2014 Denali Climate Change Course

Final Report

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Contents

Introduction

The Denali Field Camp course, offered through Alaska Geographic, is a four-day immersive teacher professional development course held in Denali National Park. The course focus promotes developing teachers' skills for integrating climate change content into their existing classrooms and/or curricula. A PolarTREC (Teachers and Researchers Exploring and Collaborating) program teacher-leader was a feature of the summer 2014 course; this teacher was involved in the course planning phase, and engaged both formally through giving lessons and informally through casual conversation with participating teachers throughout their field course. The intention of the inclusion of a PolarTREC teacher-expert is to enhance translatability between the experience of doing science as facilitated by the course scientists, and the practical constrictions faced by teachers when they then seek to engage climate change issues and ideas their classroom.

To help investigate the efficacy of the Denali Field Camp in enhancing teacher understanding of both climate change content and ways in which that content can be brought meaningfully into the classroom, Goldstream Group (as part of their work with ARCUS to evaluate their PolarTREC program more broadly) conducted interviews with participants and staff of the program at the end of the 2014 field course. In addition, course staff disseminated a daily survey with similar questions to participants. Staff used the results of this survey to modify course content as the course was happening. Goldstream Group used both the interviews and the survey data to better understand participant and staff perceptions of the role Denali Field Camp 2014 plays in supporting the goals stated above. Interview questions for teacher participants included the following:

1. Describe what you did during the field course? Think about the activities in which you participated, your actions during those activities, and who you worked with during the activities.
2. Describe what you learned during the field course? Think about the climate science content you learned as well as ways in which you might implement the climate science content in your classroom.
3. How did [the PolarTREC teacher-leader] help you understand the climate change science content and how you might apply it to your classroom?
4. How did "being in the field" with a scientist help you understand the climate change science content and how you might apply it to your classroom?

Additional questions covered perceived professional gains, favorite aspects of the course, and suggestions for improvement. See Appendix A for the full list of participant questions. Interview questions for staff members differed slightly and are found in Appendix B. The written survey is included in Appendix C.

Interview Methods and Results

Goldstream Group conducted interviews with five course participants, one participating National Parks scientist, the course facilitator, and the participating PolarTREC teacher-leader. Interviews took place between Wednesday July 30, 2014 and August 26, 2014. Participant

interviews were conducted in the field on the final evening in camp. Interviews with staff were conducted over the phone between two and four weeks after the field camp. All interviews lasted approximately 30 minutes and were recorded and transcribed.

Interviews were analyzed using ATLAS.ti to identify themes that arose within and across responses to the questions above. Quotes are used to illustrate themes; most quotes have been truncated to eliminate some filler words (such as "um") where meaning is not altered by doing so, and to maintain the confidentiality of the respondent. For example, references to specific locations or work titles have been removed. Interview Analysis Results

Major emergent themes from respondent interviews, both with participants and staff, were: 1) linking the field camp experience to the classroom, 2) drawing their own conclusions from experiences and observations, 3) gaining a more-nuanced understanding of science content, 4) appreciating the role of the PolarTREC teacher-leader, 5) valuing proximity to experts, and 6) navigating difficult topics related to climate change.

In several instances, respondents provided answers to some questions as part of their response to other questions, and not all questions were asked. Because of the overlapping nature of many responses, and because emergent themes relate closely to the interview questions despite this, the analysis of the interview data below is organized topically, rather than strictly by question.

Field Course Learning and Strong Perceived Links to Classrooms

When discussing both what a typical day during the field course was like, as well as when discussing what they learned during the course, most participants not only described specific activities and tools from the field camp and used new vocabulary to do so, but also articulated how they would use those activities or tools in their classrooms, in most cases before the interview question covering classroom applications of course content was asked. Specific tools and activities that participants referred to were predominantly the carbon dioxide (CO_2) monitor and its multi-day emissions data collection activity, and using repeat photography activities as well as exploratory observation of landscape features such as deteriorating permafrost.

Carbon Dioxide Emissions Made Tangible: CO_2 Monitor Activity

When asked what they learned, all participants referenced the CO_2 monitors that were demonstrated by the PolarTREC teacher-leader, and linked those field camp activities to possible applications to their own classrooms. Typical responses include the following:

P 3:2 [A]nd then [the PolarTREC teacher-leader] had his carbon dioxide monitor. And so we were pulling that out at a lot of stops and taking measurements and making predictions and taking measurements. And [it was] real easy to see how you could do that in your classroom, how you could have kids …use – you know, if you had one of those at your leisure to use. So that was really great.

