster student and stakeholder engagement in addressing the challenges and opportunities of climate change. And then you see on the last slide the objectives that we propose for a center like this if established at the university. First and very important is to increase competitiveness, because most proposals that are submitted to federal agencies for funding that deal with climate change over essentially almost any topic needs to engage the social sciences, and so there's a requirement that you bring together an interdisciplinary team when you're talking about climate change. And so I think doing something like this would increase our competitiveness for external resources, bringing those into the state from federal sources in particular, to more effectively address these issues; to better understand the science of climate change and investigate adaptation and mitigation strategies; to develop new and enhance existing risk-based decision support tools to improve management of water and other natural resources; to create a comprehensive climate change science curriculum at both the undergraduate and graduate level; to develop educational programs at multiple levels, K-12 as well as adult programs, to inform leaders, decision makers, and the public; and to engage stakeholders in discussions regarding the science of climate change, projected impacts, adaptation, mitigation strategies, and the identification of policy options. And so, unfortunately, this recommendation that came as a result of the request from the vice chancellor for research never moved forward and this was very disappointing, not only to me personally but disappointing to all of those people across campus that participated in the discussion about this. And I think the time is ripe now to move forward

because there's...the importance of bringing together these various disciplines to address this important issue is really paramount. So with that, I'll close my testimony. I'd be glad to answer any questions you might have. [LR455]

SENATOR HAAR: And again for the committee, we'll add this as a tab and we'll do two up so you can actually read the fine print, but we'll do this. [LR455]

DON WILHITE: Okay. [LR455]

SENATOR HAAR: Are there any questions before I have several? Okay. [LR455]

KEN WINSTON: Senator Stinner. [LR455]

SENATOR STINNER: I just want to know why it didn't move forward. Was it lack of funding, lack...competing against other...? [LR455]

DON WILHITE: That's a good question. I really wish I could give you a good answer. When I submitted it and submitted the proposal on behalf of our advisory committee, the vice chancellor for research said, you've got some good ideas in here; I need to bring together the various deans of the various colleges to talk about how to move this forward. And, unfortunately, he never did that. One of our other deans, the Dean of Agricultural Research Division with IANR, said to me, he said, can you give me a proof of concept? And I responded and I said, well, your proof of concept is there are 39 other universities--these are major universities--that have already done this. I mean, to me that's proof of concept that this is working. It's working effectively. Beyond that, I don't know. I don't think that resources were necessarily the constraint here. I think it was just a lack of action on the part of administration at the time. That's quite unfortunate because if I think about where we would be today if we would have formed something like this five years ago, we'd be much further along and much more competitive for resources and there would be a much better understanding of this issue throughout the state. [LR455]

SENATOR HAAR: Any other questions? Well, Dr. Wilhite, you are one of the world's experts in drought planning. [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR HAAR: I would like you to talk just a minute the difference between just reacting to drought and planning for drought, and in your experience, because I think that's absolutely applicable to climate planning. [LR455]

DON WILHITE: Yeah. Yeah, I appreciate the question. Yeah, not just in the United States but globally what I found throughout my career and the primary motivation for forming the National Drought Mitigation Center was to try and facilitate a change in thinking about drought, because drought is a normal part of our climate, and whether you live in Nebraska or you live in Georgia, which right now they're in terrible drought. California has been in drought for six years. And so in other areas of the world you experience on a regular basis severe drought. But it seems like everywhere you look, at least up until more recently, countries and states in the United States were just reacting and the reaction was in the form of when a drought occurs, the state pulls together a drought task force, and the drought task force looks to see what they can do. Well, what they can do when you're in the middle of a drought is very, very limited. And so if you haven't thought about this ahead of time, if you haven't planned, if you haven't put in place some sort of a preparedness strategy and worked on different technologies to decrease your vulnerability, then you're really, extremely vulnerable. So the National Drought Mitigation Center has really been focused on improving resiliency to drought institutionally but also in other ways and terms of specific mitigation strategies and development of preparedness plans that are early warning systems and so on. And this is a concept now that's moved from the University of Nebraska as a core area globally, and so we are known as world leaders in this area. And so the problem with responding to something reactively is that it's usually quite ineffective. It's also much more costly and people experience much greater hardships associated with that. So if you make the analogy to a climate action plan, if we just sit here and do nothing and just try to react to these changes as they occur, that's not a very effective way of dealing with this. And that's why, as you heard earlier, 34 states have already developed climate action plans. Nebraska needs to be one of those states. When you look at the sensitivity of our economic system which is based upon agriculture, one of the most sensitive sectors to changes in weather and climate, it's really critical that we become quite proactive on this in how it's going to affect us. So the advantages of action versus inaction are really tremendous from a cost perspective,

from a hardship perspective, and also impacts on the environment. I mean it's really, really important. So, yeah. [LR455]

SENATOR HAAR: And then one more quick question. You can teach an old dog new tricks and one of the new terms I learned from going to these round tables is stationarity. [LR455]

DON WILHITE: Yes. [LR455]

SENATOR HAAR: Talk a little bit about stationarity. [LR455]

DON WILHITE: Okay. Well, on the first page of my testimony you see that slide in the lower right-hand corner, and so that's really talking about moving from a period of stationarity in terms of our climate versus nonstationarity. There's a famous article that was done a few years ago in the scientific literature that said stationarity is dead. So almost everything we do, we do it based upon the historical climate. So the crops we grow in Nebraska, how we manage our water resources, energy demand, how we plan our cities, our roads, our sewer systems, our storm sewers and so on, how large we build our reservoirs, this is based upon historical climate. But the climate of the past is no longer indicative of the climate of the future. And so if we continue to plan based upon historic climate, not taking into account projections into the future, we're going to find ourselves, you know, worlds apart in terms of where we should be. And so this idea of nonstationarity of climate is really important as we move forward. We need to look at the historical climate but we also need to look at projections in terms of where we're going so we can plan accordingly, because the investments we make in whether it's utilities or buildings or reservoirs, all of these things are tremendous investments that are going to be made with the idea of a 50-year lifetime. And if we don't consider what the climate is going to be like in 30, 40, 50 years, we're in trouble. And so this is really critically important. So stationarity versus nonstationarity is a really critical issue now from a planning perspective, whether you're in architecture or whether you're an engineer or an agricultural producer. [LR455]

SENATOR HAAR: Or building a road, as they found in Iowa... [LR455]

DON WILHITE: Building roads, that's right. [LR455]

SENATOR HAAR: ...where they found the way they built some roads and superhighways created dams when the 500-year flood came. [LR455]

DON WILHITE: Right. Exactly. And so we need to be taking those things into account because, as you know, what we've been seeing because of these more intense rain storms associated with climate change is we're having greater incidence of flooding. And that's just going to get worse in the future. And so how you design a storm sewer for the city of Lincoln, I mean, Lincoln has taken that into account because you're going to get more and more flooding, not just of land surfaces but homes and basements and all that sort of thing. We've already experienced that in Lincoln with three 100-year rainfall events in the last 18 months. So it's really critical that we think about these issues seriously and move forward. And it's a science issue and science comes out of the universities and research institutions and so we need to be really engaged in not only informing people but doing the research that's necessary in order to implement change, so. [LR455]

SENATOR HAAR: Uh-huh. And in that same rural poll, rural Nebraskans said that their primary source for information was the university, followed by scientists and then health officials. [LR455]

DON WILHITE: Yeah. Yeah. [LR455]

SENATOR HAAR: So you...universities not only know all this stuff but they're looked at as a trusted resource by the rest of the population. [LR455]

DON WILHITE: Yeah. And to just elaborate on that a little bit, you know, one of the...we heard from these eight round tables, there's a lot of consistency in messages across the various sectors. And one of those areas of consistency was that, how is the university going to continue to provide leadership on this issue? And, you know, many of the people that attended the round tables were aware that I was going to retire from the university and I had been providing leadership on this issue. But there are other faculty members that have retired recently or will be retiring recently, and what's the strategy for replacing these faculty but also, more broadly, bringing together the different units that really need to focus on this issue and work together? We

need to have, I think, the capacity to form study teams across the institution. And there's nothing that hinders that now. I mean, a faculty member can go to...you know, a climate scientist can go to somebody in political science or psychology or whatever and say, will you work with me? There's nothing that hinders that, but what we need to do is we need to facilitate a lot more of that and deal with this issue because it's such an important and interdisciplinary issue for the future. [LR455]

SENATOR HAAR: And then finally, one of the things I've been bouncing around in my head and this is asking for your opinion... [LR455]

DON WILHITE: Okay. [LR455]

SENATOR HAAR: ...with all your years of experience at the university, and certainly a question that will go back to Chancellor Green is, do you think the university has the resources to develop a climate action plan for Nebraska just as the university put together the study of 2014? [LR455]

DON WILHITE: Definitely. I mean, I think it wouldn't be...I think the leadership would probably be provided by several different units or centers or something like that rather than an individual, I think, you know certainly if we brought together a few of the key experts on this issue. An example is that you know I work with the state of Nebraska to prepare our current drought mitigation plan. And in order to do that we visited with stakeholders throughout the state and so on and we pulled together that information around 2000, 1999-2000, when Governor Nelson was with us. And so that process is really very similar to the process that we would use to develop a climate change action plan. So I think the university certainly has the capability, has the resources in terms of faculty and staff with the expertise to do this sort of thing. There would just need to be a mechanism where that's requested of the university and then there would be some funding that would have to be associated with that. But I think the university could also...can't speak for the university, but you know there's a lot of in-kind support that the university could provide because this is an important part of their mission. And certainly we did that when we developed the drought mitigation plan for the state of Nebraska. A lot of that was in-kind contribution from the university in terms of faculty time and staff time and things like that, so. [LR455]

SENATOR HAAR: Okay. Well, thank you very much, and... [LR455]

SENATOR PANSING BROOKS: I have...and we have questions (inaudible). [LR455]

SENATOR HAAR: Oh, here's a question. [LR455]

DON WILHITE: Oh, okay. [LR455]

SENATOR STINNER: I understand there's 34 states that have a plan, a state plan. [LR455]

DON WILHITE: Uh-huh. [LR455]

SENATOR STINNER: Could you direct me to the best plan? Have you looked at them and said this is what you need to have then? [LR455]

DON WILHITE: Well, I think probably what might be most applicable to us would maybe be to look at the state of Colorado. Theirs is recent. California has a strategy in place, but California is kind of an outlier in many ways. And so I think California...or Colorado being closer to us and having some similar sorts of issues. Each of these plans are very different because each one is tailored to the needs of the state and the stakeholders and the primary economic drivers in the state and so on, so it's very similar that what you see with drought plans in various states. We have 48 states with drought plans, but they're very different from one another, but they have...conceptually there are similarities. So I'd look at Colorado. You could also look at Iowa in terms of what they've done. [LR455]

SENATOR STINNER: And do we have a comprehensive drought plan for the state of Nebraska? [LR455]

DON WILHITE: We do have, but it's out-of-date. The last one I worked with Governor Kerrey in the mid-'80s to do our first drought plan and then we revised it around '99, 2000. But we're now in 2016, not far from 2017, so I think our drought plan needs to be updated with even more emphasis on improving our resiliency to drought within the state. So, yes. [LR455]

SENATOR STINNER: Thank you. [LR455]

SENATOR HAAR: And, yeah, I'll get to you in a second. Senator Stinner, Senator Larson's office has been doing that research on the 23... [LR455]

SENATOR STINNER: Okay. [LR455]

SENATOR LARSON: And we had...our last committee hearing, which you couldn't make it because you were out of state, I think, in Pennsylvania for personal reasons, we discussed a lot of the statewide climate action plans and had an expert come in. So we can make sure...Aaron will make sure you get that information. [LR455]

SENATOR HAAR: Good. Senator Brooks. [LR455]

SENATOR PANSING BROOKS: Thank you so much for all of your work, Dr. Wilhite,... [LR455]

DON WILHITE: Sure. [LR455]

SENATOR PANSING BROOKS: ...and all of your information and your work for decades, obviously. I'm just interested in trying to understand, because to me, and I think I said it last time, is that I don't understand what the big deal is about having a climate change plan. So I'm wondering how...since you've been involved so many years, is this a politically charged issue because of the words "climate change"? And I just...I really am trying to understand what is the problem? We need to move forward and protect and be prepared for all sorts of issues, and communities are preparing for different issues, including terrorist issues. That's not controversial. It's smart. So why aren't we doing that here? And are we just stuck on the phrase "climate change" because people think that China made this up or whatever the reason is? So could you talk to that just a little bit because... [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR PANSING BROOKS: ...I really am having trouble with all the information,... [LR455]

DON WILHITE: Yeah. [LR455]

SENATOR PANSING BROOKS: ...why we're just sort of going, oh, yeah, maybe we will do a plan? That doesn't make sense to me. [LR455]

DON WILHITE: Yeah. The short answer is, yes, we're stuck on the term. I mean even the university struggles. When I've worked with our Extension Service, for example, and they were wanting to, sort of as a spin-off from our 2014 report, to develop a program to help inform ag producers in the state about climate change, but they were afraid to call it climate change and because it's just...people just tune that out. So it is a politically charged issue. My work on drought planning would tell me that to be successful when developing a drought plan, one of the most important factors is you have to have political will. And political will starts at the top. And so in 1985, approximately, when Nebraska developed their first drought plan, Governor Kerrey called a meeting of the university and state agencies and said we're going to do this, and it was done. And once we had a plan then, it was a matter of, you know, Governor Nelson saying, we need to revise this. We're not getting that message currently from the top and so it's...and it's largely because of politics. And we really need to get past this because, as I said at the last hearing and said again today and as Senator Haar said in his opening statements, you know, the politics of this issue have been really hindering progress on this in the United States. And so it's important that we move this discussion forward and remove the politics from this and just do what's in the best interest of the citizens of Nebraska and our protection of our natural resources and our environment. And so it's really critical. And there's a lot that we can learn by looking at other states in what they've done and how they've done it. But if you look at most of these states, it's...whether it's climate action plan or drought plans, it starts at the top by an executive order saying we will do this or just an announcement saying we will do this and all state agencies will work together and participate in the process. So how to get past that barrier right now is really difficult in Nebraska, so...without getting too political. (Laugh) [LR455]

SENATOR PANSING BROOKS: No, I mean I'm just interested. So what about the chambers and the various groups that do have connection? The Cattlemen have to be interested in protecting their herds, and... [LR455]

DON WILHITE: Right. Yeah, they are and they...I mean agricultural producers in the state I think is part of the survey that we referred to earlier of rural Nebraskans. They all know that the climate is changing. That stumbling block seems to be the acceptance that humans are driving this and that's because they don't understand the science of what causes...you know, how greenhouse gases affect our atmosphere and our climate. And so if they don't understand that, that's where the university and K-12 education, and we need to bring that science to them so they understand it and...because I get responses from people saying, well, we're just individuals on this planet, we couldn't possibly be affecting the global climate. But you know, we're approaching 8 billion people. I mean, we are affecting the global climate if you understand how the atmosphere works, so. It doesn't make sense not to do anything but we seem to be stuck in the mud right now, so hopefully we can find a way to move this forward, so. [LR455]

SENATOR HAAR: Okay. Well, thank you very much. And I think all the testimony we're going to get today in some way shows that we're not stuck, that we're moving forward, but the politics is more difficult. [LR455]

DON WILHITE: Yeah, the poli...yeah, okay. Thank you. [LR455]

SENATOR HAAR: Well, thank you very much... [LR455]

DON WILHITE: Sure. [LR455]

SENATOR HAAR: ...and we know we have your phone number and we know where you live, so. [LR455]

DON WILHITE: You sure do. (Laughter) [LR455]

SENATOR HAAR: You're not retiring, I want to tell you. Okay. Our next person to speak is Dr. Robert Oglesby with the Department of Earth and Atmospheric Sciences. And by the way, committee, in your notebooks, it's Tab 14 is what the Department of Arts and Science submitted, and then Dr. Oglesby will give his own testimony, but that's what's in your notebook right now. [LR455]

ROBERT OGLESBY: (Exhibit 4) Thank you, Senator Haar. It's a pleasure to be here. My name is Robert Oglesby, R-o-b-e-r-t O-g-l-e-s-b-y. I'm a professor at the University of Nebraska-Lincoln. I actually have a joint appointment in the Department of Earth and Atmospheric Sciences and the School of Natural Resources and I think actually, technically, I'm representing the College of Arts and Sciences today. And really this is also on behalf of Clint Rowe, my colleague. I do all my work with him and he's in class today. Okay. Climate change is already impacting Nebraska in many ways and will continue to impact our state over coming decades and beyond. Agriculture, water resources, energy production and demand, and human health are only some of the impacted sectors. Development of a state climate action plan is an important first step toward identifying strategies for mitigating climate change itself and for adapting to current and future changes. However, it's also critical to have an comprehensive understanding of recent past changes of the regional climate of Nebraska, as well as robust, scientifically sound projection of the projected future changes we are likely to experience, with or without substantial mitigation efforts. Moreover, these projections need to be available at the spatial and temporal scales--the time and space scales--that are useful to and usable by natural and social scientists who study climate change impacts, as well as policymakers who will develop the needed mitigation and adaptation strategies. Global climate models have been shown to capture the variations in large-scale atmospheric circulation that drives climate variability and change. We can expect these models to perform equally well in projecting these variations into the future under different scenarios of greenhouse gas forcing. In fact, the scenario of greenhouse gas forcing is the largest source of uncertainty here. However, the horizontal spatial scale of present-day, state-of-the-art global climate models is on the order of 100 kilometers or about 60 miles, not quite from here to Aurora. Put another way, only about 20 global climate model grid points would represent an area the size of Nebraska. Over almost a decade, my colleague Clint Rowe and myself have developed and implemented a successful methodology for downscaling global climate model projections to the scales needed for impact studies and the development of

mitigation and adaptation strategies. Much of our research has been focused on developing countries in Latin America and the Caribbean, as their population and economies are, and will continue to be, more immediately and heavily impacted by past and future climate change. We've conducted these downscaling scenarios for individual countries from Guatemala and Honduras, each about half the size of Nebraska, to Bolivia which is about five times the size of Nebraska, as well as the entire land of Mesoamerican and Caribbean region. These results have been and continue to be used by scientists and policymakers in these Latin American countries. In fact, next week Clint and I will be traveling to Panama, not on state money--this is funded by the Interamerican Development Bank--to continue our series of training workshops in the region. More importantly for you and your constituents, Senators, is this methodology is easily adaptable to other regions, for example, the central United States and, specifically, Nebraska. Several graduate students at UNL either under our supervision or those of our close colleagues, have already done some preliminary, though not extensive, research using our approach for this region. Thanks for your attention. Be happy to answer any questions. [LR455]

SENATOR HAAR: Good. Okay, again Tab...and I guess 14 and 20, 20 is the School of Natural Resources also. [LR455]