P 5:17 [An activity] with that equipment that [the PolarTREC teacher-leader] came up with, measuring the CO_2 is to, like I said, [my] students build model houses. They do drawings and stuff, they build houses. Well, we always do a few little

experiments like just burn a house … you put accelerants in the garage, for instance, in the kitchen, the places where… the most common fires start and burn the house and try to make a lesson out of it and it's fun. Well, I can very much picture building a Plexiglas bubble to put over a house and then have flames going ___ to represent cooking and various things and something decaying, garden around it or, you know, some little rotten fruit that represents a compost pile. That'd probably give you, I bet, enough stuff that you'd get readings from right away…those things seem to be accurate.

P 2:21 I did not know about the carbon cycle that well. I don't remember it. It's not anything I really had since school a long time ago. So I didn't really know about the carbon cycle, very little. So working with these experiments and understanding the carbon cycle was, was really probably huge for me because, um, I think that's very common that a lot of people don't understand when you're talking about greenhouse gases what that really means, you know, because gases, it's abstract. You can't see it. You can't taste it. You can't feel it.

Participants valued the CO_2 monitor reading activity because it made tangible the otherwise abstract notion of ppm (parts per million) readings. These two participants provide examples of how working with those readings made tangible the concept of carbon emissions, and deepened their understanding of the mechanics of climate change:

P 4:12 So there was one that we put in the shade, and the carbon reading went down. That was the only one out of all the carbon readings we've taken, and we've taken probably twelve in different places.

Interviewer: What was the purpose behind the carbon readings?

P4: I think – well, mainly because carbon is a main component in climate change, and so it's – and it's also something that I thought was cool that it's right in front of you so you can, like, talk about carbon abstractly, but you can't see it or whatever, but if you see the reading, it's interesting and it makes it an immediate thing, and also you're seeing that it's higher than what it should be. Like, we talked about in comparison to what – and there's – I think it's supposed to be around 350 and, like, some of our readings are in, you know, the 400s, some in 500, so that right there just says, like, oh that's a bad thing, you know, so it gets you thinking.

P 2:23 And also, learning about the baselines because now you have this abstract number. Okay, 460. What does that mean? You know, and, oh, well, 350 is the, you know – was the kind of target number where everything seemed to be working pretty well. And as we move above that, um, that's where we're starting to see, you know, the cautionary, you know, things that are giving us clues that something's happening. So, so understanding that those numbers mean something. And when we did the little sensors, you could see, you know, that – you could actually see where that was coming from, you know, rather than just

some abstract number. So that was very helpful to me…– I don't know if it's just Alaska or where exactly or globally in the 400s. And 1,000 is like, you know, things may not be able to survive… That amped up the, "Ooh, ooh." Yeah, I think everybody understands that as numbers get bigger, you know, things are impacting. And, um, yeah, so that was – that was a, a really big aha moment for me.

P 3:5 Well, it was – it was good because, you know, I knew the carbon cycle, but it was good to actually do the activity where we had to draw it from memory, because I would never do that. Because I'm not a science person. And so it was good to have to try and pull that up from memory and to be like, "Okay." You know, because we kind of got the simples, and then, you know, we were given a few clues to add in the ocean and then the geologic stuff.Like, *[laughs]* I would always look in a book and be like, "Okay." You know, and then if I were to teach it, I would just go from the book and, um – And, um, so, actually, for me, I was like, "Oh, yeah. Okay, okay." And that's – it's a good exercise to do. And then when we were doing the monitoring, it was good to think about, "Okay." … I probably learned quite a bit about the permafrost melting and the releasing of the ancient carbons, and that release of new carbons into the atmosphere. I didn't really understand any of that before.

P 7:18 [The PolarTREC teacher-leader] had the—the CO_2 probes, and we did those I think all three—two days. So I forgot about that. We did the CO_2 probes that he brought, and I think that was something that everyone was kind of interested in. I have probes in my classroom that I have not used yet, um, so that was kind of fun to—to kind of do that, because I think that really helps you visualize what carbon dioxide is doing and you get to talk—that leads into a discussion about the carbon cycle and—and photosynthesis and all of that. So having the equipment there and just playing around with it was kind of a fun thing, too.