BOB OGLESBY: Yeah, although technically I think I'm here representing Earth and Atmospheric Sciences in Arts and Sciences today. But I do have the joint appointment. [LR455]

SENATOR HAAR: Yeah. Okay. Thank you. Any questions that you might have? I have a quick question. [LR455]

BOB OGLESBY: Sure. [LR455]

SENATOR HAAR: To the...when some people say, well, let's just wait until the science is precise and your predictions are 100 percent, how would you respond to that? [LR455]

BOB OGLESBY: Science does not work that way. Science can never be 100 percent precise. Science is a continually evolving process. If we wait until we know everything there is to know about climate system, we will wait forever. [LR455]

SENATOR HAAR: Okay, or we may not be here to... [LR455]

BOB OGLESBY: Or we may not be here, exactly. (Laughter) [LR455]

SENATOR HAAR: Okay. Good. Well, thank you so much for your testimony. [LR455]

BOB OGLESBY: Sure. [LR455]

SENATOR HAAR: And again, you're not retiring and so we will... [LR455]

BOB OGLESBY: Well...soon. (Laughter) I'm one of those when Don mentioned some retiring soon. I'll probably be in that category unfortunately, or fortunately. [LR455]

SENATOR HAAR: Okay. Good. Do you feel that other countries that you've worked with...and I don't know how to phrase this exactly, but take climate more...climate change more seriously? [LR455]

BOB OGLESBY: As a climate scientist, it's amazing. I go to a place like Guatemala, I'm treated like a rock star. Yes, they very much take it seriously. They know they have problems. They know they have to develop plans to deal with these problems. We're front-page news on the newspapers in these place when we go there. Yes, they take it seriously. [LR455]

SENATOR HAAR: Okay. Great. Thank you so much for your testimony. [LR455]

BOB OGLESBY: You bet. [LR455]

SENATOR HAAR: Okay, then next will be engineering and again Dr. Perez. And we know, just to let you know that we sent out some questions again to each of the departments and so on and engineering is Tab 15, the response we got from the dean. And so thank you, Dr. Perez, for being here. [LR455]

LANCE PEREZ: (Exhibit 5) Thank you. So thank you, Senators Haar and Larson, for inviting me here to provide testimony about work that the College of Engineering at the University of Nebraska is doing related to climate change. So my name is Lance C. Perez. I'm a professor of electrical and computer engineering at the university. I've been on the faculty since 1996, and I'm currently the interim dean for the College of Engineering. So across the College of Engineering, with our 200 faculty and our approximately $35 million of externally funded research expenditures, and across both the city campus in Lincoln and the Scott Campus in Omaha, College of Engineering faculty do a wide range of work across our full mission of research, teaching, and outreach on issues related to climate change. Unlike faculty in the College of Arts and Sciences, we tend not to do work focused on cause or models associated with climate change but, rather, working on problems that are either associated with problems that have been identified as potential causes of climate change or on mitigating the effects associated with climate change, whether it's man-made or natural. This falls broadly into four areas. Issues associated with food and water, so that involves both the production of food and then also the way it is consumed, transported, distributed, and used. We also do, in the Durham School of Architectural Engineering and Construction, a considerable amount of work on the built environments, so this ranges from individual homes to large commercial buildings to communities. These buildings account for about 40 percent of the usage of several things that have been identified as potentially causing climate change, various refrigerants, and so making those buildings more efficient in their consumption of energy and their ability to manage temperature and manage the built to living environment as critical, and our Durham School, of course, is a leader in the country and work associated with that. We also have a considerable amount of work going on at both the Educational Outreach...and at all the Educational Outreach and Research levels in terms of energy. Of course, this is done in conjunction with the Nebraska Center for Energy Sciences Research. And again, this focuses on issues associated with production, distribution, and consumption. So we work on alternative energy sources, on methods for distributing and storing energy that are more efficient and result in less loss as you're trying to distribute energy across the country. And, of course, in making the various devices that we're all accustomed to, ranging from homes to cars to appliances, much more energy efficient. And then we also do a considerable amount of work in each of those areas as you start drilling down into more specific problems, that translates into research in areas of materials, into areas of communication and systems, into areas of human behavior within...as

they interact with all of these things. So we do a large range of work again on both trying to prevent things that may be contributing to climate change and also into then mitigating those things that which...that are being affected by climate change. And this is across our full mission. So...in closing, I just wanted to say that our college is deeply involved in these issues. Again, we tend not to be involved at the issue of causation but, rather, at the...working on the problems that are associated on the two sides, on the front end and the back end of climate change. So that's the end of my testimony. I welcome any questions. [LR455]

SENATOR HAAR: Questions that anyone would have? I would have a question. One of the things we're talking about here is an increase in coordination and cooperation and so on that goes on. So how does that happen in your college? [LR455]

LANCE PEREZ: Sure. So, there's two main mechanisms for this type of collaboration. So one is sort of the organic--and this is the more traditional way--the organic effort by faculty to solve problems. You know, faculty are highly motivated to develop their own scholarship and teaching and outreach efforts, and so they naturally collaborate across the college and across the university in order to get that done. So that's one mechanism. The second mechanism is a more top-down approach where it can start at the chancellor level and move on down through the org chart. Something I'm very active in, as dean, is trying to create these synergies across both the college and the university so that we are...the more faculty you have, the more resources you have devoted to it, the bigger problem you can attack. And this is the trend that we're seeing both nationally and internationally that the serious problems that are facing modern societies require large teams to address. And so we're being much more purposeful about trying to develop those teams situating them so that they can succeed on addressing these problems and resourcing them as well so that they can make...they can make progress on them. [LR455]

SENATOR HAAR: Uh-huh. And as you form these teams in more coordination, obviously that would increase the ability to get funding, right, from national sources and so on? [LR455]

LANCE PEREZ: It does, although you're also entering a more competitive arena, so historically, federal funding was...if you go back several decades, it was driven largely by single PI proposals. So I, as a faculty member, would write a proposal to the NSF and the Department of Energy

would get a couple hundred thousand dollars to do some work. There were a large number of those small grants. We've seen over the last several decades the federal government consolidate their funding into large center grants, so the teams we're forming are more competitive for those grants clearly, but also the competition has become much more intense that, you know, if you're trying to go after a large engineering research center, example, which is one of the premiere programs at the National Science Foundation, they only fund four or five of those a year. So you're competing with the top universities across the country or forming coalitions to try to get that funding, so. So, certainly it's making us more competitive as we build these teams, but also the competition is... [LR455]

SENATOR HAAR: Is increasing. [LR455]

LANCE PEREZ: ...is increasing. [LR455]

SENATOR HAAR: And that's good, really, if problems get addressed then. [LR455]

LANCE PEREZ: It is and I think our challenge as an institution of the state is simply to invest resources such that we can be competitive. [LR455]

SENATOR HAAR: Uh-huh. And then my other question is, and this is not to point fingers or assign blame or anything, but there are quite a number of major universities, in the Big Ten in particular,... [LR455]

LANCE PEREZ: Uh-huh. [LR455]

SENATOR HAAR: ...that actually have climate departments or climate...you know, a big climate emphasis... [LR455]

LANCE PEREZ: Sure. [LR455]

SENATOR HAAR: ...when you see it up-front. Is that something that hinders or helps or how does that compare to the way we do things currently? [LR455]

LANCE PEREZ: Sure. So if I make this the broader issue, I think the question you're asking is about the utility of forming centers at the university to address large problems. And this is what most major research universities do. We do not have the same history of doing that at UNL or within the college, I should say particularly with the College of Engineering, to build out that kind of infrastructure to allow that kind of inter- and multidisciplinary work to address large problems. That's not been our culture for the past couple of decades since I've been at the university. I think it is a mechanism that is very effective and one that is necessary if we are going to compete within those programs and with those other institutions that are doing work in these areas. [LR455]

SENATOR HAAR: Good. Well, we really appreciate your coming and again, we hope to continue to get input and foster coordination, not just within UNL but across all of postsecondary institutions in the state. And at some point we will get you probably the electronic copy of all of this, because it's really interesting what some of the other institutions are doing. [LR455]

LANCE PEREZ: That would be great. I look forward to that. [LR455]

SENATOR HAAR: Good. Thank you so much. [LR455]

LANCE PEREZ: Thank you. [LR455]

SENATOR HAAR: Okay. Next on line we have Dr. Martha Shulski, who is now head of the new Nebraska State Climate Office and we have one handout there. It's Tab 22. It's kind of the standard thing that you hand out to people, but we'll also include your testimony in Tab 22 as the Climate Office. So Welcome. [LR455]

MARTHA SHULSKI: Perfect. Thank you, Senator Haar. As you said, my name is Martha Shulski, M-a-r-t-h-a S-h-u-l-s-k-i. Good morning again. I'm associate professor of applied climate science in the School of Natural Resources at UNL. I also serve as the director of the Nebraska State Climate Office and the State Climatologist. I have been at UNL since 2009. My role as faculty in the school consists of teaching, research, and administering the State Climate

Office. I teach a course each year that is at freshman level, introduction to climate change, which I'm teaching this semester, and give students knowledge and capacity to understand our changing climate. From my research, I'm engaged in multidisciplinary applied climate projects that brings scientists and stakeholders together at the table so that climate information can help inform management decisions. By way of background on the Climate Office, all but two states in the country have a State Climate Office. Most offices are located within universities, some are located within state agencies. We are a recognized State Climate Office by a national organization, the American Association of State Climatologists. Our role and mission is to deliver science-based climate services at the local and state level. We accomplish this by monitoring current and emerging climate conditions, engaging with stakeholders to understand their needs and by working to serve those needs. To give you an idea of our level of engagement with climate data users, on an annual basis we serve approximately 500 individual weather and climate data and information requests. We travel around the state to deliver approximately 50 talks to a range of audiences on various weather and climate topics. We give radio and television appearances each week discussing the short-term weather outlook. We write and distribute a monthly climate summary, something we just started a few months ago. We provide local input to the U.S. Drought Monitor and also serve on the state's Climate Assessment and Response Committee that is run out of the Department of Agriculture. Many sectors are represented in our customer base. The primary ones being the University Extension, Department of Natural Resources, Department of Agriculture, Nebraska Emergency Management, crop consultants, water managers, insurance, legal firms, municipalities, schools, the general public. It's a very broad range of customers that we serve. What our work really boils down to essentially is this: We serve as translators for our broad user community. Through our engagement with this community we take complex climate information and deliver it in a meaningful and actionable way. Climate change is not a specific focus of our office but, rather, climate in general. There are many scales and aspects to climate. For example, this could mean historical conditions or trends. It could mean El Nino or La Nina weather extremes and their associated impacts for the climate outlook for the upcoming season. That's probably our most common question that we receive. The climate change and future climate projections is a growing area of interest from our stakeholders and we're increasingly asked questions related to this topic. Questions such as, what does climate change mean for Nebraska agriculture? What does climate change mean for Nebraska forests? These are very common. So what we do to answer these questions is interpret

climate projections available from various outlets in a meaningful way for whatever sector we're talking to. In terms of my federal research grants, I'm currently working on two projects related to climate information and decision making. One is geared toward delivering useful and usable climate information for corn and soybean producers in the Midwest U.S. The other project involves working with municipalities in Nebraska, Kansas, Missouri, and Iowa for the purpose of incorporating climate change information into city planning decisions. And finally, our office is involved in what is called "issue teams" with the Nebraska Extension. You'll be hearing from somebody within Extension a bit later today. There's team focused on weather and climate variability as it impacts farms and communities. This team structure within Extension is relatively new and consists of Extension educators engaging with the learner community in terms of what their needs are related to climate literacy, scenario planning, and weather-ready farms. So I hope this information gives you a flavor of what our office does and offers insights into how our expertise could be utilized in the effort of developing a climate action plan. I personally feel that a climate action plan is a worthwhile endeavor and thinking about how to incorporate climate information into management decisions is a worthy effort. So that concludes my testimony. I'd be happy to answer any questions that you may have. [LR455]

SENATOR HAAR: Good. Thank you. Any questions? Yes. [LR455]

SENATOR PANSING BROOKS: Thank you for coming, Dr. Shulski. I am wondering...so you're talking about...you're dancing around climate change in a way, right? Is that what's happening? Because I hear "climate variability," "a climate action plan" that...where "change" is not in any of that discussion so...which may be a good decision. And I'm...so I'm just trying to understand. Do you have...you're saying you think it's a good idea to have a climate action plan, which sounds similar in many ways to people saying climate change plan. I'm just trying to again grasp this. And...do you...you said it's a good idea to have a climate action plan. So your group, the Nebraska State Climate Office, does not have a climate action plan? [LR455]

MARTHA SHULSKI: We do not currently. [LR455]

SENATOR PANSING BROOKS: And why is that? Why...it seems like the perfect thing that you guys could do. [LR455]

MARTHA SHULSKI: Right. So we're relatively...we're a new office. We were just formed January 1 of this year. So Nebraska has always had the position of State Climatologist, but never a formalized State Climate Office. And so that happened...the university put resources into place to make that happen on January 1. So we're an office of four people, so myself, and an Extension educator, four full-time people. And I also serve as faculty. And then we have two people who are involved with our statewide weather network and they deal with management and operations of that. So...and maybe this didn't come clear in my testimony, but we're not a state climate change office, but we're the State Climate Office. And so we have to cover all... [LR455]

SENATOR PANSING BROOKS: It was clear. I'm just interested in that nuance. [LR455]

MARTHA SHULSKI: Right. Yeah, and you know a part of it is on purpose. We deal with lots of different groups and if we go in there pounding the pulpit and talking climate change, initially then we're going to turn people off. And so I find myself really walking a very fine line in terms of how I talk about climate and climate change. And often you can talk about climate change without actually using the terms. [LR455]

SENATOR PANSING BROOKS: That's why I've been asking these questions, whether or not we need to change the way we talk about it. If there are needs that...I mean, obviously climate variability is an issue that affects our state, so if people are closing the door because the word "change" is placed in there, then maybe it is the way we phrase it. Maybe it is the way that we just look with a vision. I don't know. I mean, obviously, a whole group of people has worked very hard for decades on climate change and we understand that, but if it's not getting through to people, I like the idea of climate variability and a climate variability plan and looking at climate information across our state and how it affects our number one industry. So anyway, I was just trying to clarify again. I'm hearing these words and the words matter, so I'm just interested. [LR455]

MARTHA SHULSKI: They do, yes. Good question. [LR455]

SENATOR PANSING BROOKS: Thank you for your input. [LR455]

SENATOR HAAR: Yeah. The course you teach, who is that course for? [LR455]

MARTHA SHULSKI: It's Natural Resource Science 104. It's...Climate in Crisis is the name. So it's open to all majors. Typically, we have about 30 students this semester. It's mostly natural resource science students and those that are located on East Campus, but it's open to all majors. There's no prerequisites. You know, we welcome people from nonscience majors. That's kind of the point of the course is to get everyone to the table and talking about climate change. [LR455]

SENATOR HAAR: Uh-huh. Do you have an idea, like we couldn't specifically pin down who teaches future teachers, especially science teachers and so on. Does that fall within...well, I see a head shaking so we'll ask that question a little bit later. One of the things I handed out initially was that survey and it showed that, you know, where across the board like 15 percent of, nationally, people said they believe in anthropogenic global warning and so on. But in that class it was 56 percent. Do you see that young people get it? [LR455]

MARTHA SHULSKI: The young people that I engage with, they do. And in the course that I teach we talk about the idea of the Six Americas and so I give my students...I have them take that, you know, where do they see themselves, and we talk about that. And they're certainly on the one side of the spectrum where they're engaged and involved and believe, so to speak. And we talk about even the question of believe versus nonbelieve. So that's covered in the class and that's something I see where the youth that I engage with are more on the one side of the spectrum. [LR455]

SENATOR HAAR: Uh-huh. Uh-huh. Now the class I dealt with at...or talked to at Lincoln High School, and Lincoln High School is a very diverse population and so there were all kinds of people in that room, colors, and nationalities and so on, and yet we got 56 percent saying they believe in climate change and that we can do something about it. So I'm glad to hear what you said. I think, across the board, young people tend to get it more than old white men, like me. Now you're called, and you kind of addressed this, but you're called the Nebraska State Climate Office, not the Nebraska State Weather Office. Make that distinction real clear. [LR455]

MARTHA SHULSKI: Weather versus climate? [LR455]

SENATOR HAAR: Yeah. [LR455]

MARTHA SHULSKI: So weather or...weather is the clothes I'm wearing today and climate are the clothes in my closet. And so climate covers various scales. It covers historical, going back to period of record. It covers going into the future of, you know, climate change scale. So we're covering the whole spectrum here, whereas, weather is typically kind of a short term, what's going on day-to-day. So we try and kind of separate ourselves from, say, a weather forecast office, but we're a Climate Office. Obviously, weather is a big part of that and we're concerned about the weather, but we're concerned about all scales of weather, looking back in time and looking into the future. [LR455]

SENATOR HAAR: Uh-huh. And from what you said, people get that, right, that it's not just weather but you have to look at how the weather is changing? [LR455]

MARTHA SHULSKI: That's actually of...I think, I do find that a lot of people confuse the term "weather" and "climate" and use them interchangeably. So that's a point that I make often when I give talks, is talk about the difference between "weather" and "climate" and what do those terms actually mean; when should they be used. So I could see where there needs to be some education in the broader community of the difference between the two. [LR455]

SENATOR HAAR: Okay. By the way, I've used your quote of "weather is what you wear today" and I've used that a number of times. (Laughter) [LR455]

MARTHA SHULSKI: Good. I hope it's helpful. [LR455]

SENATOR HAAR: I like that. It makes sense, so. Well, again, we'll be using you as we develop a recommendation for a climate action plan, I'm sure. We appreciate your new office, wish you good luck, and thank you for coming today. [LR455]

MARTHA SHULSKI: Thank you very much. [LR455]

SENATOR HAAR: Okay. And next we have Dr. Mike Hayes who is going to give us an overview, sort of, of the climate initiatives in the Nebraska Institute of Agriculture and Natural Resources. And so I would say probably if you're looking at Tabs...we're back again to 20 and then he will talk about other things as well, so. Tab 20, as in the School of Natural Resources. [LR455]

SENATOR PANSING BROOKS: I don't have anything in 20. [LR455]

SENATOR HAAR: Okay. Well, we missed you then. Make us a note when you hand that back and we'll make sure you get something under 10, huh? [LR455]

SENATOR PANSING BROOKS: Is there supposed to be something in all the tabs, because...? [LR455]

SENATOR HAAR: No, not at first, but this...starts off: Climate Variability and Climate Change Capacity. [LR455]

MICHAEL HAYES: Ready? Okay. [LR455]

SENATOR HAAR: Yes. [LR455]