Landscape Change: Repeat Photography and Observing Permafrost

All participants also reported learning about permafrost and landscape change through both repeat photography activities and visual observation of landscapes. Again, participants in most cases immediately connected what they learned and did to some form of application of this activity to their classrooms back home:

P 2:10 And then we went down by the Toklat River and we talked about the, um, the braided, um, rivers and how dynamic they are and, um, looked at some of the repeat photography, which I was fascinated with. And I think that's the direction I'm gonna go with, with how I'm gonna bring this into the classroom…just because it, um, it's right up kids' alley. At, at the grade – the grade level I teach, they are detail-oriented. They love to find things and discover things and be detectives. Um, so when you have a photograph and you can give 'em [that] and you can say, "Look at – look at this one, and look at this one. And what are the differences? What do you see?" You know, they, they really like doing that.

P 4:28 I think that's a big part of, like, the repeat photography and just in general, I mean, um, science, I think, is all about noticing and asking questions and being an independent thinker. So that's some of the things that I'm hoping to [take back to my classroom]– like, I know we always wanna have the plan, the lesson plan, but I think it's just kinda cool to get the inquiry-based stuff out there, like, okay, let's just try this and inquiry for me. Like, I don't know what's gonna happen.

P 2:4 A permafrost lens had completely melted and slid off the side of a hill and created the landslide over the road. And that was kind of interesting because I remember reading about it, you know, that they had a landslide in Denali, and they had to clear it and everything. You know, I just figured there was lots of steep hills, and rocks fall down, and they block the road. That happens, but I didn't know why. The fact that it actually was a, a bigger deal than that and, um, something that was very unique, a real unusual phenomenon. So they had a, um, a chance to study that and see what that, that was.

One teacher made an explicit connection between the repeat photography activity and new curricular standards at her site:

P 2:8 So, so I – so now what, what I like about [the repeat photography activity] is they presented me with this information. They had resources, you know, that I can go to and use with my students, especially with, um, the new standards where there's a lot of, um, nonfiction, a lot of science reading and writing. So, um, so it goes really well with those, um, standards on – you can – you know, you can see the photographs, but you can also read the descriptions. You know, so you're going to be introducing vocabulary. And then for me, with the art piece, you're looking at a landscape. So you can introduce the art terms: foreground, middle ground, background, atmosphere, perspective. You've got an art lesson right there looking at the repeat photography.

Other teachers made connections between repeat photography and becoming more aware of the historical aspect of climate change science. The following exemplifies these responses:

P 5:12 I learned there's all the little things, you know, like…the repeat photographing and how the vegetation is changing going up… the slopes of the mountains and, I of course read [the pre-course readings about these changes], but it was – when we actually saw the photographs, went into the mountains and saw them, it – it was more real, and, so I got – I got, I guess, a reminder of how important history – the historical part of science is, you know.

Participant Perceptions of Staff

While two of the interview questions focused on the PolarTREC teacher-leader and park scientists specifically, many participants and staff reported positively on these individuals' efficacy in response to questions about what they did and learned, before the staff-specific questions were asked. Responses were overwhelmingly favorable, and highlighted depth of

staff knowledge, and ability to answer questions patiently and in a supportive, non-judgmental way. In one case, a participant noted the disparity between the PolarTREC teacher's example classroom and her own less-affluent classroom.

Appreciating PolarTREC teacher-leader

All participants felt strongly that the presence of a PolarTREC teacher-leader serving as a teacher-leader during the field course aided in their ability to translate their field course experience to their classrooms. Several participants focused on how the PolarTREC teacher-leader showed how the technology of the CO_2 monitor was within reach monetarily through grants for classrooms with limited budget, and more practically, through an easy learning curve for both the teacher and the students:

P 2:26 [H]e made this little homemade sensor thing. Science doesn't have to be inaccessible, like you have to have fancy equipment or stuff. You know, he uses his ingenuity in making something portable, easy to use… it's a teacher being very practical, you know. Knowing that your school is not going to be able to buy, you know, 30 of these little sensors, but you might be able to write a grant to get a couple and how you can use just a couple with a big group… [H]e has an understanding of [climate science and related technologies] that is so much more advanced than your average teacher because that's what he – you know, that is his focus.

P 4:19 And also, he's a teacher, so knowing the instruments, that was one of the things I was hoping to gain from this course is using what kind of instruments so that I could use this in my classroom, and I might not be teaching [primary] grade forever. I'm licensed up to eighth grade for science, so, um, I'm – I wanted to know about, you know, what we could put into the kids' hands. Um, so that was really cool. I'm hoping to get one of those carbon readers.

P 5:9 Having [the PolarTREC teacher-leader] here was great because he's actually a classroom teacher. So he was a – I mean, he was able to get out the equipment and he had some of the same little problems and glitches that you would have in a classroom. You know, like, oh, you know, he's letting us run some of the equipment and one of us forgets to press the Go button, and you get the thing done or, you know, just – just actually getting the hands-on experience of using the equipment and seeing whether… this is simple enough that I can use it or not, you know.