MICHAEL HAYES: (Exhibit 6) Thank you, Senator Haar. Good morning. My name is Michael Hayes. Michael is M-i-c-h-a-e-l, and Hayes is H-a-y-e-s. I'm a professor with the School of Natural Resources at the University of Nebraska. I've worked with the university for 22 years. In early October I stepped down as the director of the National Drought Mitigation Center, a position I have held for almost ten years, to assume a more traditional faculty role within the School of Natural Resources. Thank you for the invitation to participate in this hearing. My comments today address some of the existing capacity within the School of Natural Resources at UNL that could potentially assist the development of a state climate action plan. As mentioned earlier, and in testimonies to come, UNL has tremendous expertise in topics covering food security, water security, energy, natural resources, climate resources, and other related topics relevant to climate variability and change, sustainability and resilience. This expertise exists

across many departments within institutes like the Daugherty Water for Food Institute, and you'll hear about that later, and centers. And all of this expertise creates a tremendous scientific foundation to inform the development of a state climate action plan. The tag line for the School of Natural Resources is, from earth to sky and everything in between. This is the perfect representation of all the activities within the school. SNR is home to three mission areas: applied ecology, environmental science, and the applied climate and spatial sciences. It is also home to the Conservation and Survey Division and multiple centers, including the Nebraska Cooperative Fish and Wildlife Research unit that Don Wilhite mentioned earlier. This unit trains graduate students and conducts research often with an emphasis on long-term resilience issues. The remote sensing center in SNR, CALMIT, is focused on tackling issues at the food, water, climate nexus utilizing innovative spatial science technologies. The packets of information I provided today illustrate examples of the capacity that exists within the School of Natural Resources. I've labeled each document at the top of the page. Document one is a two-page brochure, highlighting the research support provided by the High Plains Regional Climate Center. Similar to what you just heard described by Dr. Shulski moments ago, the High Plains Regional Center provides an archive of regional and national climate data and decision-making tools utilizing current and past climate information. The center is directly connected with NOAA, the National Oceanic and Atmospheric Administration. Document two is a brochure highlighting the drought management resources available at the National Drought Mitigation Center. These resources includes decisions for tools for users at a variety of scales and sectors. Drought planning and the support for drought planning is one of the traditional activities that the National Drought Mitigation Center has considerable experience with across the country and around the world. The NDMC is also closely connected to national networks such as the National Integrated Drought Information System, or NIDIS. With drought planning, the lesson learned is that it is a process, not an event. It is a process that begins with understanding the background, to building appropriate monitoring strategies, to understanding vulnerabilities, to looking for solutions, all the while working continuously with stakeholders throughout this process. It is a process that encourages revision and updates as conditions change and technologies evolve. The NDMC, the NU Public Policy Center, the Department of Community and Regional Planning, other folks within SNR, and others at the university can share these experiences about the planning process, which I think would be very helpful for the state climate action plan. Document three is a description of the Climate Masters of Nebraska course. Education must be a key component of a

climate action plan. This Climate Masters course has been offered multiple times and it is unique because it is open to both university students and to the general public, potentially K-12 teachers, for example. The goal of the Climate Masters course encourages participants to better understand climate variability and change, and how individual or local actions toward sustainability build community resilience. The second page of this document, which is still document three, is a list of the topics covered by the Climate Masters course the last time it was offered. These topics are adjusted each time the course is offered, incorporating new materials and topics as they arise. I teach a course called Climate and Society, and document four is the lecture schedule when I taught this course this past spring. It is a course designed for all students, undergraduate and graduate, from any discipline, to understand both the impacts climate has on society as well as the impact society has on the climate. Document five is a printout of PowerPoint slides illustrating some of the other capacities within the School of Natural Resources that provide a foundation for information into a climate action plan. Slide one highlights the centers that exist within SNR. Slide two highlights the course offerings that incorporate climate issues and climate change into that particular course. Slide three highlights some of the linkages SNR has with programs focusing on climate and resilience, including UNL Extension which you'll hear about this afternoon; the USDA regional climate hubs that Don Wilhite mentioned earlier; the regional climate science centers within the Department of Interior; and the NIDIS regional drought early warning systems. These linkages provide a network of amazing scientists and stakeholders to collaborate with when developing a climate action plan. Slide four provides a sample, by no means exhaustive, of journal articles published recently by SNR faculty and staff as either the lead authors or as partners. The wide variety of topics and scientific journals featured in this list also illustrate the national and international climate networks linked with SNR. Slide five provides a sample of recent dissertation and thesis titles being pursued by master's and Ph.D. students within SNR related to the topics of climate monitoring, adaptation, and resilience. While not an SNR program, slide six highlights the university's Holland computing center, which provides tremendous supercomputing resources. These resources are necessary when looking at big data issues such as climate variability and change. It is also a facility that links NU researchers with researchers working on similar issues around the world. It plays a key role in the development of research partnerships. A state climate action plan must depend on a foundation of science. It will also need the communication and team work that University of Nebraska resources can potentially supply to the development

effort. The wide range of linkages that UNL and SNR provide will be key to the engagement of stakeholders necessary in order to develop a state climate action plan that is relevant for Nebraska. Thank you very much. [LR455]

SENATOR HAAR: Any questions? Well, I have a number of questions. Thank you very much for your testimony. And again, what you've shown is in particular in the SNR, the School of Natural Resources, there's a broad range of research going on and the three functions again of a land grant: research, education, and outreach. And all of those are happening. I guess a question I have, and this is going to be entirely opinion-based on your part. You mentioned, for example, grants from the National Science Foundation, etcetera, etcetera, and from branches of the government. If we have a president who is saying, you know, I don't know if he has exactly said, I don't believe in climate change but at least skeptical, will all that go away? [LR455]

MICHAEL HAYES: That's a great question. So over the past couple of decades we've seen pretty wide swings in the shift of how the federal government provides support for climate and climate change related studies. And I am hopeful that we will not swing the pendulum back too far the other direction now, but I think that support at the federal government level is very important for providing the resources for many of these universities, including UNL, to provide the science that goes into this. And if those resources become limited, it's going to definitely increase the challenge, but I think it actually might hurt some of the efforts going forward. I don't see how it cannot be a negative to some of those. [LR455]

SENATOR HAAR: But I've heard some concerns that all this will go away, but you know, Senator Pansing Brooks brought up, do we always use the word "climate change" and the word is, you know, we don't, but other terms like resiliency and sustainability are ongoing concerns no matter if you believe in climate change or not, especially when it comes to agriculture. [LR455]

MICHAEL HAYES: Yeah, those are really very questions and I think that discussion is an excellent topic of discussion. You know, we have all gone through those thoughts and those ideas and some of it is jargon, you know, sustainability and some of that...those terms. And so sometimes those terms can get held hostage by the fact and I think climate change is one of those. And so one of the ways we try to move past that is by saying climate variability and

change, and hoping that people are okay with that. Climate...the study of climate in its own right, it's highly valuable. We have extreme events regardless of climate change, droughts have occurred in the past. They occur today. They'll occur in the future. And so the study of climate is still extremely valuable. Even if climate change was not occurring, I think I would be here testifying to you today about the importance of a climate action plan for the state of Nebraska. I think it's highly relevant that we're prepared for extreme events, natural disasters, all these things. And I know the Nebraska Emergency Management Agency is working on a state natural disaster mitigation plan. I don't know exactly what the term is, but yeah, so Mary Baker at Nebraska Emergency Management is working on that. And she's involved in the university to help her with that, so. I don't know if that answered your question or not. [LR455]

SENATOR HAAR: No, I like your thinking. Sometimes words and phrases get held hostage and often it's political behind that. There's something I'll hand out to the committee called Let's talk climate messaging to motivate Americans. And this little survey I handed out came from that. So I'll give that to the committee. Do you find, too, that young people get it more, so maybe you haven't had that kind...exact experience? [LR455]

MICHAEL HAYES: No, I think that's a great question. So I think it might vary where you are, who the young people are that you're talking to. So when I teach my class, young people being college age kids in this case, usually they'll take my class because they're very interested in the climate change issue. So they've already gotten it. But one of the things they like is the fact that I bring into that class all of the different perspectives so why would someone be potentially against the issue of climate change, or why would the Evangelical community struggle with some of that philosophy. And the students really appreciate that and they...one of the things I get back in the feedbacks from those courses is, it's been really helpful for us to hear the different perspectives and why people actually might be opposed because then that allows us to go forward and maybe address some of those concerns going forward, so. From that perspective, I'm encouraged. But I also think there are some of the communities out there where it's really tough to get into that community and I think we still need to work to do that. I think there's work ahead in that area. [LR455]

SENATOR HAAR: My schedule for this coming spring is pretty open right now, maybe I can sign up for your class. (Laughter) [LR455]

MICHAEL HAYES: It would be welcome. In fact, I need to be thinking about that going forward. Thanks for that suggestion. [LR455]

SENATOR HAAR: Yeah. Well, thank you and as people...as senators are coming and going, there's a lot of hearings going on today and so please don't take that as interest or noninterest in terms of people being in their chairs. [LR455]

SENATOR PANSING BROOKS: I have one more question. Sorry. [LR455]

SENATOR HAAR: Yeah, go ahead. [LR455]

SENATOR PANSING BROOKS: Sorry. Thank you for your thoughtful presentation today, Dr. Hayes. I guess I'm interested in what the...can you give me an indication what the Evangelical groups do not like, because that helps? [LR455]

MICHAEL HAYES: Oh, yeah. Because I am actually within the Evangelical community so that's my community and sometimes I just say, oh, no, why do you think that way? But a lot of it is, you know, right from the beginnings of Genesis, God gave man the right to rule the earth and He will take care of us, and we don't need to be thinking about trying to control or change the weather climate because He is in control of those things. And so who are we to think that that's something that we can actually override God's will on? So I think that's one of their ways to think about it. The way I turn that around is talk about the role of stewardship that is right up-front there and in Genesis as well. The other things is, and this was brought up in some of the answers from the other testimonies, is that it's political. A lot of it gets back to politics and a lot of that community is very much tied to one side. And so I think that plays a big role in it too. So, you know, I had a Bible study a couple of weeks ago. We were going around introducing ourselves. I said I was in the climate field and you could just see the walls come up on faces. And so, that's frustrating. It provides me with an opportunity, maybe, to try to make headway in that community, but I really appreciate the question. [LR455]

SENATOR PANSING BROOKS: Well, I appreciate your answer. You know, I also liken it to the study of health because health isn't just reactive, it's proactive. [LR455]

MICHAEL HAYES: Absolutely. [LR455]

SENATOR PANSING BROOKS: And in the same kind of way we're talking about the health of our beautiful gift of our earth. And again, we can be reactive, which is what we're doing,... [LR455]

MICHAEL HAYES: Right. [LR455]

SENATOR PANSING BROOKS: ...no matter whether you're looking at whatever cause it is. [LR455]

MICHAEL HAYES: Right. [LR455]

SENATOR PANSING BROOKS: But to be proactive and to see what we can do and how we can...if we are going to react, to have a plan on how to be reactive. [LR455]

MICHAEL HAYES: Absolutely. [LR455]

SENATOR PANSING BROOKS: It's something that doesn't seem the antithesis of what those who believe in, you know, every word of the Bible. It seems like that aligns with and I do like the stewardship idea as well. [LR455]

MICHAEL HAYES: Yeah. Yeah. [LR455]

SENATOR PANSING BROOKS: So I appreciate those thoughts and that way to communicate more effectively with all people in bringing people to the understanding that we do need to protect our earth and to be able to wisely look at and respond to climate variability. [LR455]

MICHAEL HAYES: Yeah. Thank you very much for those comments. [LR455]

SENATOR PANSING BROOKS: Thank you. Appreciate it. [LR455]

SENATOR HAAR: Anything else? Well, thank you very much and again we will be using you as a resource. Okay. Yes. [LR455]

DON WILHITE: Could I just make a comment? One of our eight round tables focused on the faith community. [LR455]

SENATOR HAAR: Don, you'll have to come up to the chair here. [LR455]

DON WILHITE: Okay. Just in response to the senator's question, one of our eight round tables focused on the faith community and that one was organized by a pastor who was actually working with me on the round tables at the time. And so it was a very interesting discussion. So you might want to look at that or I could send that to you because there was a discussion. And we had a very diverse group of ministers and different religious groups and so on that came together to discuss this issue in their congregations and how they were dealing with it, so. [LR455]

SENATOR PANSING BROOKS: Wonderful. [LR455]

SENATOR HAAR: And you need to identify yourself for the record. [LR455]

DON WILHITE: Don Wilhite. [LR455]

SENATOR HAAR: Okay. [LR455]

DON WILHITE: Okay? [LR455]

SENATOR PANSING BROOKS: Thank you, Dr. Wilhite. [LR455]

SENATOR HAAR: Okay. Thank you very much. And now we get to Tab 17 and the question of climate change to the Law College. And we have Maggie Wittlin, who is going to address a very

interesting topic that she's been working on. And I appreciate it...if I don't always get titles correct, I've always had trouble with titles and... [LR455]

MAGGIE WITTLIN: No, that's fine. I'll restate. [LR455]

SENATOR HAAR: ...would call my university professors by their first name, and...(laugh). [LR455]

MAGGIE WITTLIN: That's fine. [LR455]

SENATOR HAAR: Okay. [LR455]

MAGGIE WITTLIN: (Exhibit 7) Okay, great. Good morning. My name is Maggie Wittlin, M-a-g-g-i-e W-i-t-t-l-i-n. I'm a new assistant professor at the University of Nebraska College of Law. Thanks for allowing me to speak with you today. I'd like to tell you about some research I've done concerning climate science communication. People are divided on climate change, not just what we should do about it but also on whether it's a problem. Some people believe it's happening, it's human-caused, and it presents a large risk; others don't. They think that climate change does not pose a serious threat. This is a problem for democratic deliberation. If the science says that anthropogenic climate change is real and will have negative effects, we want to be able to communicate that to people and have them credit that evidence so we can then debate climate policies on their merits. This problem raises a question. Why do some people fail to credit scientific evidence on climate change and what can we do about it? One theory sometimes tossed around is that people just can't understand the climate science. Some people don't know anything about science, or they don't have sufficiently strong reasoning capacities, so they're easily misled and don't appreciate the value of quality research. If this is why people don't believe in climate change, then one solution would just be to give them more information, give them more and clearer scientific information. If we simplify and clarify the information, people will understand what the research says and they'll accept it. In the article I've handed out, which I worked on with a number of other researchers while I was a law student at Yale, we tested this theory against a competing type hypothesis which we call the "cultural cognition thesis." Cultural cognition is people's tendency to form perceptions of societal risks that cohere with the

values that define their cultural identities. It's a form of motivated reasoning. People are motivated to perceive facts that fit with their world views. We look at two cultural groups mainly, hierarchical individualists and egalitarian communitarians, which loosely map on to social and economic conservatives and social and economic liberals. The more conservative group tends to be pro business and industry. And previous studies have shown that they tend to be skeptical of environmental risk. They intuitively recognize that if environmental risk poses a serious problem, that might call for government interference in industry which motivates them to disbelieve evidence demonstrating risk. The more liberal group tends to be suspicious of industry and they tend to credit claims of environmental risk. They find it congenial to believe that certain business practices should be restricted so they're motivated to believe evidence demonstrating that climate change poses a risk. The culture cognition thesis then is that people aren't divided over climate change because some people don't understand it. People are divided over climate change because their cultural world views motivate their risk perceptions. If this is true, then just giving people more and clearer information isn't going to mitigate the division because people will interpret that information in light of their cultural values. So we tested these two hypotheses by surveying a nationally representative group of subjects. We took three key measurements. One, their cultural values: we asked a series of questions to figure out which cultural group they fall into. Second, their science literacy and numeracy: to test their science literacy we asked a number of science knowledge questions like, do antibiotics kill viruses as well as bacteria; to test numeracy, we asked questions that measured how well the subjects understood quantitative information and how well they could engage in mathematical reasoning. Third, we asked them how much risk they believed climate change poses to human health, safety, or prosperity, and they answered on a scale from one to ten. If people are divided over climate change because they don't understand the science, we would expect people who score highest in science literacy and numeracy to be the ones who believe climate change poses the greatest risk, but that's not what we found. We found a very slight negative correlation between science literacy and numeracy and belief that climate change poses a risk. You can see that on figure one which is on the second page of the article. The graph on the left shows what we'd expect to find if the hypothesis were true. The graph on the right shows what we did find. More interesting perhaps is figure two on the third page. People who were higher in science literacy and numeracy tend to be the most polarized on the issue of climate change. Those people who knew the most about science and are most capable of dealing with quantitative information are the ones who most interpret the evidence to

favor their own side, independent of which side that is. One of my co-authors observed something, I think even more powerful at a recent study. Those people who know the most about climate science are most polarized in whether they say that they believe in human-caused global warming. This suggests that people disbelieve evidence that climate change is occurring, not because they can't comprehend it but, rather, because they're motivated not to credit it. So just giving people more information probably won't help. Instead, people communicating climate change science should work to make this information less culturally divisive. They should use communication techniques that remove the cultural meaning from this information. There's currently research being done on how to communicate science and how to deliberate science policy in a deep polarizing way, much done by the lead author on this paper, Dan Kahan. Researchers have achieved some success using culturally diverse communicators and they've had some success with communicating information about the risk in conjunction with policy solutions that might be more appealing to this hierarchical individualist group, like geoengineering as opposed to regulation. Kahan uses the southeast Florida Regional Climate Change Compact as an example of climate science communication done right. Counties in southeast Florida have lots of open meetings and forums done on the local level which allow citizens to see people they know personally supporting the use of science in addressing the problems posed by climate change. And those people are working across party lines. So the fact that this is a nonpartisan Legislature and committee, the fact that you're looking at how the state can adapt as well as mitigate climate change problems, I think that all points to promising nonpolarizing communication, but I hope you'll keep the need for nonpolarizing communication in mind as you move forward with your work on the committee. Thanks. [LR455]

SENATOR HAAR: Wow. How interesting. Any questions? Yeah. [LR455]

SENATOR PANSING BROOKS: Thank you for this. Wow. So do you have examples? Did you test nonpolarizing communication? [LR455]

MAGGIE WITTLIN: So we didn't test it in this study. Here we were just kind of looking and asking people, do you believe in climate science. Again, the lead author on the study has been starting to do work on that. I haven't participated in that yet myself. One early study used cultural communicators who are kind of counterintuitive so you'd have somebody who would be...I

mean, I'm not sure if that was in the climate change context or another polarizing science contacts, used somebody who based on how they appear on their position, you might believe them to be of a different cultural group than the one that they are advocating through their testimony. So you might take somebody...if you had somebody in the extreme, like from the oil industry coming in and talking about climate change, that would be culturally counterintuitive and might bring people from a certain cultural group in. The geoengineering study kind of framed the communication and the context of more adaptation and mitigation, not through regulation but through human ingenuity, finding a way to counteract climate change by doing something else, not by restricting business. And that had some success, I believe, in depolarizing people on that. But I think what Professor Kahan is most optimistic about I think is discussing things on a very local level and what southeast Florida has been doing with their communication, which I haven't gone too far into, although I could send you the papers that he's written discussing what they're doing down there. [LR455]

SENATOR PANSING BROOKS: Okay. I just...I guess I'm just interested in, you know, is the issue...I mean, it's how you ask the question clearly in any of these studies. So if you're saying do you...I mean, was the question based on climate change due to human...is that the...? [LR455]

MAGGIE WITTLIN: Yeah, you know, you have to look at the phrasing of the question. I think it was just, do you believe that climate change poses a risk to human health, safety, or prosperity? I'm trying to see if...how much risk do you believe climate change poses to human health, safety, or prosperity? So it wasn't phrased necessarily in terms of anthropogenic climate change. [LR455]

SENATOR PANSING BROOKS: But again, the phrase "climate change" is the phrase that means a lot to people. [LR455]

MAGGIE WITTLIN: Possibly. We haven't done testing, to the best of my knowledge, comparing "climate change" versus "climate variability" as you were discussing before. [LR455]

SENATOR PANSING BROOKS: I'd just be interested if, you know, if the question were, do you believe that changes in climate will affect our future or, I mean, the changes occurring? I don't know, I mean,...or the variations that are occurring today make a difference? [LR455]

MAGGIE WITTLIN: Yeah, it seems wholly possible. Right? It certainly seems plausible to me. Again, I haven't seen a rigorous study of it done. One other thing that Professor Kahan has done in a different study, the one where he tested whether knowledge about climate science produces belief in climate change risks, he prefaced each question he asked about what's going on in terms of climate change science with just the phrase, "according to climate scientists," or "climate scientists believe that." So they kind of took away the expressive power of answering yes or no to something actually happening. So he would ask, you know, climate scientists believe that sea levels will rise in the future or something like that. And people would be much more willing to answer that with a yes than they would just being asked, climate change will make sea levels rise in the future. So that's one way that I think you're right that phrasing is very important. But I can't say that I've seen climate change versus something else in the research. [LR455]

SENATOR PANSING BROOKS: Thank you. Thank you. [LR455]

SENATOR HAAR: How interesting. Any other questions? In Tab 17 where the interim dean of law responded, I mean, I was kind of interested, for example, that how law is getting into this area of climate change. Eric Burger who is studying the standing of people who talk about sea level rise. So, I mean, the issues of law and climate change are ramping up, aren't they? [LR455]

MAGGIE WITTLIN: Yeah, I mean they're vast. I'm not an expert in any of those specific areas, so I can't speak to Professor Burger's standing research or water law, and how that's dealing with agricultural law and how that's dealing with climate change, but certainly, I imagine would have an impact on a large number of areas. [LR455]

SENATOR HAAR: Uh-huh. Yeah, and we're...this state, we're really familiar with water law... [LR455]

MAGGIE WITTLIN: Yeah. [LR455]

SENATOR HAAR: ...challenges and I hadn't quite even thought of that as part of climate change, but... [LR455]

MAGGIE WITTLIN: Right, can be, yes. [LR455]

SENATOR HAAR: Good. Well, thank you so much for coming up. [LR455]

MAGGIE WITTLIN: All right. Thank you very much. [LR455]

SENATOR HAAR: Okay. Tim Hemsath is now going to--from the College of Architecture--talk about climate change and architecture. And that is Tab 13. And again, the flavor of what we're trying to do with this hearing is to give an idea of the breadth of areas that touch on climate change and the research that's going on, postsecondary...research education and outreach that's going on at postsecondary education in Nebraska. [LR455]

TIMOTHY HEMSATH: Well, thank you. [LR455]

SENATOR HAAR: Okay. Would you start by saying your name and spelling it? [LR455]

TIMOTHY HEMSATH: Sure. Timothy Hemsath, that's T-i-m-o-t-h-y, Hemsath, H-e-m-s-a-t-h. I'm with the College of Architecture at the University of Nebraska-Lincoln, associate professor there. I've also served leadership in the Nebraska Community Energy Alliance. I'm also past chair of the Nebraska Flatwater Chapter of the U.S. Green Building Council, and do research with faculty at the Durham School for Architectural Engineering and Construction as well as UNO's Center for Urban Sustainability. I'm here today because I know energy and buildings, and I say energy because that's a direct measure of how CO2 emissions primarily occur within the built environment. And so I want to provide a context for energy use in the building sector, and then from my statewide involvement, the challenges facing the built environment. As Dr. Perez mentioned earlier, the building sector consumes nearly half of all the energy produced in the United States and 75 percent of all electricity produced in the U.S. is just to operate the built environment. Globally these percentages are even greater and the building sector was responsible for nearly half of U.S. CO2 emissions in 2010. By comparison, transportation accounted for 34

percent of CO2 emissions and industry just 21 percent. And so as you already may know, the Energy Information Agency ranks Nebraska 37th among states in total CO2 emissions with 53 million metric tons in 2015. Another study by the ACEEE, Nebraska ranks 42nd in the 2016 State Energy Efficiency Scorecard, scoring poorly in energy generation and transportation sectors. To give you a little context, in 2013 Nebraska's residential sector emitted close to 3 million metric tons of CO2 and commercial buildings were responsible for 2 million metric tons. To put this another way, in 2015 the monthly average Nebraska home consumes 962 kilowatt-hours in just electricity, which is equivalent to 310 kilograms. If we look at that annually, that's 11,554 kilowatts or 3.7 metric tons of CO2 emissions. Most people have a 30-year mortgage on their home, so after that period that's 111 metric tons, which happens to be a polar bear is about a metric ton so that would be 111 polar bears of emissions you'd have in your backyard sitting there for you. According to the Intergovernmental Panel on Climate Change, carbon dioxide emissions from fossil fuel energy used directly or as electricity to power equipment and condition the air, include both heating and cooling, within these buildings is by far the largest source of greenhouse gas emissions in the building sector. In another report, the Intergovernmental Panel on Climate Change suggests the energy supply sector emissions are expected to continue to be the major source of greenhouse gas emissions, ultimately accounting for the significant increases in indirect emissions from electricity use in the buildings and industrial sectors. And so I think the question you're asking today is, what does this mean for Nebraska? And when we discuss energy use and the built environment I think, one, it's a regulatory issue of codes and how current building codes are outdated. I've participated in the Nebraska Energy Office's 2014 study of commercial energy code compliance. Some of the issues were...dealt with who's responsible for enforcement of energy codes. I say energy codes because all buildings should, in theory, comply legally by that state-mandated code. But in 2010, only 64 percent of residential homes were compliant with the 2003 International Energy Code. And in 2014, only 83.2 percent of commercial buildings were compliant with the 2009 IECC. States receiving ARRA funding are expected to be 90 percent compliant by next year and then who knows what the consequences of failure to comply with that would be. With existing buildings, obviously they consume a lot of energy but, beyond code, new and existing buildings have no standard by which to measure their energy consumption; therefore, we don't know what greenhouse gas emissions individual buildings have. However, some professional AE firms in Nebraska, such as BVH Architects, DLR Group, Leo A. Daly, and HDR, have signed on to

voluntarily reducing their emissions of buildings they design to zero by 2030. Programs in monetary support exist to improve existing housing energy efficiency but many homeowners are unaware or uninterested in utilizing these resources. Research also suggests that these dollars and other tax incentives are utilized by wealthier households. Infill of urbanized areas has been shown to have a lower carbon emission...have lower carbon emissions than greenfield developments, due to leveraging existing utility and transportation infrastructure which produces less burdens on communities. There's a lot one can do to improve the energy efficiency of a building. However, current market forces and low cost of energy provide little to no incentive for energy efficiency and renewable energy sources in Nebraska. In my experience as an architect in Nebraska is builders really lack a reason to do anything different from conventional building practices. A select few home builders do exceed code compliance and offer housing 50 to 70 percent better than conventional built homes. There's little profit in energy efficient construction in Nebraska, as well as consumers may see little financial impacts for making energy efficient upgrades. So I'm going to go off my script and skip to the end. You can read that if you want. The role of design, since I've heard a lot of the other people testifying talk about the contribution of their college, our college is a little bit different. It's not a scientific-based college. It's more of a professional-based college in training architects, interior designers, landscape architects, and community regional planners. These disciplines shape our built environment, our cities, as well as our buildings and interiors that we live in. As such, they play an important role in thinking about how we occupy and inhabit this planet. And since we talk about design, we talk about a way of thinking that is more...is not deductive, it's not about a scientific experiment, but it's asking how might we question, a "what if" question, in learning to play and speculate in an uncomfortable situation where the answer is not clear, and the problem may not even be clear. And so we teach students in our first year of design thinking how to approach these big questions and ill-defined ones, as you might say, wicked problems is a term that's been used, and think through these wicked problems to come up with solutions that might actually address some of the more complex issues. I think this way of thinking is very appropriate when we talk about climate. We talk about using the word "change." I think our way we kind of approach thinking is through this design approach because a building ultimately is a complex system, has to integrate not only us, which is unpredictable, but all the other things that make our lives and habitation of those buildings successful. So I just wanted to make that little comment about design because I didn't have that in my comments. And so the challenges of reducing CO2 emissions and

minimizing the consequences is a design activity. For example, retrofitting existing buildings, if not done properly by qualified individuals can degrade the indoor air quality. Densification of urban areas can increase light pollution, heat island effects, and increase ozone levels. Both have serious effects on public health. As my resource has highlighted, zero-energy housing and retrofitting existing homes can have unintended consequences on indoor air quality. Additionally, the improper orientation of housing has a long-term community cost related to utility bills and expenses. And only if these homes were...have been oriented properly, these costs could be avoided. In efforts to adapt to climate change and reduce CO2 emissions, care is required that the right policies, expertise, and foresight is employed to not create future problems. And as a historic perspective is 1976. President Carter looked to coal to diversify our nation's power infrastructure and that's the very fuel source now we're trying to get away from. Today, we're looking to a missions free renewable energy as a source of power. However, wind and solar are not able to meet our dynamic consumption needs as reliably as coal does. That being said, communities across Nebraska, such as Central City and Bellevue, among others, have or plan to invest in large-scale renewable energy systems to reduce their reliance on coal-fired power. I thank you for this opportunity to present today. Happy to answer any questions you might have. [LR455]

SENATOR HAAR: Are there any questions? Well, I appreciate very much your coming in to talk about this and certainly you're topic of architecture is something that where what has happened in the past was not what may be in the future, so. Yeah. [LR455]

SENATOR PANSING BROOKS: Well,...oh, did you have something, Senator Larson? [LR455]

SENATOR LARSON: No, go ahead, please. [LR455]

SENATOR HAAR: And then we'll get to you. [LR455]

SENATOR LARSON: You always work out to in. [LR455]

SENATOR HAAR: That's right. (Inaudible). [LR455]

SENATOR PANSING BROOKS: Okay. Thank you for coming today. I appreciate it, Professor Hemsath. I am just wondering about...early on in your testimony you talked about the EIA ranks Nebraska 37th among states. I presume that's 37th worst on CO2 emissions. Is that what your testimony is, or is that...is 1 the worst or...? [LR455]

TIMOTHY HEMSATH: When I write this, I had assumed 1 as the worst. I have to go back and double-check to see that that's the case. So Nebraska doesn't rank poorly in my mind on that. [LR455]

SENATOR PANSING BROOKS: Okay. I just didn't know if...I mean, if they're ranking on total CO2 emissions... [LR455]

TIMOTHY HEMSATH: Yeah, I don't think Nebraska is...that's not a poor ranking. That's pretty good. [LR455]

SENATOR PANSING BROOKS: Okay. That's what I was trying to figure out for sure, because it isn't exactly clear. So I guess I'm in...if that's the case then...okay. Thank you, that's what I...if it was the 37th and it was the worst, you know, heading towards the worst ranking, I had other questions. Thank you. [LR455]

TIMOTHY HEMSATH: Yeah, sure. [LR455]

SENATOR HAAR: Okay. Senator Larson. [LR455]

SENATOR LARSON: One of the things you said struck me a little bit and I know Senator Mello and Senator Haar worked with it last year in terms of financing homeowner's projects in terms of getting more green. And this Legislature passed PACE and we're looking at possibly expanding it to county levels. But do you feel that...and I'm not sure if you know what the PACE program is and that's fine if you don't. It allows, well, low-interest financing that's paid through property taxes after you update. Do you think that there's...that if we were able to create avenues for homeowners, more avenues, that more homeowners would work to make their homes more

green, because right now I think what you kind of said is there's just not enough avenues for them to look at? [LR455]

TIMOTHY HEMSATH: Yeah. No, being on the board of the Nebraska Community Energy Alliance, we've discussed PACE funding a lot and it's a great opportunity for communities to really diversify and improve the building stock that they have. So I think there's a great opportunity in that program to provide additional avenues for homeowners to improve their buildings, so I think that's a good program. [LR455]

SENATOR LARSON: Would you say--I guess that kind of goes to my second question--if we were to create more avenues or create added funding sources, do you think homeowners would use those as well to continue to build the infrastructure in their own homes? [LR455]

TIMOTHY HEMSATH: I think I can't speak for all the homeowners. It's a tough question. [LR455]

SENATOR LARSON: But in general. Obviously, not all homeowners, but... [LR455]

TIMOTHY HEMSATH: Yeah. Yeah. I think, you know, from the conversations we've had with the various communities who are involved with Community Energy Alliance, which is Wayne, Central City, South Sioux City, Grand Island, Lincoln and so forth, it's both a possibility. You know having that possibility to access those phones but also then making sure that homeowners are aware of the process that's involved in procuring that, because information doesn't always flow downhill like you might expect. You know, the city administrator for Wayne laments the fact that every year they set aside community funds to make weatherization improvements, but nobody taps into those. And so there's something else that needs to be done to make that awareness. What that is, I don't know off the top of my head. [LR455]

SENATOR HAAR: Okay. I think we probably want to explore that a little bit more, her question, because I know according to the EIA the per capita consumption in Nebraska is one of the highest in the nation. So I don't know how that all dances together. [LR455]

TIMOTHY HEMSATH: I was thinking that on my drive here, too, that if I didn't have a cold and had a clearer head I might have presented more clarity on that number there. [LR455]

SENATOR HAAR: Then...or obviously architecture students are...have to look towards the future. So is there an actual course in climate change or is that just assumed as you go along? [LR455]

TIMOTHY HEMSATH: Our college offers Architecture 107, which is the Sustainability in the Built Environment taught by Dr. Sharon Kuska in our college. It's open to all students across the university to take. And that's probably the course where that issue is addressed. You'd have to talk to her about the specifics of the content of that course, but I know she's been involved statewide with the Joslyn Institute for Sustainable Communities, so...which I have been in McCook talking about climate change, so that's been fun, ten years ago. [LR455]

SENATOR HAAR: Good. Well, thank you very much for coming today. We appreciate it. [LR455]

TIMOTHY HEMSATH: Yeah, thank you for the opportunity. [LR455]

SENATOR HAAR: Okay. Next we have Nick Brozovic. Did I say that right? [LR455]

NICHOLAS BROZOVIC: Perfect. [LR455]

SENATOR HAAR: Perfect. Okay. Water policy responses to climate change. And as he will tell you, he is from the Daugherty Water for Food Institute and one of the great resources at the university when it comes to this area of climate change resiliency and sustainability. Okay. Would you start by saying your name and spelling it and then... [LR455]

NICHOLAS BROZOVIC: (Exhibit 9) Certainly. Well, good morning, special committee members. My name is Nicholas Brozovic, that's spelled N-i-c-h-o-l-a-s B-r-o-z-o-v-i-c. I am director of Policy at the Robert B. Daugherty Water for Food Global Institute at the University of Nebraska, as well as an associate professor in the Department of Agricultural Economics at

UNL. Higher education has two important roles to play in helping the state of Nebraska to plan for extreme climatic events such as extended droughts. First, much of Nebraska's economy depends on agriculture. The production of food and fuel, as well as the business and industrial activities that support agriculture, is greatly affected by climate. Having the best information available, and a deep understanding of how climate can impact business, represents an important competitive advantage. Within the University of Nebraska system, there are world-class experts in disciplines such as atmospheric science, agronomy, engineering, and agricultural economics. These researchers can help in understanding and planning for current and future climate. At the Water for Food Global Institute we have partnered with both public and private sectors to analyze the impacts of climate on food and water security. Our products are used to improve water management and food production around the world. Second, while future droughts and climate extremes create challenges, it's also important to acknowledge the opportunities for Nebraska and for the state's higher education system. As other states and countries increasingly develop and implement their own climate action plans, there is demand for talented scientists, engineers, water managers, and policy and finance specialists. This is an important opportunity for the University of Nebraska and the state's higher education system. Nebraska is an ideal place to train students that will become a climate-smart work force that understands how to thrive in complex and increasingly stressed systems. In summary, the University of Nebraska, including the Water for Food Global Institute, has the leadership and experience to provide advanced climate information and decision support to policymakers, the business community, and the public. Thank you for your time. [LR455]

SENATOR HAAR: Very good. Any questions? Yes, go ahead. [LR455]

SENATOR PANSING BROOKS: Well, thank you for coming. I really appreciate it. And what I like hearing about, and I think maybe part of the issue that's going on, because I keep sort of likening this to the world is flat theories of like, you know, think back to that time and people coming forward and saying, no, we really do have all the information that you need about why the world is round. And so, yes, we really do have all the information, the university, you know, the Daugherty Institute, the...I mean, all these people coming forward and saying, we have this information, how about a plan? And it's just...this is still hard for me to wrap my mind around, but I really like the fact that you're coming forward and talking about opportunities. Maybe part

of the problem is that people are just like so tired of hearing the doom and gloom, and maybe, you know, I think that's true on a number of the initiatives that we have before us in the Legislature. If we talk about opportunity and economic development and looking at how we can move forward positively as a state dealing with some of these issues, and bringing in talented scientists and engineers, I love all of that. That's a great...that's a great story and maybe that helps people to understand and listen better rather than just saying the doom and gloom stuff that relates to Genesis a little bit. So anyway, I really appreciate your testimony and hope that we can move forward in that positive vein as well. Thank you. [LR455]

NICHOLAS BROZOVIC: Thank you very much, Senator Pansing Brooks. [LR455]

SENATOR HAAR: Any other questions? The Daugherty Water for Food Institute does not have its own distinct faculty as such, does it? I mean, you draw from many colleges, departments and... [LR455]

NICHOLAS BROZOVIC: We're actually a systemwide institute, Senator Haar, so we draw from all four campuses of the University of Nebraska System and we currently have just short of 90 faculty fellows from all disciplines. But that's right, we don't have a department as such. We're not in the college, and so all of our work is, by that nature, quite interdisciplinary. [LR455]