Other staff also remarked on the PolarTREC teacher-leader's ability to bridge science and teaching. A representative comment:

P 8:3 [T]the main function he seemed to serve was kind of like the—basically the glue that held everything together. He kind of had the general technical background about some of the physical properties involved with climate change. He had a pretty broad knowledge of the literature and things that…the teachers might actually be called upon to teach when they got back. And he sort of helped me

and the others of us that were involved kind of pooling our information and helping it relate back to what the teachers might be dealing with. And in addition he had a lot of experience in actually teaching this material, and so he was able to provide a lot of insight on how this information could be presented to students.

One participant, however, did remark on the socioeconomic difference between the PolarTREC teacher-leader's classroom and her own, and continues to feel doubt about how she would integrate this technology into her classroom:

P 3:7 Well, he just came with this – these great technology pieces… [T]hose carbon dioxide monitors are pretty awesome. And, um, and I think the, the thing about [the PolarTREC teacher-leader] and his teaching is he works with these super smarty-pants advanced kids from I think a pretty rich school district, which is not where I am.

The PolarTREC teacher-leader was also valued for his ability to recast his explanations of and questions about the content, both as a model for how participants might do the same for their own students, and as a strategy for helping participants themselves with comprehension:

P 2:27 [The PolarTREC teacher-leader was] making analogies into everyday things. So we had a long conversation about things decaying and what, you know, what levels of carbon there are. You know, carbon that's trapped or ancient versus carbon that's very just organic, you know, on the top of soil or in a tree or something. So that was, um, so he was able to take that concept and make that a little more understandable because he's used to teaching kids. And restating and restating and asking questions and restating, trying to get everybody to understand.

P 4:19 Having [the PolarTREC teacher-leader] here was really cool because, he would answer my questions and – like, and I had a ton of questions. So it was really helpful for – you know, and since he teaches high school, I think it, you know, he could just give me the simple answer building up to the complex answer. Um, so it was by no means condescending; it just was, like, level-appropriate for where I am, and, um, so that was helpful.

Finally, the PolarTREC teacher-leader's presence during the field course serves as a model for "walking the talk" – being a teacher who reaches out beyond the classroom to the real world:

P 2: 28 I think more so, too, it was his passion. I mean, he's so passionate about his work. And he's – you know, you can tell that he is a teacher who's taken the next step. You know, he didn't just stay in the classroom. He's reached out. He's become part of a bigger organization and a bigger knowledge base. So because he's reached out, you know, he has access to more, which then he brings to teachers and to students. Which I think is real important. The professional development piece, he's actually walking his, his talk, which is great.

Valuing Proximity to Experts

Participants all valued being is such close, extended proximity to the scientists on the trip. Some participants reported asking lots of questions as they emerged from what the group was observing as they walked or worked with equipment or materials, while others spoke more generally of being able to listen to conversation about the environments they were observing. All participants valued the highly interactive nature of these conversations. Some note how they learned much more this way than accessing books or other media:

P 2:3 I really enjoyed those, those hikes, those hands-on, standing, looking, seeing, testing, you know, all – and picking the brains of these experts in the field, that was wonderful.

P 3:23 [T]he thing is whenever you do something like that, it's such a great experience for yourself, to just go out and, like, see things firsthand, and really have someone explain processes, and ask questions, and really kind of engage you in Denali Park. And, uh, so, you know, going out with the scientists, going out with other teachers and having that kind of professional surrounding was good.

P 4:24 I was able to ask questions. You know, why is that rock white or why do those have… stuff on them or just being able to say, like, can you explain how that happens…like, when you say the CO_2 gets into the water, do you mean that it's in a liquid form, a gas form or, what state is that in? So just being able to ask those questions. And I think it helps that I'm honest. I'm not gonna be, like, oh yeah, the carbon sink, and I really don't know what it is. And it helps because I could just keep having all of these questions, you know, in my head if I didn't. I mean, you have to have a scientist if you're gonna do this class. Otherwise we wouldn't be learning.

P 5:14 [The scientists, the facilitator, and the Polar TREC alumni], they all have actual – you know, they can talk about, "I was up there getting the sheep that used to be here" or "we were doing that monitoring of the tundra out there," you know, and they actually were there and they could actually answer… [T]hey could answer questions like… how did you actually trap the gas? Well, we built these Plexiglas things and they could dig out pictures or pull them outta their iPad or whatever, and to me, that's important. And to my population of students, that's what I've got. I've got… the hands-on kids, tactical learners, and – and I'm that way too, so having someone here that could actually explain it or whip it up and show you or point to the slumping happening, that, to me, helps a lot.