SENATOR HAAR: Okay. You sort of imply in your testimony that all the expertise we have, and we asked earlier if the university were capable of putting together a climate action plan for the state. Do you see that? What would be your opinion on that? [LR455]

NICHOLAS BROZOVIC: My opinion is that it absolutely would be able to do so. And again, I think I would come back to Senator Pansing Brooks's comments that, again, my personal opinion is that it should be put in terms of economic development opportunities, work force development opportunities, and have the leverage of that knowledge both within the researchers within the university and within the student body to make this kind of a positive outcomes for the state. [LR455]

SENATOR HAAR: Uh-huh. Good. Well, thank you very much for coming. We appreciate it and we will be using you as a resource certainly. [LR455]

NICHOLAS BROZOVIC: Thank you very much. [LR455]

SENATOR HAAR: Okay. Our next testimony is from Biological Systems Engineering, Dr. Suat Irmak, who is going to talk about climate impacts on water and agriculture. [LR455]

SUAT IRMAK: (Exhibit 10) Good morning. My name is Suat Irmak, S-u-a-t I-r-m-a-k. I currently hold an Eberhard Distinguished Professorship in the Biological Systems Engineering Department, formerly known as Agricultural Engineering Department. Throughout my career, I have been involved in researching, conducting scientific research for better understanding the climate, water, soil, and crop production interactions, and not only studying but if you don't deliver and decimate this information, data, and knowledge to the producers and to the citizens, that does not mean much, in my opinion. So I have been conducting extensive Extension outreach education programs in all of the 93 counties in our state since 2003, talking to thousands and thousands of producers, crop consultants, state water management agency personnel, irrigation districts, NRCS or federal agency colleagues. I travel 15,000 to 20,000 miles every year to conduct workshops, seminars, presentations to take the information, data, and knowledge to our citizens, take it to the field, take it to the ground. So that's what I do in my research programs. I have very large climate or change in climate variables impact on agriculture and water resources research program in my team. And in the handout, I just highlighted some of the examples of what I do. We study long-term climate patterns that impact our natural resources. Those variables include maximum/minimum air temperature; solar radiation; precipitation, which is never talked about at the university system, I will say; vapor pressure deficit, which is the area that the...or the moisture demand in the atmosphere. (Inaudible) and I work extensively on soil moisture, soil temperature, and how crop production is impacted by those variables, environmental and climate variables, and how will that impact our water resources. So, you know, I see excellent exchange of questions about the communication of climate change or whatever you call this. You know, I have given 490 presentations since 2004 in different counties in our state. And I honestly never had a single door closed on my face about communication. Whether I used "climate change" or "change in climate variables," which is a

more scientific technical term, in my opinion, or if I use "climate variability," I do get 150 to 200 people in my programs to listen, to learn, and have conversation and idea exchange. I think it all depends on how we communicate climate change topics to our citizens. So, for example, I told to them that in Central City area, since 1890s, minimum air temperature has been increasing significantly. And if I told to them what that means in terms of crop production, then they are listening very carefully. Nighttime temperature usually has a minimum day temperature. And if nighttime temperature increases, then respiration process increases, which is plants utilize their own carbohydrates that they produce during the daytime. They utilize it at nighttime and that process is primarily driven by nighttime temperature. So if minimum air temperature increases at nighttime then that will reduce our crop productive and crop yields. So producers, anybody who is in agriculture, natural resources settings pay attention to that. We talked about maximum temperature change and if maximum temperature increases, which it does in our state, then that would increase evaporation losses that might increase...that would in turn increase evapotranspiration, which is crop transpiration plus soil evaporation component, which in turn increases irrigation water requirement to irrigate our crops in the state. So that is fundamentally important topic for our citizens. So they do listen to those conversations or presentations. So I have conducted with my research team members extensive studies on better understanding how climate is changing; if so, why it's changing. Rather than presenting (inaudible) global numbers, to me, I think it's critically important that we present them local information, local climate. If climate is changing in on a global level in Arctic or in Antarctica, that's great to know it as a scientific...as a scientist and engineer. But I want to know what is happening in our counties, in our state. And then we can provide more relevant local information to our citizens and help them to make very informed decisions in their agricultural production. Again, I don't want to get into too much technical details, but we are showing that growing season length is getting much longer in the last century in different counties in our state, up to 14 days. Growing season length gets longer up to 14 days. And one other important issue that I want to mention, climate is...or changing climate variables have spatial attribute. What I means is temperature, radiation, wind speed, precipitation doesn't change in the same magnitude or direction in eastern Nebraska versus Panhandle. So we have to study the spatial attributes of those variables in each county, and I have done that for the last 13 years with long-term data for every single county in the state. We are showing that the precipitation patterns change in...and I have done...these are some examples from Fremont, from Clay Center, Hastings area to Culbertson to Alliance and these are

some examples in your handout. We are showing that precipitation pattern is changing. Some areas are getting much drier, up to 5 inches of reduction in precipitation patterns, but some areas are getting wetter. But extreme events, extreme precipitation events are increasing. For example, on page 3 on the right upper-hand side, this is a maximum data precipitation amount for Central City area. You can see the precipitation numbers or amounts that are above 2 inch per day are increasing. While this is not really beneficial for agricultural production standpoint because that will increase the chance for runoff, surface runoff, and deep percolation and then nutrient leeching to ground and surface water resources. And crop producers pay really close attention to those topics. And then some examples include that irrigation requirement determination for every single county and I have done that for corn, soybean and sorghum and other cropping systems. On page 4, you can see some examples that in many counties in our state, irrigation requirement is increasing significantly. If we were able to produce X amount of yield back in 1980, using X amount of water, then this, the same amount of water is not enough to produce the same amount of yield today. So irrigation requirement has been increasing significantly. And we quantified that for every single county. On a statewide average basis, on page 4, the upper-right two graphs, showing that up to .8 inch per growing season increasing irrigation requirement for corn and then .7 inch per growing season irrigation requirement increase for soybean. This is very important: .8, almost an inch, in five years that's 5 inches; in ten years that's 10 inches. And then multiply with 9.1 million acres of irrigated acres in the state, that is a huge, huge issue. We extrapolated our research and scientific studies to 820 counties in the Great Plains, and that's on page 5. We have conducted productivity, temperature, evapotranspiration, yield versus water relationships for 800 counties from Texas, southern Texas, all the way to North Dakota, from Iowa to Colorado. That area is about 30...29.5 percent of the total area of our country, so 30 percent of the United States. And then the last graph is, you know, I don't see much attention to...you know, we focus on climate variables, temperature, radiation, precipitation, but in agricultural production standpoint what happens underground is also critical. And the last graph is from one of my long-term studies, research projects where we monitor soil temperature every 6 inches down to--forgot my glasses today--but down to 48 inches every hour since 2008. And then we are seeing an increase in soil temperature. In addition to air temperatures, soil temperature is also increasing, which has significant implications to agriculture and natural resources. So these are very short summary of some of my programs. And I have had the privilege to testify to various committees over the years in our state and also I have been honored

for the last year or so to work with United States Supreme Court on a case that involves multiple states on the very same issues, climate versus water resources versus agricultural productivity and what is happening, how to quantify, how to communicate. And so thank you so much for your time. [LR455]

SENATOR HAAR: Thank you. Any questions? Okay. Well, we appreciate your testimony and also the research you're doing. [LR455]

SUAT IRMAK: Okay. Thank you. [LR455]

SENATOR HAAR: Thank you. Okay, next, and this will be Tab 25, from Doane College we have Dr. Ramesh Laungani. So now we're reaching outside the University of Nebraska and there is a lot going on, so thank you for coming. [LR455]

RAMESH LAUNGANI: (Exhibit 11) Hello. My name is Dr. Ramesh Laungani, R-a-m-e-s-h, Laungani is L-a-u-n-g-a-n-i. Let me start by thanking the members of the Legislature for taking the time today to hear testimony from members of the academic community here in Nebraska about this very important topic of climate change and sustainability. I'm a faculty member in the Biology Department at Doane University. I received my Ph.D. in biological sciences from UNL. My expertise is in the area of terrestrial nutrient cycling with a focus on carbon and nitrogen cycling. In this testimony I will highlight a few key components of how the topics of climate change and sustainability are integrated across a number...all across numerous parts of our campus life at Doane, from course work to student and faculty collaborative research to residence life and student programming to our university's strategic goal to reduce our impact on the environment. We at Doane are committed to educating our students and the public about climate change and sustainability. Before I get to my formal statement, I must first acknowledge that the efforts highlighted here today and their success is a result of dedicated...a dedicated group of faculty, staff, and administrators at Doane. Furthermore, the aspects of Doane University's climate change and sustainability efforts that I speak of in this testimony are not meant to be a comprehensive list but is meant to be...is meant to highlight activities that are emblematic of the work that is done at all levels of our university. So the topics of climate change and sustainability are found across the university at both the introductory and advanced

level. As many of you may know, we are...in Crete, we are an undergraduate institution, although we, at our satellite campuses, we have adult learners who...and we do offer graduate degrees. My statements here today will largely be focused on the efforts at the Crete undergraduate campus. In the Biology Department we introduce the topic of climate change of an avenue for which students can learn to evaluate evidence and draw conclusions based on that evidence, a function that is central to being a scientist. We highlight the preponderance of scientific evidence demonstrating the role that humans play in the impact...in impacting our climate and how those changes impact other parts of our earth biological systems. We also highlight opportunities where there's still questions to explore, so as to show our students that science is an ongoing process. Additionally, we have a number of upper-level courses that emphasize climate change and sustainability. For example, students in my conservation biology class have produced educational materials for the larger Doane community about climate change, the evidence for it, and its impacts. Our students have also carried out a series of tree plantings on campus with the intent to reduce the carbon footprint of the college. Students have designed and planted two pollinator gardens on campus that will help fight pollinator decline, an issue that impacts our human food supply that's also inextricably linked to climate and climate change. In a more formal research lab setting, a number of my students have actively been examining climate change and methods to slow climate change. They've been examining topics ranging from the interaction of elevated CO2 levels and invasive species to its effect on nutrient retention in prairie soils, which has been highlighted here today by some other...by some other folks. Another student is actively building a climate change simulation chamber for classroom use. A tool like this, once operational, will be a resource for all our students at Doane at both the introductory and advanced level. And furthermore, this specific project could provide an opportunity for K-12 classrooms beyond Doane's walls to examine the impacts of increased atmospheric CO2 levels. In other departments at the university there's a lot of action on this topic as well. For example, the Environmental and Earth Sciences Department at Doane offers classes which address climate change, energy issues, and other topics related to the impact of humanity upon the entire earth system. This department is committed to outreach, research, and education in all areas related to climate change. Doane's environmental curriculum was established back in 1974 and was recently updated in 2005. The curriculum is taught by this interdisciplinary group of faculty that spans both the natural and social sciences, from biology to oceanography to economics. This department is also engaged in research including work examining the efficiency of tools like

solar panels that were recently installed at Doane. There are also a number of service learning projects that are directly related to sustainability, specifically examining food waste at Doane, again, all inextricably linked to climate change. Additionally, the Office of Residential Life and Education is committed to educating Doane's residential community on how a sustainable lifestyle can make a positive impact on earth's environment. Their aim is to encourage all residents to adopt a sustainable lifestyle as part of being an overall responsible citizen in their community. The actions of the Office of Residential Life and Education are listed below. Lastly, but definitely not least, our president, Dr. Jacque Carter, signed the Second Nature President's Climate Commitment. By signing this statement, Dr. Carter places Doane within a national network of colleges and universities, both large and small, which are committed to action on climate change and sustainability. As a direct result of the signing of this document, Doane completed its first carbon footprint calculation for the Crete campus at the end of the 2015 academic year. Thank you again for letting me speak and I'm glad to answer any questions. [LR455]

SENATOR HAAR: Yeah. Any questions? So I take it that climate education in one form or another isn't just for your science students. [LR455]

RAMESH LAUNGANI: That is correct. That is correct. It is...a lot of...I will put it this way. A lot of the formal efforts are concentrated in the science department, but because of a variety of outreach efforts within Doane, a lot of our general education students are being exposed to the topics of climate change. And so it really is a university...it's part of the university mission to educate about this critically important topic, absolutely. [LR455]

SENATOR HAAR: Okay. Now, you have a relatively small staff within Doane that are talking about this all the time. How do you reach out? One of the things we're interested in is, you know, how does everybody touch everybody else that's working on this. [LR455]

RAMESH LAUNGANI: Uh-huh. [LR455]

SENATOR HAAR: How do you manage that at Doane? [LR455]

RAMESH LAUNGANI: Well, because we're so close in Crete--I live here in Lincoln--I've actually collaborated with a number of individuals at UNL. I've had speakers from the High Plains Regional Climate Center come speak in my class. You came to speak in my class. And so what's been really great is that we've been able to leverage the other resources locally to make those connections. And Dr. Souchek, who is back there, I know is working collaboratively with a number of people, I don't want to speak fully for him, but at places like UNL and I'm sure other institutions as well. But we are a small staff, but we really think that because climate change is so important we try to infuse it into all parts of our campus life, as I said, from resident hall life all the way through formal education. And we think by doing something by approaching it from that comprehensive perspective, it's only going to do...it's only going to provide an opportunity for our students to understand that this topic isn't just stuck inside the four walls of a classroom, that it affects us every day, whether we're turning up the air conditioning in our dorm or whether we're trying to figure out what food...how far our food travels. [LR455]

SENATOR HAAR: Okay. And I would like to...when that chamber...climate change chamber is ready to go, I'd be very interested. I assume you don't have to live in an enclosed space for months and months and months. [LR455]

RAMESH LAUNGANI: No, this is actually...so, we're trying to actually, with this project, we're trying to make this out of very cheap, accessible materials like Borax and baking soda. When you mix those things together it actually produces CO2. And so, we're...a little aquarium and we're going to be...you could run little experiments in there. And the reason we're focusing on these highly accessible materials is because we understand that schools, both in Nebraska and nationally, globally are under...are always under financial constraints. And so if we can provide, hey, here's a cheap, accessible way for students to study climate change, let's do it. So that's one of the other major goals...it's a major outreach goal on that project. [LR455]

SENATOR HAAR: Good. Invite me down when you have it working and I can see it. [LR455]

RAMESH LAUNGANI: Sounds good. Sounds good. [LR455]

SENATOR HAAR: Okay. Well, thank you so much for coming and we'll be in touch. We'll be using you as a resource for sure. [LR455]

RAMESH LAUNGANI: Thank you. [LR455]

SENATOR HAAR: Thank you. Okay. From UNO, Dr. Beth Chalecki. Did I say that right? Chalecki. I got it pretty close. Okay, if you would say your name, spell it. And then UNO...some of the materials we've gotten are in Tab 12 for the committee members. [LR455]

ELIZABETH CHALECKI: I was added to the roster a little bit late, so I don't have any prepared remarks for you, but I'm going to talk to you about what we're doing at UNO and some of my own academic research. [LR455]

SENATOR HAAR: Good. [LR455]

ELIZABETH CHALECKI: My name is Elizabeth Chalecki, C-h-a-l-e-c-k-i. I am an assistant professor of international relations in the Department of Political Science at UNO. I have been extensively involved with climate change and related issues throughout my career and the federal government in think tanks and in academia. I'm also the director of the Sustainability Minor in the College of Arts and Sciences, and part of my duty as director of the Sustainability Minor is to develop courses to support and expand the sustainability curriculum at UNO. Currently, we have 21 courses attached to this academic minor and we're looking to develop more. I also teach classes on global and environmental politics, global security, international organizations, and straight up international relations, and they all have a climate component to them. So this is, of course, not just a Nebraska issue; this is a global issue. Climate change is a part of each of these classes. I also encourage my colleagues to incorporate climate-related sustainability issues into their existing courses or to develop new ones, that number 21 needs to go up if we're going to field a decent minor with this. I also recruit students for the minor from within the college and eventually from across the university. Our aim is to make this an academic major, and to do that we need to build up our repertoire of courses and faculty competent to teach these courses. The minor is new. It was only started in 2014. But the numbers are increasing and we look to increase these in further years. We had zero students in 2014 because it was brand new. By 2016, we have

about 12. So that's a 12,000 percent increase. (Laughter) We make the point to the students that sustainability, a minor in sustainability, goes with every major, whether you're a humanities major, social science, hard science, business, education. Any major you can have at the university will combine with the sustainability minor. And sustainability is a university level strategic priority. So we are working with a number of different colleges and schools across the campus as well as cocurricular activities to try to increase the profile of sustainability in climate issues from one end of UNO to the other. We have a campus-wide sustainability coordinator named Sarah Burke, and I can pass you her contact information if you would like to have it. She is responsible for coordinating most of these noncurriculum efforts, from organizing campus sustainability day to bringing in speakers and films, various kinds of events that we have. She's been invaluable and the students can go to her and she functions as a sort of clearinghouse for the noncurricular information. As an academic, my own research is focused on climate change and its impacts on national security in international governance, geoengineering and other climate altering technologies, and the role of science in politics and international relations. This is pretty significant because we can see that climate change is going to have an impact not just in the state of Nebraska but on the United States' security and stability of the entire international system. So while most of our environmental education efforts might come out of the sciences, we are in fact doing this from a political science point of view, from an international relations and governance point of view. I've only been in Omaha for two and a half years, but I've given radio and TV interviews about climate and sustainability; I've given guest lectures across UNO and UNL on climate related issues, as well as talked around the country at various councils of world affairs and so on. Most people who think of climate don't think of politics, and people who think of politics don't think of climate, but of course these two things are closely related. I would like to congratulate the state of Nebraska for considering a climate action plan. The IPCC data has made clear, we need to not only abide by the terms of the international Paris climate agreement, we need to go beyond it. This is not sufficient to meet the 2 degree target that we...that IPCC tells us we need to meet in order to stave off catastrophic global warming. After the election results of Tuesday night, this duty may very well devolve to the states rather than being handled at the federal level. The Center for Climate and Energy Solutions has currently ranked the state of Nebraska second worst in terms of having climate...a climate action plan. And the elements of a climate action plan could be implemented out of 25 possible elements. Nebraska only has seven. The only two states that were worse with six were Alaska and South

Dakota and they're both petrol states. So Nebraska has some ground to make up here and I'm extremely pleased to see that this Legislature is in fact doing that. My students are going to be your voters. My students are going to be your consumers, your ratepayers, your producers, and the hot bed of creative activity that's going to generate the ideas to help pull Nebraska out of this second worst position and hopefully into the first best position. It's going to revitalize the economy, as some of my colleagues has already mentioned, and it's going to be a pull factor, not just for UNO but for the whole Nebraska...University of Nebraska System. So I look forward to answering your questions and thank you very much for having me here today. [LR455]

SENATOR HAAR: Okay. Questions? I would have a question, of course. Do you find...I mean, it sounds like you find that young people are interested in climate change who are not just in science curriculum. [LR455]