P 7:26 I think it's just having access to that knowledge and sharing that knowledge, 'cause you can—I mean, you can go on the internet. You can… read about it, but I think it's completely different when you're talking to somebody in a casual setting so you feel like you can ask them questions and—and just get that back and forth.

P 7:34 I think that was the best part for me, was just, you know, [the PolarTREC teacher-leader] and [park scientists 1 and 2] and—and other people, um, just listening to them talk about what they do and what they had to say about things.

The PolarTREC teacher-leader valued this proximity as well, and reports gaining insight from extended, on-site access to park scientists. He notes the stark difference between a previous self-guided visit and this expert-guided one:

P 1:13 Having the park scientists there is – again, that was …an all-time thrill to be out in the park with biologists who work there and know it inside and out. I went to Denali…with my wife last year, and we just kind of traveled around on our own. And it was such a contrast this year to be there with a park biologist who could teach and talk about things and put things in context that it was a whole different level of understanding.

Finally, some Alaska-based teacher participants framed the park staff as potential future resources for their students. The quotation below is representative.

P 2:35 Like if – like if they were to come down here, you know, I would be able to tell them, "These park rangers, they, they know a lot. Ask a lot of questions, you know, and understand that they, they are a wonderful resource." But, you know, being in the field with a scientist, again using the vocabulary, the correct vocabulary, making the connections to the big picture, but also understanding the minutiae of everything, and, so that was – that was pretty cool.

Participant Perceptions of Peer Collaboration and Meaning-Making

Some participants report positive, active collaborative experiences with other teachers on this trip. Others report more passive interaction with other teachers. Finally, some participants report anxiety over asking questions in front of the group. Participants frame collaboration primarily in terms of making-meaning together during the experiential learning. Some participants also discuss lesson plan and project collaboration beyond the field course experience.

Meaning-Making: Asking Questions in the Field

Participants, when asked about collaboration, in some cases focused not on more traditional collaboration such as creating lesson plans or projects together or accessing other teacher's classroom resources, but instead on the collective exploratory questioning process that the group engaged in while in the field. The quote below is representative of this focus on collaborative meaning-making during field camp, as contrasted with other experiences attempting to collaborate with teachers:

P 7:33 [Y]ou know, you talked about collaboration. I find it almost impossible to get teachers to collaborate and talk. And so I find myself—I mean, I do everything on the internet because you can't get stuff from other people. So this was an opportunity to come and just listen to these people. And, you know, I probably don't ask as much questions as other people; I just kind of hang back and just listen to the whole conversation. But for me that's really important, too, just to be

able to have my ears open and—and hear what they're talking about. And I—I think that was the best part for me, was just, you know, [the park scientists and the PolarTREC teacher-leader] and—and other people, just listening to them talk about what they do and what they had to say about things.

For some participants, having a few avid question-askers including other course staff was valued, as it allowed them to either listen while remaining quiet and within their comfort zone, or engaged them in questions they would not have thought to ask on their own:

P 3:21 For me to have a bulldog question-asker was helpful. But that wasn't the course, that was just the dynamics of the group. But, like, if you have your bulldog question-asker, then you feel like, "Oh, yeah. I can just kind of ride along on this train here." And, actually, [the facilitator] does that, too. [She] will just come in and kind of – she's like, "I know this is a kid question." So, you know, those are things that you would just want to make sure maybe are happening if you've got this huge range of science experience.

Interviewer: So [the facilitator] asking questions helps?

P3: Yeah, I think that would be good feedback for her that that is – when you have a population of that – and people don't know each other, so they're really trying to feel – I mean, for me at least, it's a ton of social anxiety to do this.

P 7:15 We talked about how those would change. So how would this environment change as things warm up? Um, we talked about how—there was a lot of just discussions, and that's kind of what I liked 'cause you get information that maybe I don't think to ask the questions, but if somebody else does—okay, I didn't really know that.

Collaborating with Other Teachers

Some participants do report productive collaboration with other course participants. P2, in particular, responds to a question about what her favorite part of the course was with the reply immediately below:

P 2:44 I guess being with other teachers. You know, we spent a lot of time – my bunkmate, [P4], she's a [primary]-grade teacher. So we talked a lot about how we would bring this to our kids and what – how to start, what kind of vocabulary, what kind of activities you could do, what kind of books you can read. You know, so it was collaborating with other teachers I think is – was really – but I just love collaboration.