ELIZABETH CHALECKI: Absolutely. And the sustainability minor, we have an environmental sciences major, and that's mainly biology and geology and geography and so on. But we have the sustainability minor, draws in students from the humanities and the social sciences as well. And they're hungry for this information. They want to know what's going to happen in their lives environmentally. They want to know what they can do to make sure that the planet is as good when they're my age as it is now. So we try to give them this across every possible discipline and that's why I try to stress to them that a sustainability minor relates to every major, whatever college or school you're in. This is something you can avail yourself of. And I'm always happy to do it. So we're excited to grow our curriculum. [LR455]

SENATOR HAAR: So for them, it's more than an intellectual exercise. [LR455]

ELIZABETH CHALECKI: This is the way they live. This is the way they can see their friends living and their colleagues living. This is the way they hope their children will live. And answering these questions is going to be critical for them because they're going to be the ones that make it happen or don't make it happen. [LR455]

SENATOR HAAR: Uh-huh. So from your perspective, what's going to get politicians off their chairs when it comes to climate change on...you know, nationally? [LR455]

ELIZABETH CHALECKI: When I entered in here today I came in on the tail end of the lady who was talking about climate communication. And I think that's going to be critical because it is still unfortunately painted as a partisan issue. But as you ladies and gentlemen know very well, there's no such thing as Democratic air and Republican air, or conservative water or liberal water, or American climate and anybody else's climate. It's all the same climate and air and water. That is reality, I think, that we have to bring home to politicians and I think my students are helping to do that. Lord knows by the time I'm done with them, they get it. But this is something that I think we have to convey to them that it's not only...it's not only the right thing to do to preserve the environment, there's not only a moral component to it, but there is a political and ethical component to it. These students are going to be Republicans and they're going to be vote pro environment in the future. And if you want to be reelected, Senator, Representative, President-elect, whomever, then you need to be able to address this. In addition, I stress to some of the security community that adapting to climate change, some of that is certainly going to be required. But looking at climate change from a security point of view means that we have to understand its ramifications around the world, and this comes back to us in terms of security commitments around the world. So addressing climate change is patriotic. It actually furthers our security to do so. So I think that can motivate a lot of voters as well. Security was certainly a big concern in this past election. And I think casting sustainability and climate change as opportunities for development and growth, and the change that so much of the electorate so badly wants, is exactly the path we need to go down. We cannot continue to consider this a Democratic issue. It's not a Democratic issue. It's everyone's issue. So, I would be happy to talk to any and all politicians about this. [LR455]

SENATOR HAAR: Okay. Well, certainly we're a Unicameral, so we don't have Republican and Democratic air. [LR455]

ELIZABETH CHALECKI: True. I was looking at the Congressional map on The New York Times, and that's what I was thinking of. (Laughter) [LR455]

SENATOR HAAR: Okay. Well, thank you so much for your testimony and your enthusiasm on this topic. [LR455]

ELIZABETH CHALECKI: Thank you. [LR455]

SENATOR HAAR: Okay. Next from UNL we have Rick Yoder. So if you'll say it and spell it. [LR455]

RICHARD YODER: (Exhibit 12) Sure. My name is Richard Yoder, R-i-c-h-a-r-d, Yoder is Y-o-d-e-r. Thank you for the opportunity to present today. The Nebraska Business Development Center is a department of the College of Business Administration at UNO-Nebraska. The NBDC operates out of eight offices statewide helping good businesses become better. NBDC has a highly qualified staff and often works on projects with faculty researchers at the College of Business Administration and elsewhere around the university. I've been there for 20 years. I was first on board as the Manufacturing Extension Partnership and I'm...I've always been looking...working to find process inefficiencies and ways to conserve resources with businesses. For 17 years I've worked with business technical assistance programs in the four states of Missouri, Iowa, Nebraska, and Kansas. They work to increase adoption of what the U.S. Bureau of Labor Statistics terms "green technologies and practices." I've learned much in my career and I've seen a lot of changes in the outreach to businesses over those years. A common approach that's still used by assistance programs is the information deficit model that was referenced earlier today, where everyone is assumed to be a rational actor, where if you give them information they will act upon it. The research does show that this is a limited approach. From what I have seen, only a quarter to a third of the people, at best, will listen to information and choose to change their practices even if it saves them money. Businesses are like people. They have dozens of ways to save money, to streamline their operations just like you do in your everyday life. It's not that they ignore those opportunities. It's just that they're oblivious. It's sometimes called inattention bias. We are creatures of convention and mental shortcuts. So powerful are the forces of our habits, we will continually lose money, time, and profits rather than looking to observe, measure, and change for the better. And if you allow me a little bit of drama, of audience participation, what there is of it, I would like you, if you would, to finish the sentence with the name of a color said loud enough so that everybody else can hear it but not so loud. Okay? So the color of the sky is... [LR455]

COMMITTEE MEMBERS: Blue. [LR455]

RICHARD YODER: Okay. The color of grass is.. [LR455]

COMMITTEE MEMBERS: Green. [LR455]

RICHARD YODER: The color of a yield sign is... [LR455]

COMMITTEE MEMBERS: Yellow. [LR455]

RICHARD YODER: In 1976, the yield signs were changed to red and white. So, you know, we have these mental (laughter) shortcuts, okay, that we always take. That if we're not framing...if we're not evaluating our assumptions and we're not looking at how we frame things, we will always end up in the same place where we've been going. Okay? So what NBDC likes to do is we like to work on putting in new interventions and new frameworks for businesses to operate within so they don't really have to think about the color of the yield sign, but they do have to operate differently. So when this committee develops a climate change plan framework, I hope it will recognize the value of outreach structured to motivate change. People don't always use information, education, skills--they need effective motivation. And so, some of the things that we're doing now...just what we're doing now is focused on motivation and it's not a both...not an either/or approach. It is a both/and approach that I advocate. So of the three things that we're doing, credentials and certifications. As Dr. Hemsath said, buildings consume he said more than 40 percent--that's the number I throw out--of our energy nationally. The 2010 Federal Buildings Personnel Act requires the federal building operators to achieve a minimum level of performance. So NBDC provides training that includes the International Facilities Management Association's Sustainable Facilities Professional, the Building Owners and Managers International High Performance Sustainable Building certificates, the Green Building Initiative's Green Globe Certifications. So the point on all of those are credentialing personal expertise helps build a normative expectation within a peer group. Challenge people: Can we do as well as the federal government in our building operations? That's the way that we like to put it. Benchmarking and reporting: NBDC is among the many technical assistance programs that advocates the use of the Energy Star Portfolio Manager to measure the energy use of buildings and then compare that energy to other similar use buildings. If you recognize that your building or business operates at a higher or lower cost than your peer's, it's a powerful motivator to

change. Framing: This...and we talked about different communication tactics here today. Framing is something that we are always working on and there are many different audiences that are out there. This coming year we are working with businesses around the state to identify which business practices that are used by green business programs around the country make sense for Nebraskans. And many businesses reject the term "green business." They don't want anything to do with it, but it's clear they are interested in learning more about the business case for adopting resource conservation practices. So NBDC and other technical assistance programs around the country have successfully been working to aid businesses, to help them implement mitigation strategy. And we've been doing this for years. Some models have been more successful than others. There are new models that are coming on-line. We don't have them all in place in Nebraska yet, but I'm hoping. And we at the Nebraska Business Development Center are committed to helping good businesses become better and are ready and interested to continue to work on climate change issues if provided the opportunity to do so. Thank you for the opportunity. [LR455]

SENATOR HAAR: Now you notice that all of us up here recognize that yield signs are orange, right? [LR455]

RICHARD YODER: Yeah, I recognized that. I would tell you that even in the youngsters...I mean the numbers change a little bit. It's not a 100 percent, but it's still over half even when they're 26. And so... [LR455]

SENATOR HAAR: Well, I'll notice that next time. But any questions for Rick? Okay. I haven't noticed any businesses who are talking about climate change, but I notice a lot of businesses who are talking about "green" or "sustainability." Could you talk about that? [LR455]

RICHARD YODER: Sure. Businesses like to do the right thing and some of them are branding themselves intentionally to do the right thing. Now, there are many businesses, the larger ones, in fact, that are annually reporting on the Global Reporting Index (sic--Initiative) and that is a sustainability measurement. And so, in annual reports or on their Web sites you'll often find they are talking about not climate change, but they are talking about... [LR455]

SENATOR HAAR: Yes. [LR455]

RICHARD YODER: ...CO2 emissions. They are measuring that. They're reporting that. They're benchmarking that. So I think it depends...I mean, ConAgra, even though they're leaving the state, they were on the Dow Jones Sustainability Index. And within that is a measure of climate change. So there are many businesses who actually measure this and report it. But among the small businesses, the one that we deal with mostly, they do it because it's the right thing to do and they save money besides. [LR455]

SENATOR HAAR: Now, when it comes to investors, we had a bill this past session on divest, you know, from fossil fuels... [LR455]

RICHARD YODER: Sure. [LR455]

SENATOR HAAR: ...and at least it was a discussion. It didn't go anywhere. But that's an increasing...I mean, people expressing their concern over the environment and climate change and so on, through their investment. Is that what you've observed too? [LR455]

RICHARD YODER: I have not seen that among the businesses, no. [LR455]

SENATOR HAAR: Okay. [LR455]

RICHARD YODER: I think businesses are concerned about supply chain and that they have the long-term access to the resources that they need to continue delivering what...their goods and services that they deliver. So that's a different kind of watchfulness over resources. I personally have an issue about investment, but that's my personal issue. [LR455]

SENATOR HAAR: Good. Okay. Yes, question? [LR455]

SENATOR PANSING BROOKS: Well, I just...this is a...I was just wondering if the three UNO people came together and if they have to wait the hour and a half, we could just let... [LR455]

RICHARD YODER: We didn't come together and... [LR455]

SENATOR PANSING BROOKS: You didn't? [LR455]

_____: We tried to. [LR455]

RICHARD YODER: She tried hardest. I had another meeting set up and... [LR455]

SENATOR PANSING BROOKS: I was just wondering about Dr. Kolok. I mean, because... [LR455]

RICHARD YODER: I haven't seen him in the room. [LR455]

SENATOR PANSING BROOKS: ...to have to wait...oh, he isn't here? Okay. [LR455]

SENATOR HAAR: He's not here, so. [LR455]

SENATOR PANSING BROOKS: Perfect. All right. Thank you for... [LR455]

SENATOR HAAR: No. [LR455]

SENATOR PANSING BROOKS: I was trying to be efficient for them. [LR455]

RICHARD YODER: I appreciate that. [LR455]

SENATOR HAAR: And we're pretty much on schedule, so... [LR455]

SENATOR PANSING BROOKS: We are. [LR455]

SENATOR HAAR: ...we will recess until 1:30. And thank you all for being here. Appreciate it. [LR455]

RECESS

SENATOR HAAR: Let's get started. Okay, well, there are all kinds of hearings going on today so we've had people dropping in and out. It's not an indication of anything except there are a lot of committee hearings going on today. As you know, this is the LR455 Committee and our charge is to kind of give an outline of a climate action plan to the next Legislature, and then it's going to be up to champions in that group either to do something or not. So if you'd turn off your cell phones, please. And I've lost all my notes from...no, here they are from this morning. Our page is Brenda from Wakefield. We appreciate you being here in this hot room today. Actually, we set this up to mimic climate change. (Laughter) And so we'll introduce ourselves. Why don't you start, Patty, introduce yourself.

SENATOR PANSING BROOKS: Oh, hi. I'm Senator Patty Pansing Brooks from Lincoln, LD28, which is right here where the Capitol sits. Thank you.

SENATOR HAAR: Oh, so you own the Capitol.

SENATOR PANSING BROOKS: I do. Thank you.

SENATOR HAAR: Okay. I'm Senator...State Senator Ken Haar from District 21.

SENATOR STINNER: John Stinner, District 48.

SENATOR HAAR: Okay. When you come up, please say your name and spell it and also fill out a green sheet. Then just a moment to give the talk again about what I did at the beginning of the first one this morning. You know, we just had an election. We're wondering how things will change. But we know that the climate doesn't care. It's going to go on as it was before, changing and reacting to CO2 and so on. But I have hope and there are a couple things I wanted to mention. One is this survey I passed out and this, as you can see, comes from a document called "Let's Talk Climate," which is really quite a good document. It talks about the language to use and so on. And I used this at a talk I gave to a class at Lincoln High School last week. And the kids fill this out at the beginning, no names attached, and then we tallied the results. And I'd like

to tell you those results. The first one: I believe climate change is due to human activities; we can stop the effects of climate change if we take effective action. Nationally, and this was done as a substitute poll, 13 percent of the population responded to that. At Lincoln High School, 56 percent of the students responded, and again, this was done at the beginning. They didn't know, you know, we didn't know who said what. The second one, I believe climate--and they call this, in the poll, they call this the "persuadables": I believe climate change is happening and I'm not sure what we can do. Nationally, 77 percent of the population fit in that group right now. At Lincoln High School it was 33 percent. And then you get down to the deniers: nationally, 10 percent; and at my Lincoln High School class that was 3 people or 11 percent. But the thing that's very hopeful is 56 percent of the students, and it was a very diverse class of all kinds of colors, all kinds of, you know, gender and age and so on. The second thing that makes me very hopeful is the rural poll that the university conducted in 2015 where the emphasis was on climate change and energy, and 61 percent of rural Nebraskans responded either approve or strongly approved that the state should have a climate action plan. So I think sometimes we're a bit afraid maybe to use those words and maybe we don't always have to use those words, but 61 percent of rural Nebraskans say that they either approve or strongly approve of the fact that we should have a state climate action plan. So I like to look at what our committee is doing as responding to the citizenry and so we go...yes.

SENATOR PANSING BROOKS: Thank you, Senator Larson (sic). Well, I just wanted to add that I wish that on this questionnaire if we could also add I believe climate change is due to natural causes and we can do things to prepare for those natural changes.

SENATOR HAAR: Yeah.

SENATOR PANSING BROOKS: So I mean I think that would get a lot more of the people, of the naysayers, to say, yeah. I mean we all know about the tornado readiness plans that we've got.

SENATOR HAAR: Exactly, yeah.

SENATOR PANSING BROOKS: Every school has a tornado readiness plan, so that isn't even questioned. It's...so, to me, again, it's all verbiage. It's how we ask the questions. It's how we get

people to wrap their minds around it. And I really feel like, again, I'm glad that you have the communications person from the law school. Words matter and we've got to communicate and deal with this from each person's perspective and language.

SENATOR HAAR: Yeah. Exactly.

SENATOR PANSING BROOKS: Thank you.

SENATOR HAAR: Good points. Now just in my own defense, I took this right out of their report because then we had some...

SENATOR PANSING BROOKS: Well, yeah, I'm not...I've not been told.

SENATOR HAAR: (Laugh) No, we had some results to compare it to. But, yeah, certainly language and, you know, do we talk about sustainability, resilience, climate change? How do we talk about that, so..?

SENATOR PANSING BROOKS: Thank you.

SENATOR HAAR: Thank you very much. Okay. Now all the committee members and those that are not here as well are getting a book with the responses that we're getting from UNO and UNL and Hastings and Creighton and so on and so forth. So the testimony that's given today will be added to that book. Okay. So we're going to start then with Brent Adrian from Central Community College. Thank you very much for coming. And for those us on the committee up here, Central Community College is Tab 3 in your notebooks I handed out to you. [LR455]

BRENT ADRIAN: I am Brent Adrian. That's B-r-e-n-t A-d-r-i-a-n. [LR455]

SENATOR HAAR: Okay. [LR455]

BRENT ADRIAN: Well, good afternoon, Senators. It thrills me to be here to represent Central Community College in my capacity as the cochair of the faculty-led Environmental

Sustainability Across the Curriculum Committee. That collegewide committee draws from every academic and technical program in the college, and the college's Environmental Sustainability director, Ben Newton, has provided responses to the written questions that describe the college's commitments to other organizations for a more sustainable future. Since 2011, the college has made significant progress toward our general goals of healthy communities, healthy people, and sustainability. It is not, however, my purpose today to simply cover the same ground as the written responses but, rather, to focus on three key areas where learning opportunities are provided to students and communities in our 25-county service area. These involve curriculum, outreach, and infrastructure. In terms of curriculum oriented towards climate and environmental sustainability issues, every program area in the college has identified specific areas where improvements can be made for the purpose of modeling sustainability behavior for our students. Significant effort has been directed toward implementing climate and sustainability related curriculum into courses in a manner that does not displace curriculum established in our course syllabi and articulated in our course credit agreements with other institutions. In many of the trades and industry courses, sustainability is inherently part of the course. For example, in our automotive and manufacturing areas, recycling of materials and proper disposal of hazardous waste have long been a core part of those curriculum. In areas such as the biological and environmental sciences, we have identified numerous areas of opportunity for climate and sustainability instruction that is consistent with course objectives and competencies. In the humanities, however, it's not so easy. We have found environmentally themed English and speech courses provide students with fresh areas for research, investigation, and critical thinking. But it becomes more challenging in courses such as math, music, history, psychology, and the like. Since the goal of the college is to educate all students across the college about climate issues, we feel strongly that every student should have an opportunity to gain such knowledge and understanding in their program area. To respond to this challenge, Central has created what we call e-badges. I've provided a pamphlet that details the e-badging program that I'm not really able to cover in the time that we've got today. Central introduced our pilot e-badge this semester called "Leadership in Environmental Stewardship" and recently began enrolling e-badge learners. It's currently the college's intention to offer as many as five e-badges in each of the Nebraska career education programs of study. You may recognize that model on the back of the pamphlet. It is used statewide. This will allow our e-badge learners to provide an academic transcript and a cocurricular transcript to potential employers that demonstrate not only that

they're qualified for a position but that they understand the issues and have the skills related to environmental sustainability in their career field. There are three key things to keep in mind about the e-badge program: first, it's free to enroll in e-badging; second, any employee at the college can be an e-badge sponsor as we are all educators in content and modeling our behavior; and third, the college is willing to share with other institutions and the state. All instructional materials will have a Creative Commons or open license, not a restrictive copyright. The e-badge program supporting materials have been developed using taxpayer dollars and taxpayers in the state of Nebraska should not have to pay multiple times for curriculum and cocurriculum development. Central would be thrilled to articulate future e-badge competencies with other colleges in the state. In terms of community outreach, Central is involved in many efforts regarding outreach in the community in our 25-county service area regarding climate issues. We have campus events, community education courses, and the Sustainability Leadership Presentation Series. Yearly events include the Groundwater Festival held on the Grand Island campus for hundreds of elementary school children from surrounding communities. Area elementary students study the importance of water, in general, and the Ogallala Aquifer in particular. The Hastings campus has celebrated Earth Day in April, and we hope to expand that event to an entire week. The Columbus campus will be kicking off what we hope will be an annual America Recycles Day for the first time next week. The college's Communication (sic--Community) Education Department is focused on providing noncredit courses to examine the environment in climate-related areas such as gardening, landscaping, and beekeeping. The learners enrolled in these programs are also eligible for e-badges. For example, the beekeeping course has grown from 10 participants the first year to 20 this year. The success is so notable that it's part of the pilot e-badge program on the pamphlet that I discussed earlier, and the Community Education Department works with the Humane Society, businesses in areas such as tree cutting, pest control, and landscaping, and other organizations throughout the community to help educate about honey bees and other pollinators. This provides connection between local citizens and beekeepers for the safe and timely removal of unwanted colonies and swarms. The college has already started sharing the beekeeping outreach methods at national conferences, and the curriculum, when completed, will be available with an open Creative Commons license for other institutions in the state to use if desired. The Sustainability Leadership Presentation Series is a monthly presentation done in cooperation with the University of Nebraska-Lincoln, UNO Center for Urban Sustainability, Metropolitan Community College, the Joslyn Institute for