Correspondingly, P2's bunkmate P4 also reports collaboration on activities that would extend their learning from the field course to the classroom:

P 4:27 So, I'm interested in the cryosphere 'cause it's something I've overlooked. So my lesson plan idea is basically, looking at it – we're gonna do, like, a chunk of ice and, different temperatures and taking the temperature and what's gonna

happen. So, another idea is with glaciers, so you can – and I got this idea from [P2]. She's the art teacher. And you melt different colored ice cubes and, just to see what would happen, like, maybe put them on a paint tray and put some debris in the way and just notice.

Notably, at least one participant who reported active collaboration during this course linked that collaboration to the actions and pre-course planning of the trip facilitator:

P 2:52 I just love collaboration. I really do think that [the facilitator's] ability to facilitate this four-day class was wonderful. She has a depth of knowledge and she's very good about – her intuition about people and what – how you move things along in kind of a gentle way…She really brought the enthusiasm. You know, so I really enjoyed her work, um, that she has done, you know, to make this possible… Because it said it was for educators, I did expect that I would be with other, um, educators. But I wasn't sure if it would be, uh, you know, sci – high school science teachers or if it would be, you know – who it would be. And so it's kind of fun that it ended up to be quite a range of different teachers.

Diversity of Participants

As noted above, the course enrolled teachers with a wide range of science and teaching backgrounds. Some participants found this to be an opportunity to be reminded of the wider context in which climate change education occurs, and what students are asked to do at different grade levels:

P 5:23 [The participants in this course] were from all different ranges, elementary school teachers on up. That was nice because you – you know, you get to – we had an opportunity to talk about how, you know, this grade you're doing this and that and kinda helps you get back online with – I mean, even though you – you're supposed to know, it's like, oh yeah, that's kinda right.

However, other participants noted that the wide range of backgrounds proved to be a challenge:

P 3:24 I think teachers are, – like, as a group, they don't like to feel stupid. So if you bring teachers in, and you have, – you know, I think that they did a great job making us feel comfortable. But, look, I'm, I mean, I know I struggle from that, like, where I'm like, "I don't really want to ask that question." You know, are people gonna judge that? "How can she be a teacher if she doesn't understand this?" But… it is challenging then to have scientists in the class, people who have just come out with a science degree, and you're like – I don't know. I, I just – of course everyone should be welcome and involved, but I think you guys might want to just consider, "Well, how are we gonna balance that?" 'Cause there was space open, I could immediately tell.

The PolarTREC teacher-leader also expressed concern over how some participants were not as grounded in the science of climate change as some of the lessons had assumed they were:

P 1:16 I thought it was great having a mix there. I think the, the one thing that made it a little challenging was that the teachers were such different levels. One of my worries was that – and, you know, it didn't come out until like the second or third day. But some of the, you know, um, [participant name], who is a [primary]-grade teacher, uh, I know a lot of the stuff in the – in the very beginning really went right over her head 'cause I spent a fair amount of time talking to her. And, you know, she was coming up with some basic questions that made it pretty clear that she didn't really understand any of the background information. I think it might have been good if we had a little better sense of where people were coming from in the beginning.

Navigating a Difficult Topic

Participants and staff acknowledge that teaching climate change can sometimes be a contested action. While participants did not refer directly to a role-play activity that staff facilitated on the topic of handling possible push-back from communities, parents, or administrators, most did refer to the topic of how to respond to being challenged on the topic of climate change.

P 7:23 I think the biggest thing I got was, you know, how do you—how do you teach climate change when it's such a controversial topic? And you always run into people who are gonna say, "This—this—this is just bunk; there's nothing to this." But what he was saying is you just pretty much have to be neutral, and I think that really stuck with me, that you need to be neutral. Just present the facts, and what you really want to do is have the kids discover it for themselves. So, I mean, that's kind of a way of—I'm just looking at how he teaches things and okay, I tried teaching a little bit of climate change last year, so you know, I haven't—I have this in the back of my head. "Okay, what did I do? What was I not sure about?" And then talking to him and listening to him it's like, "Okay, yeah, that's—that's what I need to do next year." So the next time I would kind of make sure I changed that a little bit and focus more on this isn't about me and my opinion; this is about these are the facts out there. You can look them up. Let's go look at the facts and …you can come to your own conclusion.

Participants discuss the social and cultural implications of climate change, and the difficulty of navigating these topics in educational spaces.

P 3:11 But, you know, I feel like I just learned also, how a scientist looks at climate change. And, they, I think in a way kind of protect themselves from how painful it is for some people by never really thinking about, how – like in the community I live in, you know, it will be very traumatic… And it's very upsetting. But you just have a guy talking about, like, how the trees are moving up and the animals will change. And, you know, they might make even, like, a little joke about it. But I understand that people really – it's a very painful thing, and, and that everyone tries to cope with it. … if you think about climate change as a Holocaust for [all] humanity, then you would really be wanting to think about those, or to species or,

you know, to a certain way of life or a culture. And the Indigenous Alaskan communities will definitely be impacted first and foremost, you know.

In addition, for some participants, the science itself is intimidating, but these participants also demonstrate ways to cope, such as focusing on extra preparation before teaching:

P 3:6 And I kept getting confused. Honestly, I could never remember if carbon is gonna be high or low or why, because you – you know, it's, it's kind of backwards of what you would initially think. Like, if it's hot, then it's gonna be low. But, um, you know, I would just have to be really prepared if I were gonna do a lesson on it myself.

Participants at sites in Alaska note little resistance to discussing climate change because its effects are so evident:

P 3:15 You know, I will, um, *[laughs]* I will look at putting together a science, uh, a climate change unit for my class. And, you know, I'm really thinking about how to do that in a way that's, um, you know, respectful of kids and their different backgrounds and, you know, their parents' opinions at a sixth-grade level. But, you know, I don't actually think in my village there would be a ton of resistance. I think that a lot of people know it's happening, and they're experiencing it. And no one got to ride their snogo last year.

P 5:8 I have a real interest in this kinda stuff just as a person, and of course, a lotta my kids have interest in talking about the wildlife, you know. We get a lotta native kids, so they're – we have a lotta conversations about what's happening to the caribou and the whales and stuff – stuff like that in my classes. Um, and how that affects – and how their buildings and – and – and roadways and things that they're expanding up in the villages are affecting that or can affect it. So we – he talked a lot about how things are changing.

However, there are other cultural concerns to navigate when fostering inquiry-based learning about climate change, such as figuring out how to access community resources such as elders in culturally appropriate ways:

P 3:18 I'm in a Yup'ik village, and there's a few, uh, people that we have as Yup'ik mentors that we can go to and, and talk about things if they're culturally appropriate or sensitive. And, um, 'cause I was thinking it would be nice if kids could, could talk to an elder about climate change and then have them take notes on it. But last year I wanted to do an interview project, and one of these mentors was like, "You know, it's actually really not, um, acceptable for kids to ask elders questions. Like, they are to sit and listen." And I was like, "Okay." So I just didn't do it. But again, like, I kind of want to. Like, I want to do something where they can get that information. And some of the elders will come in, and talk to the kids, so that might be a better way. But I did think that that would be nice.

Suggestions for Improvement

In addition to the many responses about the diversity of participants in regards to their climate change knowledge, and range of grade and subject taught in their home classrooms, participants provided a few additional suggestions.

The enrollment process was complicated for one participant, and another participant found the logistics of arranging family care for the duration of the field course to be a challenge:

P 5:22 These classes in general are – and I don't think this is a problem for everybody, but for those of us on a – my learning plan, that's what the [city] school district uses is our registration paying for these classes, it's a pain. I can't even explain it very well because if it had been left to me, I never woulda got signed up and came. My wife did it.

P 3:21 You know, you had to commit so early, and for me there were so many logistics to get here and have my family agree to do childcare for four days. I probably won't do one for a while. It was just – it was just too hard. I guess that would be one thing to consider is how many teachers are parents and how many would struggle to be able to come to Denali.

In addition, one participant suggests providing a guiding question for the day, to help focus participants throughout the day:

P 4:35 Maybe a guiding question that you might go back to at the end of each day. Like what was the main takeaway from today.

Finally, at least one participant articulated a desire for increased emphasis on how to integrate climate change science into art classrooms:

P 2:49 [B]ut I think I would like to see an art strand, you know, because science and art is something that really, um, you're dealing with observations, patterns, um, you know, field sketches, lots of, things that have to do with, with other content. It'd be really fun to, maybe even have a second part of this course that is art and science.

Daily Survey Analysis Methods and Results

In addition to the interviews analyzed above, teacher participants were also asked to fill out daily surveys at the end of each day in the field. The first four survey questions were nearly identical to the first four interview questions, except for time references where applicable (for example, references to "the course" in interview questions were instead references to "today" in survey questions). Survey questions five through seven then ask:

- Overall, how satisfied were you with the workshop today? (Numerical value, 1-4)
- What aspects of today's workshop led you to be satisfied or not satisfied?
- What suggestions do you have to improve the field course tomorrow?