Sustainability Communities, and WasteCap Nebraska. These presentations are available through many Internet protocols, WebEx, and on-line systems. Of course, you can do it in person, too, at various sites throughout the state. Central enjoys the cooperation and resources we get from these other colleges and nongovernment organizations. The infrastructure that's being developed at Central is oriented toward making each campus a learning laboratory for climate and sustainability learning opportunities. The college hopes to reach net zero energy consumption in the near future. The building under construction in Kearney is being built with that goal in mind. In Grand Island, we have nearly 300 geothermal wells for heating and cooling the main campus building. The Hastings campus has at least one building using solar energy, and a commercial wind turbine currently under construction will be available for training and educational purposes. Each of the campuses is very different and different technologies need used. For example, wind turbines are not a good option on the Grand Island campus because it's a bird migration area. Our students are able to tour these facilities and learn about their purposes and basic operations. Landscaping on all of the campuses is moving toward natural grasses, and pollinator habitats are being developed. The Columbus campus is currently working with a grant under UNL for development of pollinator habitats, including bee hotels, trails, and gardens. The apiary on the Grand Island campus is used in numerous courses for life cycle studies of honey bees, the beekeeping course, and the public speaking instructor uses the hives and bees to teach different organizational structures for speech development in his environmental issues themed courses. Furthermore, the college has water filling stations, trash recycling stations, and free bicycle rentals provided through a grant in conjunction with Blue Cross and Blue Shield of Nebraska. Obviously, Central is engaged in many climate partnerships locally, statewide, regionally, and throughout the nation. We actively present regarding what we do at national conferences to share the great things being done in Nebraska by the college and with our partners throughout the state. I hope that my testimony regarding our curriculum, our outreach, and our infrastructure have provided the audience in general and the committee in particular a glimpse at the many ways Central is engaged in helping our employees, students, and communities to live healthier lives in an environmentally friendly manner. That concludes my testimony. Are there any questions? [LR455]

SENATOR HAAR: Anybody have questions? Okay, I do. On your first page you say every program area of the college has identified specific areas where improvements can be made for

the purpose of modeling sustainability. I read that several times and, of course, your choice of words, being a speech instructor, are going to be very careful. So when you talk about modeling, so this is actual action kinds of things. [LR455]

BRENT ADRIAN: Absolutely. Central believes that climate awareness begins locally and right in front of you. So, for instance, one of the first things that we started doing was limiting the amount of paper that we hand out in the classroom. Another thing that we have done is made people far more aware of the trash that they use and so we don't have trash cans in the classrooms. We have recycling stations in the hallways so that they're very aware of how much waste they are using, because you have to think twice when you can't just drop it in the trash can wherever you are. We also model behavior in terms of, for instance, with the beekeeping class going out to the actual hives, talking about what goes on there and talking about how, you know, if you've got a colony in your garage, you've got a choice about what to do. And we talk about how Central then sends out beekeepers to collect those hives and then become managers rather than just spraying Raid on them. [LR455]

SENATOR HAAR: Uh-huh. Excellent. Then the little survey I handed out to begin with, what made me smile when I got the results back is how many young people, you know, have at least some level of understanding about climate change and they see it as a real issue. Had I given this to a group of my peers, (laugh) I'm sure that it would have been a much lower percentage. Do you find that young people get this better and why do they get it? [LR455]

BRENT ADRIAN: The approach that we have, as I indicated earlier, is to talk about these things in a local manner, and it's difficult for our students to think about things like saving orca populations in Washington. It's hard for them to really visualize ice caps melting and polar bears and things like that. But they are fully aware of the smells that come out of the Swift meat-packing plant and the damages that the water has done...the effluents that come out of there have done to the pipes in the area. They're perfectly aware the hazardous waste dumped improperly sometime perhaps in the 1950s has created an underwater plume that has led to the shutdown of the water pumps in that area of the west side of the community and that that has also poisoned the wells for many of their neighbors that don't use city water. Our students at Hastings are perfectly aware that the nitrates that have been put on as fertilizer on our farms now are causing

the city of Hastings to have to spend roughly $40 million for a new water treatment facility. And so when we look at the problems that we have right in the community, it makes it very real for them and so we get a very positive response as a result. But we have to keep it local. [LR455]

SENATOR HAAR: Yeah. [LR455]

BRENT ADRIAN: Otherwise, they may think it's a hoax in China or from China or something. [LR455]

SENATOR HAAR: Yeah, it's harder. It's harder. [LR455]

BRENT ADRIAN: Uh-huh. [LR455]

SENATOR HAAR: At some point we'll have a PDF with all of this stuff in it and we can share. We hope that not only are we learning from this, but, as we've talked to all the colleges and universities, that they can learn from each other as well. So we'll get that information to you as soon as we have it. Yes, you have a question. [LR455]

SENATOR PANSING BROOKS: Oh, I just thank you for coming, Mr. Adrian. I just really think it's...I like the fact that you said that you'd be willing to partner with the other institutions so that we don't have to reinvent the wheel every time for each educational institution. And so, you know, and having the state pay for it at every institution is difficult. So I just like that you thought...I hadn't heard anybody say that and I wanted to thank you. [LR455]

BRENT ADRIAN: Well, thank you, Senator. I will share those comments with my colleagues. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

SENATOR HAAR: Good. Well, we appreciate your being here. Thank you very much. [LR455]

BRENT ADRIAN: You are welcome. [LR455]

SENATOR HAAR: Okay. And now we have Tyler Williams to talk about rural climate outreach. And Tyler is with...? [LR455]

KEN WINSTON: UNL Extension. [LR455]

SENATOR HAAR: Yeah. Tyler is with UNL Extension and I believe I put Extension as one of our tabs. If not, we'll add it. But Extension falls, technically, in just terms of a flow chart, falls under SNR, right, the School of Natural... [LR455]

TYLER WILLIAMS: It falls under IANR, the... [LR455]

SENATOR HAAR: Oh, okay. [LR455]

TYLER WILLIAMS: ...Institute of Ag and Natural Resources. [LR455]

SENATOR HAAR: Okay. [LR455]

TYLER WILLIAMS: Okay. Well, good afternoon and thank you, Senator Haar and committee, for the invitation. I'm Tyler Williams, T-y-l-e-r W-i-l-l-i-a-m-s. I'm an Extension educator focusing on cropping systems and climate resiliency located here in Lancaster County. I'm testifying on behalf of Nebraska Extension, formerly known as UNL Extension. I've been in Extension for about six years but I've been in the cropping systems and climate resiliency area for about the last two. My educational background is in meteorology and climatology, as well as some agronomy. I'm a weekend rancher with my father, so I also have a little bit of beef experience as well. [LR455]

SENATOR HAAR: Uh-huh. [LR455]

TYLER WILLIAMS: As you know, Extension is the third branch of the university you discussed today: research, teaching, and Extension. You may also know that many faculty in multiple departments have Extension appointments which is one way that allows them to extend their research out into Nebraska. One of the most valued assets within Extension is the way in which

we reach Nebraskans. As again you probably know, Nebraska has an Extension office in 83 of the 93 counties, but also has a presence in all 93 counties out in the state. Of course, each county is not home to a specific content area, such as a climatologist, so we sort of go through the model of sharing expertise across the state while utilizing that local contact to deliver our programs. I currently serve as the climate issue team leader. This is why you are hearing from me today. I'll explain a little bit more about the climate issue team here soon, but just to give you a little overview of where we've been lately, I'll just give you a recent time line of activities. In the summer of 2014 a group of faculty in beef systems, cropping systems, and community came together to form the climate resiliency team. This was in response to the creation of the publication mentioned earlier: "Understanding and Assessing Climate Change and Implications for Nebraska." This group initialized discussions on how to respond to this report and what can we actually do to help Nebraskans. This group utilized a partnership with the USDA Northern Plains Climate Hub and provided a professional development opportunity to our county and campus-based faculty and staff in Extension on climate change in Nebraska. This was held in 2015. Concurrent to the work of this climate resiliency team, in the summer of 2015 Nebraska Extension sent out a survey to stakeholders to held determine what issues were impacting them and their family. From this survey came 18 overarching issues, 1 of those being climate. This led to the climate issue team, which is tasked with helping agricultural producers, businesses, and communities deal with climate change and variation, as well as extreme weather. This diverse team began to form in the winter of 2016 and is made up of 25 to 30 individuals in cropping systems, beef, horticulture, water, 4-H, irrigation, and community areas. As you can imagine, many of these individuals don't have their focus being on climate, but they do understand the impact that climate can have on their focus area; thus, why they joined the team. This team came up with a few focus areas, which you can see on the triangle in your handout. Climate literacy is the base. It's the beginning sort of foundation of our focus. But as you all heard earlier, that cannot be the sole method to addressing this issue. Climate literacy provides research-based climate science and climate change information, as well as information on the latest tools and resources available. This primarily today has been accomplished through in-person presentations, mostly to adults, in combination with other focus area events or presentations. For example of this I provided a Climate Trends and Projection presentation at the no-till conference in Beatrice last winter, but I tailored that discussion to look at the benefits of no-till farming to mitigate the impact from extreme weather and climate projections in Nebraska. The second focus

area is focused on scenario-based planning which is designed to have a forum discussion with stakeholders in a given focus area while developing a plausible climate scenario that might impact their operation or their industry. We had our first climate scenario planning session this fall with beef producers and stakeholders in West Point and in North Platte. We had climate researchers and educators meet with the beef producers to discuss which climate scenarios impact them the most and how might climate change have an impact on that. There will be follow-up meetings with this same group this winter where we will discuss more in depth the adaptation strategies that they can input to be prepared for and increase their resiliency to these identified climate scenarios. The next area of focus surrounds the Field-to-Market Initiative which is a national consortium of businesses, producers, organizations, and universities focused on sustainable agriculture. Nebraska Extension is piloting a project to utilize the Fieldprint calculator, which there's more information on the handout that I gave you. But this allows farmers to input their farming practices and data into this calculator and it provides out a benchmark to look at the sustainability of their farming operations. Putting an actual metric on sustainability is quite complex and definitely needs more research, but this starting point does provide a value to give some management advice based off given practices. One of the outputs from this calculator is greenhouse gas production and they are able to see how each farming practice impacts their greenhouse gas output and they can compare it to other farmers in their area or their state based off that number. The next round of these meetings with farmers will be held next month. The last of the focus areas is to develop a weather-ready farm certification. This is a certification program that's definitely in its infancy stage, right in the beginning, but the goal is to help producers understand their risks to extreme weather events and make management changes to increase their ability to recover from and be resilient to these events. As you heard today, one of the concerns with climate change is the number and severity of extreme events and these events impact farms in multiple ways. We hope to make this certification a three-step process of education, implementation of that strategy or practice, as well as the certification part. We know many of these changes will not come without an incentive of some sort so we hope to eventually have a financial incentive either through insurance premiums or discounts or interest rate discounts through banks, whatever that may be. We plan to incorporate many partners into this initiative, but again we are at the very beginning, designing stage of this program. UNL also had a display at the Husker Harvest Days this year and last year, and the focus around that was on extreme weather and managing those extreme weather events. We provide educational booths

focused on multiple areas within agriculture and how people can utilize latest information and become resilient to some of those extreme events. We were able to visit with multiple thousands of farmers and people in rural Nebraska about climate and weather and we got mixed feedback but mostly positive, so we gained a lot of information out of that. There are many other climate and weather-related activities that are going on in Extension just because of the profound impact that climate can have on Nebraska in multiple ways. I hope this provides you at least a brief overview of the Nebraska Extension initiatives in the climate area. Thank you again for this opportunity. This ends my testimony. And I would be happy to take any questions. [LR455]

SENATOR HAAR: Questions? Okay. One of the things we've talked about back and forth here is the language that's used. [LR455]

TYLER WILLIAMS: Uh-huh. [LR455]

SENATOR HAAR: Okay. So what language do you use that seems to work best when you talk? Is it "sustainability" or is it "climate change" or what do you find, in your experience? [LR455]

TYLER WILLIAMS: Yes. I've discussed mostly with adult farmers. That's sort of the audience that I refer to the most. And it depends a little bit on the messenger. I found that you can use the words "climate change." A lot of times it just depends on who says them. [LR455]

SENATOR HAAR: Uh-huh. [LR455]

TYLER WILLIAMS: So having an ag background, sometimes I can have those conversations differently than someone that might not. But wording is definitely important. We have found that if you go into a crowd and you're talking about climate change, it may upset one person. They may not like that and it might cause the rest of the group to not speak up, so a lot of times that limits the discussion. So we found that it's easiest to sort of get our foot in the door with "climate variability," "climate variation," and "extreme weather events." When it comes to primarily farmers who I work with, a lot of times their outlook is in the next one to two years. [LR455]

SENATOR HAAR: Sure. [LR455]

TYLER WILLIAMS: That's sort of what they look at in their management practices. They don't seem to think too much about 50 years down the road because they have to make it through the next two. So a four- or five-degree increase in temperature in 50 years doesn't quite bring up the change in practices initially. But if you talk about being ready for the next 2012 drought, that does. So focusing on extreme events seems to have at least a pretty good action on their part. [LR455]

SENATOR HAAR: Uh-huh. Do you ever talk to young men who want to follow in the footsteps of their farmer fathers and grandfathers and so on? [LR455]

TYLER WILLIAMS: Sure. Sure. [LR455]

SENATOR HAAR: And do they have a different understanding of, you know, thinking more of the future or is it the same? [LR455]

TYLER WILLIAMS: In most cases, no. A lot of them seem to kind of follow what's been done, at least in my limited experience with them. I'm sure there are definitely cases that are not that, but it seems a lot of them kind of do what they see being done. That might change if that first generation is no longer making decisions on the farm. They might change those practices. I'll use no-till farming, for example. We've seen the benefits of that, but if Dad or Grandpa doesn't want to change those practices, typically the younger person working on that farm doesn't get that accomplished, to actually change those. So I haven't seen a big shift in younger people thinking necessarily differently other than they have more resources available to them and have been involved in maybe more things related to climate than the older generation has. [LR455]

SENATOR HAAR: Well, even the software and so on I'm sure that farms are using these days... [LR455]

TYLER WILLIAMS: Yes. And that's another interesting point is there are a lot of private industry companies that are using climate data and measurements to make actually on-farm management decisions. It's sort of becoming a second precision ag industry. [LR455]

SENATOR HAAR: Uh-huh. Then we had the one person testify. Who was that again that did all the charts? [LR455]

KEN WINSTON: Dr. Suat Irmak (inaudible). [LR455]

SENATOR HAAR: Yeah. And I'm sure you know him,... [LR455]

TYLER WILLIAMS: Uh-huh. [LR455]

SENATOR HAAR: ...Suat Irmak. Yeah. [LR455]

TYLER WILLIAMS: Uh-huh. [LR455]

SENATOR HAAR: And then his...the data he's collected showing that there are 15 more days, you know, that things are warming... [LR455]

TYLER WILLIAMS: Uh-huh, sure. [LR455]

SENATOR HAAR: ...and I am sure that has a very big impact on... [LR455]

TYLER WILLIAMS: Yes, and that's another thing that we add to our messaging is that not all of the impacts from climate change might be negative. There may be some positives that they could capture out of that. It's...but they have to manage both. [LR455]

SENATOR HAAR: You have to manage both, right. Okay. Anything else that you had in mind? [LR455]

SENATOR STINNER: I kind of like the weather-ready plan. We've changed the "climate plan" to "weather-ready plan." How's that? [LR455]

SENATOR PANSING BROOKS: I like that. [LR455]

SENATOR STINNER: It's catchy. [LR455]

SENATOR PANSING BROOKS: Weather ready. [LR455]

SENATOR HAAR: Weather ready, I like that too. [LR455]

SENATOR PANSING BROOKS: We're going to have the weather-ready bunny. (Laughter) Sorry. [LR455]

SENATOR HAAR: Do any of your activities extend into the public schools or are you mainly...do you mainly work with, you know, people out in the industry? [LR455]

TYLER WILLIAMS: I mainly work with people in the industry. I've done a few youth events, mostly at out-of-school field days. I think once our team gets a little bit bigger and more confident in the subject matter, I think we'll definitely be into some of the schools, if not an out...you know, an after-school program, could just be a school enrichment program through 4-H. But it just hasn't really happened yet. [LR455]

SENATOR HAAR: Good. Well, we appreciate your being here and I like what you're doing. Thank you very much. [LR455]

TYLER WILLIAMS: Well, thank you. [LR455]

SENATOR HAAR: Okay. That will...is the testimony we asked for, and now, in whichever order you can rush up to the front, we welcome anyone who'd like to testify. [LR455]

AARON BOS: Senator Haar, you want to do five minutes? [LR455]

SENATOR HAAR: Sure. Does that work for you, five minutes, or...? [LR455]

DAVID CORBIN: I'm only ready for three. (Laughter) [LR455]

SENATOR HAAR: Okay. [LR455]

DAVID CORBIN: Hello. Thank you for the opportunity to give testimony. [LR455]

SENATOR HAAR: And your name and spelling. [LR455]

DAVID CORBIN: I'm David Corbin, D-a-v-i-d C-o-r-b-i-n. I'm an emeritus professor from UNO. I've also worked on the first Masters of Public Health Program that was originally a cooperative between UNO and UNMC. And I've also taught courses at Creighton University since I retired from UNO. I'm the affiliate representative to the American Public Health Association. The Public Health Association of Nebraska is an affiliate of the American Public Health Association and we have our governing council, which we just came back from our annual meeting where the governing council met. So the American Public Health Association, the biggest public health association in the world, and last year at our governing council we passed a climate change in public health resolution. And one of those things that was recommended in this policy is it calls upon all training programs for health professions, including public health, medical, nursing programs, to include climate change in their curricula. It also urges postsecondary programs in all relevant earth sciences to include instruction on the public health consequences of climate change, and for K through 12 science instruction. As a professor in education, part of my job was to prepare teachers in K through 12 and if they don't learn what they should be teaching or could be teaching, then they're not likely to teach that. So as an example of some creative things that are coming up, the American Public Health Association has teamed up with the American Planning Association to have some programs. The reason I bring this up is because oftentimes people don't think of planning in public health, but this talks about land development patterns, zoning ordinances, land use classifications, impact walkability, access to services, and transportation, all of which are affected by climate change or may actually help to cut down on carbon emissions. So if these types of collaborative efforts are taught about in higher education, then it will help to create more coordinated effort to a healthier society that's prepared for the impacts of climate change. The American Academy of Pediatrics issued a report called "Global Climate Change and Children's Health," and in that they said they should work to promote medical educational opportunities regarding the effects of climate change on the environment and child health. Programs during medical school and residency, as

well as continuing medical education, can inform pediatricians on current and anticipated effects. You've all heard many times about the round-table sessions in response to the original UNL report, but some of theirs say, extending climate change education to all health professions to prepare them to serve a wide range of climate-related health needs. And it asks a question: What research or education gaps need to be filled? The report goes on to recommend that Nebraska should incorporate materials on climate change impacts and responses into state education standards for K through 12 curriculum. Now of course the legislation does not...Legislature does not set curriculum for universities or K through 12, but what they can do is sometimes support grants, whether private or federal, and allow money or institutions to apply for it. I use in here the Innovation Center Campus and also recently the $19.8 million to UNMC on Ebola. So the fact is then that there are many things that we can do. And previously I talked to this group about having a Department of Roads which kind of hampers our applications for grants because we're not a Department of Transportation. So it looks like we're only looking at roads when transportation is important to that. I mentioned before the kinds of things that we could be doing with electric cars, charging stations, what's the future with self-driving vehicles and so on. So there's many...there's a lot of opportunity for education to be broadening it, whether it's economics, whether it's transportation, whether it's the things that you heard about earlier, those excellent programs you heard about earlier. So I think the Legislature can support some of those innovative things. Sometimes it's fifty-fifty. [LR455]

SENATOR HAAR: Ignore the light. Just (inaudible). [LR455]

DAVID CORBIN: Yeah. Okay. So if you get a matching grant from the federal government and the Legislature says, well, yeah, this is a good thing, we'd like to match it, it's those types of opportunities that I'm speaking about. [LR455]

SENATOR HAAR: Good. Any questions? [LR455]

SENATOR STINNER: I do find it interesting, by changing the name to "Transportation" we'd qualify for more grants. I'd like to research that. [LR455]

SENATOR HAAR: (Inaudible). [LR455]

DAVID CORBIN: I can only say that I had talked to some people. I'm not saying we can't get them. I'm just saying when you're competing against...let's say you're trying to get mass transit and you're only talking about roads, you're trying to get better sidewalks or bicycling, it looks as if we don't care about that because of the very name. And you've been talking earlier about words and how important they are and the ones that you use. This I think is a good example. [LR455]

SENATOR HAAR: Uh-huh. Well, as you know, David, you and I have talked a lot about this stuff and the Nebraska rural poll, one of the...from 2015 that dealt with climate change and energy, one of the questions they asked was, who do you trust for information? And third down the list but not far down the list was health professionals. [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR HAAR: Do you feel that enough is being done right now to...so that, you know, an ordinary citizen could come and talk to their health professional or the health department about climate change and that that knowledge would be there? [LR455]

DAVID CORBIN: We've got a long ways to go. I think I've testified before that when somebody is working on, let's say, HIV or tobacco issues or alcohol issues and how they're related to health, it's some...and that's where their funding comes from, it's difficult to say, well, what's...why should I worry about climate change. You know, I've got to do my job. But it is a broad issue and so just like a person in climate change should also be interested in tobacco issues and people that are being killed by drunk drivers, the converse is also true that what's in our air, what's in our water should be of concern to all of us. [LR455]

SENATOR HAAR: Uh-huh. And I get that because it's true of all of us that the thing that's right in front of us gets the most attention. [LR455]

DAVID CORBIN: Right. [LR455]

SENATOR HAAR: So looking at your profession, how do we get people to be thinking future when they've got a barking dog to take care of, you know? [LR455]

DAVID CORBIN: Right. Well, since I've talked about the American Public Health Association, our next annual conference, the theme for the entire conference is public health and climate change. So that's about 15,000 people that go to the conference and then another 35,000 that are members of the organization see that and then they start staying, you know, well, if this is the theme and this is what a lot of the sessions are going to be on, including the main opening session and so on, this must be an important topic. But you know, if it's out of sight it's out of mind oftentimes, so it does have to be brought to the forefront, the policy that I talked about earlier. Those...we're making headway but there's quite a ways to go. [LR455]

SENATOR HAAR: Very good. Okay. Well, thank you very much for coming... [LR455]

DAVID CORBIN: Thank you. [LR455]

SENATOR HAAR: ...and we appreciate your testimony. (Inaudible). [LR455]

DUANE HOVORKA: Good afternoon. My name is Duane, D-u-a-n-e, Hovorka, H-o-v-o-r-k-a, executive director of the Nebraska Wildlife Federation. We are a statewide organization devoted to Nebraska's wildlife and wild places, and we've been working with a growing network of organizations and individuals who are trying to help move Nebraska towards a clean energy future. So I appreciate the opportunity to be here today. We brought you some more specific recommendations about, for the committee, and that's what's on the first handout that you'll get. And then we've also got a few of the measures of how we're doing in terms of moving forward on clean energy, so that's what that second handout is. And to be clear, we think that we'd like to see Nebraska move forward with a clean energy, I guess, a climate change action plan. We think it makes sense to have the university get the resources and the direction, working with state agencies and federal agencies and other institutions of higher learning in the private sector, to help develop at a strategic level those paths for moving us forward. And as you've been hearing all day, we've got a whole lot of expertise at the university, in the system, a whole lot of folks who have a lot of background in this. And so it seems to us that that would be the...that would

make the most sense as sort of the lead agency in terms of moving forward on this stuff. So that's our first recommendation in terms of a climate plan, climate change plan. We also think that we need to incorporate on an ongoing basis climate change planning into the work that our state agencies and our local agencies do. And when you think about the decisions that were being made with respect to natural resources but a lot of other things that have often 10-, 20-, 30-year time lines on them, those decisions need to take into account the latest science that we have. And we've got some examples there that are just examples of why this is important. Certainly with our electric utilities we need to be planning to move towards a 90 percent or 100 percent renewable energy economy. We need to figure out how to adopt and put those renewable energies, wind, solar, and energy efficiency into place, and also how to retire those old fossil fuel units. In transportation, some of the biggest opportunities we think we have is electrifying some of our transportation but also with biodiesel. Biodiesel is a very low-carbon alternative renewable resource and we think that's one of the great opportunities we have for moving our transportation sector forward. In agriculture, to give you a little perspective, if you look at Hall County, Nebraska, which is Grand Island, and you look at the latest United Nations projections for temperature, for summer temperatures and winter temperatures, in about the year 2050, not that far away, the...and assuming rainfall stays about constant, Hall County, Nebraska, will have winters similar to about Wichita, Kansas, by the middle of the century, but summers, during the growing season, about the same as Sweetwater (sic--Nolan) County, Texas. That's a pretty big change. The biggest cash crop in Sweetwater (sic--Nolan) County, Texas is cotton, so that's some perspective on the kind of change we're looking at over the next 20 to 30 years in the ag sector in Nebraska. That's a pretty big change in climate that's coming to us. And so certainly we have a fairly carbon-intensive, oil-intensive, and even water-intensive ag production system in our state, and those are the things that we need to find ways to move toward more sustainable resources and more sustainable ag production that also helps us store or sequester some of that carbon in the soil, where we can take it out of the air, put it in the soil, put it in our ag systems. If you looked at some of the other opportunities we have in terms of buildings and not only updating our building codes to move our new buildings toward net zero but updating our, at a community level, all of the old buildings that we've got in the state. [LR455]

SENATOR HAAR: You can ignore the lights too. [LR455]

DUANE HOVORKA: Okay. Well, I'll... [LR455]

SENATOR HAAR: Yeah. [LR455]

DUANE HOVORKA: I'm getting close to the end. So that's a big challenge. In terms of our business, if you think about the economic benefits to Nebraska of the center-pivot irrigation was invented in Nebraska but it was also Nebraska companies that then produced it and distributed it. The ethanol industry in Nebraska, it wasn't...didn't happen by accident. It was state policies, state incentive, state money that drove that ethanol industry in Nebraska. It's had huge financial implications for the state. We have those opportunities now with respect to biodiesel, with respect to some of the clean energy production, but also some of the sustainable ag production methods we're going to need. And so Nebraska needs to look for those opportunities to move our state forward and to take...to cash out on all those needs that we're going to see here in the U.S. and along the world. And finally, with respect to our natural systems, which of course is our wheelhouse, there are things that we need to be doing to help make our natural systems, our wetlands, our rivers more resilient to the climate change that's coming and to try to use those natural systems to the best of our ability to help take carbon out of the air and to store it in the ground. So we've got a lot of work to do, but we sure appreciate that you're focusing on this and look forward to answering any questions. [LR455]

SENATOR HAAR: Okay. We had talked a little just this morning. We weren't quite sure where our ranking, whether it was high or low. But I'm curious about the seventh--and I've read this before--but the seventh highest state in total energy consumed per person. I know you...this sort of thing really interests you. So what...why is that? [LR455]

DUANE HOVORKA: Well, I've looked at the Energy Information Administration, which is the Department of Energy where this came from, and their explanation is that we have some fairly energy-intensive industries which include agriculture, which include food processing as one of them. And because we're fairly sparsely populated compared to other states, we also have distances to travel in terms of driving around and stuff. And so it's sort of a combination of things. [LR455]

SENATOR HAAR: So that metric doesn't tell us a whole lot whether we're being efficient or not but just tells us where we are as a rank. [LR455]

DUANE HOVORKA: Good question. Yeah, I think that's a good question. And you're right. It tells us how much energy we're using. It doesn't tell us how efficiently we're using it. [LR455]

SENATOR HAAR: Yeah. And I'm really glad you talk about opportunity because so often it's like the sky is falling when we talk about climate change. And there is a bit of falling sky when it comes. So I just wanted to mention that my wife's grandfather in the late 1800s apprenticed as a blacksmith and, of course, he went through the time when horsepower went to, you know, horsepower of engines, and he wound up owning a car repair shop at the end of his career. And so there will be change but there's also a great deal of opportunity. And sometimes I'm just concerned, you know, like when we talk about coal miners, yeah, they're going to lose a lot of jobs, and a lot of it is because of mechanization of the process, not so much even the use of coal. But I think we as a society have a responsibility to help them adapt and change to new opportunities. [LR455]

DUANE HOVORKA: I agree and I think there are tremendous opportunities. And the modeling that we've seen done by the Rocky Mountain Institute and others, even just looking at electricity production, if you go towards, you know, very cost-efficient energy efficiency, towards wind and solar which is getting increasingly cheaper, their models show that over the next 20 or 30 years transitioning to a renewable energy economy is actually cheaper than continuing down our business-as-usual path that we're going now. So it will take change. It will take investment. But ultimately, you know, you got free fuel down at the end of the line when you're talking about wind and solar. And so I think there are some real opportunities that can really keep money in our state and provide jobs in our state and make that transition to a clean energy economy a net win for Nebraskans. [LR455]

SENATOR HAAR: Yeah. Every time I drive down the interstate and I see all the blades going from east to west, we know they've been produced in Iowa and we should be producing. We should have that manufacturing here in Nebraska I think. [LR455]

DUANE HOVORKA: Yeah. [LR455]

SENATOR HAAR: So, okay. Well, if there are no other questions, we appreciate you coming. Oh. [LR455]

SENATOR STINNER: (Inaudible) no one. I'm telling you that we had an opportunity out west actually to have a production facility in Scottsbluff-Gering. [LR455]

SENATOR HAAR: And what happened to that opportunity? [LR455]

SENATOR STINNER: Went to Colorado. [LR455]

SENATOR HAAR: It went to Colorado. [LR455]

SENATOR STINNER: Because Colorado passed a law that said that they're going to put a lot of dollars, a lot of time and energy into wind generation. They have huge, huge, huge windfarms there. [LR455]

SENATOR HAAR: So what we do at this level is we can really be enablers, yeah. Yeah, I drove just from north to south into Colorado, near Kimball, and you go five miles in and you... [LR455]

SENATOR STINNER: It's amazing, yeah. [LR455]

SENATOR HAAR: ...see the thousands of wind turbines in Colorado that produce not only millions of dollars of revenue for the landowners but millions and millions of dollars for the taxpayer (inaudible). [LR455]

SENATOR STINNER: Banner County right south of Scottsbluff is either second or third county in the United States in wind energy capabilities. We don't have an infrastructure (inaudible). Think about that. [LR455]

SENATOR HAAR: So it's not that the wind doesn't blow in Nebraska; it's that we're not using it. (Laugh) Okay. Well, thank you very much. We appreciate it. [LR455]

DUANE HOVORKA: Thank you. [LR455]

SENATOR HAAR: Okay. And were you going to testify? Come on up. And don't bother with the lights. We're not going to time (inaudible). So you have an hour. [LR455]

BRUCE JOHNSON: No, I better not. (Laughter) Don't tell me that. My name is Bruce Johnson, B-r-u-c-e J-o-h-n-s-o-n, Swedish. And I'm here to testify I guess as an independent individual citizen. [LR455]

SENATOR HAAR: Sure. [LR455]

BRUCE JOHNSON: I have sat in on this session with great interest, and having been at the university for most of my career and living in the state of Nebraska virtually all my life, my interest goes very deep on this. But as I was listening to the discussions this morning and this afternoon, all rich and valuable, I couldn't help think of a little concept we used to use in community economics and community and rural development called SWOT analysis--I don't know if that's something that's familiar--but strengths, weaknesses, opportunities, and threats. And when you look at this whole array of climate issues, and then focus Nebraska, you know, in that context, I think it really shows some interesting things. And I think we've hit on all of some of those today. But you know if you think of the strengths of Nebraska, two-thirds of the Ogallala Aquifer volume is under this state. We are rich in land, not just cropland, 20-plus million acres, but about that many acres of rangeland, all of which is a carbon sequestration kind of domain as well as very vital food production and so forth. Energy potential, as we were just talking, amazing. Certainly the spacial aspects give opportunity for a state like Nebraska. And let's not forget human capital that did invent the pivot systems. We're basically world leaders in minimum and no-tillage as far as agriculture is concerned, and going way back to Arbor Day Foundation and etcetera. So you know, the strengths go on and on. Now the weaknesses get to be sometimes the tyranny of the urgent, don't they? [LR455]

SENATOR HAAR: Yes. [LR455]

BRUCE JOHNSON: We just don't have time to look that far down the road, the common citizen doesn't, but neither do the people in leadership positions. When you're facing, what, almost a $950-plus million shortfall for the next biennium, I'm sure that there's too many other things on the plate for this Legislature in the weeks ahead and so, you know, which by the way ties back to kind of a difficult farm economy right now too. So that, too, is tied into natural resource use and management. But besides the tyranny of the urgent, it's the political will, or lack of, that might be a weakness because, you know, we have too many things on our plate or whatever. But let's get on to the opportunities and threats, and if the opportunities is...you know, it really should be, and I like the points just made here about being...seeing the optimistic side of it. You know, this is a problem, pervasive, crisis situation literally if we really give it a good look. And yet it represents opportunity for transforming and changing and adapting to, that perhaps we in Nebraska underestimate our potential, I really do, in terms of looking at it from, you know, just the traction that comes if we as a state would take some initiative now and invest in that for the long run, and provide, as has been done in the past, but those kind of incentives through appropriate legislation, adjustments, and adaptations so that we get the economic traction as well as the environmental sustainability traction. We certainly can do more in the energy area. We certainly can do more in terms of food production and agriculture in this area. And with that comes amazingly resilient kinds of job opportunities. I just talked to a father who was tickled that his 24-year-old son has a job working for a windfarm developer out of California and was proudly saying, and he's making about $50,000 a year and living in rural Nebraska. Those are the things that come up. But, you know, the opportunities for our state, with the rich resources we have, seems to be almost unlimited to make this change. So from a standpoint of economic opportunity but also maybe from the economic standpoint of adaption and risk assessment that's correct, in terms of proactive movement towards risk management, is very, very important. And it takes a lot of players and a lot of people involved. And I just see the State Legislature being a culminating place for good minds to come together and say, let's work on this, getting, basically, a Nebraska climate action plan in place and really see it as not a whole bunch more regulations coming down the board and the bureaucracy but the potential benefits of this, not just economic but in the long-run well-being of the state. So I applaud you for having this hearing and I

applaud you for...and all the people that have come to voice interest and expertise. And would sure like to see this proceed. So enough. [LR455]

SENATOR HAAR: Good. Good. Thank you. Any questions? Yes. [LR455]

SENATOR PANSING BROOKS: Thank you for coming today. I just...again, you're just...you are a part of the valuable information we've received today from so many educators and so many people that really whose opinions I really respect, and I think most of the state does. So thank you for taking the time to come forward and I've enjoyed reading your work in numerous areas, and I appreciate it. [LR455]

BRUCE JOHNSON: (Laugh) Okay. [LR455]

SENATOR PANSING BROOKS: Thank you. [LR455]

BRUCE JOHNSON: Okay. Thank you. Uh-huh. [LR455]

SENATOR HAAR: Now if I'm correct here, you mentioned that we have such a treasure-trove of energy in this state. [LR455]

BRUCE JOHNSON: Uh-huh. Yes. [LR455]

SENATOR HAAR: And it's renewable and it's good, and yet I believe that right now we import more energy from other places than we export. [LR455]

BRUCE JOHNSON: Well, it depends on which utility, I think, we're talking about. NPPD, basically, what, over 50-55 percent of its energy is coal based, so that's coming right out of Wyoming. But as far as the renewable component, you're saying are we using...are we exporting more of the renewables? [LR455]

SENATOR HAAR: I don't think we're exporting any as far as (inaudible). [LR455]

BRUCE JOHNSON: Well, you know, it's all contractual, back and forth. Yes. [LR455]

SENATOR HAAR: Sure. Sure. [LR455]

BRUCE JOHNSON: Yeah. But I do know that LES is already at one-third, one-third, one-third roughly between natural gas, coal, and renewables. So we're moving in that direction but those are things that, you know, we need to be thinking about encouraging more. [LR455]

SENATOR HAAR: Yeah. We've got to go faster. [LR455]

BRUCE JOHNSON: Yeah. (Laugh) So... [LR455]

SENATOR HAAR: Okay. Well, thank you very much for coming. [LR455]

BRUCE JOHNSON: Thank you. [LR455]

SENATOR HAAR: And with that, we will end the hearing for today. Thanks to everyone. [LR455]