(For the full Daily Survey, see Appendix C.) Responses were hand-written and submitted to staff; the PolarTREC teacher-leader and course facilitator reviewed this feedback daily. This statement is corroborated by interview data from the PolarTREC teacher-leader.

Survey data in this section is organized by question, and presented without extensive interpretation; see the Discussion section for commentary. A table summarizing daily points made by respondents begins each question section. Spelling errors of scientific terms or place names, as well as non-standard phrasing that may provide insight into participant comprehension, have been retained. Smaller errors such as spelling of non-concept words and some errors in punctuation have been edited for reading ease.

Question 1

"Describe in a few sentences what you did today as part of the field course? Think about the activities in which you participated, your actions during those activities, and who you worked with during the activities."

Question 1 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
-looked at repeat photography -looked at example of gelufluction -did glacier experiment - learned how to "see" landscape -Savage River guided walk	- hike to Tyler's pass - viewed permafrost detachment site - hiked to Toklat to view effects of bridge, talked about natural and manmade changes - tour of Eielson Center - performed CO2 monitoring - viewed alluvial terrace, insulation at Polychrome Pass	- hiked through 3 biomes - discussed wildlife and vegetation of each biome	- "share fair" – reported out on resources - hiked Primrose - discussed NPS, policy, and future park/resources management - teaching activity: decomposition

Question 2

"Describe in a few sentences what you learned today? Think about the climate science content you learned as well as ways in which you might implement the climate science content in your classroom."

Question 2 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
- gelufluction - importance of photo archiving - repeat photography - importance of presenting objectively - thermokarst - carbon and methane release of melting permafrost - moose/bear/wolf safety	- CO2 in atmosphere; human impact on it - how to use data collection instruments - climate change's effect on permafrost and animals - sustainable building design - how to bring CO2, permafrost, sustainable building design content into classroom	- changing habitat; impact on predator/prey cycles (Dall sheep, wolf cycles) - soil is living/microbial - Willow releases more than spruce	- alder facilitates soil nitrogenation; soil temperature fluctuates - decomposition lesson/lab activity can be modified for specific classrooms - How and why National Park resources should be managed; role of Park Service in climate change education outreach

Question 3

"How did [the PolarTREC teacher-leader] help you understand the climate change science content and how you might apply it to your classroom?"

Question 3 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
- as a teacher, you need to "have your facts together," but it is also an ongoing learning process - used graphics, short clips applicable to the classroom - repeat photography can be used in the classroom - understanding how scientists come to conclusions is important	- helped teachers consider how to lay foundations for students to think about carbon - questioned and challenged teachers to hypothesize for themselves - hands-on CO2 exercise showed how scientists collect data and also how students can do the same	- CO2 readings in various locations - reassurance and encouragement made participant more comfortable when discussing data	- clear and precise demonstration; can teach to all levels - classroom-friendly decomposition lab exercise (screen and paper) - drew on knowledge to help teachers make connections to real world (Dept. of Clean energy, link to existing decomposition data)

Question 4

"How did "being in the field" with a scientist help you understand the climate change science content and how you might apply it to your classroom?"

Question 4 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
- comprehension of reading assignments - seeing and discussing aids comprehension and retention of concepts; helpful for confidence - ask questions as the occur; listen to others' questions - made climate change "immediate"; motivated to translate to students	- stronger/validated knowledge → confidence in classroom - valued seeing/doing content; will teach similarly - valued direct access to scientist; will seek to bring scientists into classroom - valued discussing with other teachers, and learning from PolarTREC teacher-leader	- Aided comprehension of possible big-picture predator/prey population changes - Renewed sense of wonder about interconnectivity	- climate change made more tangible, "hands'on" - not significantly helpful today - listening to scientist/participant conversation more useful than reading same information

Question 5

"Overall, how satisfied were you with the field course today?

1 = not satisfied at all, 2 = somewhat satisfied, 3 = satisfied, 4 = very satisfied"

Question 5 Average of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
4	4	4	3.6

Question 6

"What aspects of today's field course led you to be satisfied or not satisfied?"

Question 6 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
- professional, kind responses to questions - interactions with experts and other passionate learners - willingness of staff to help fit content to a specific classroom	- food, scenery, friendliness of staff/participants - ample/informative discussion time - outdoor setting - Hands-on, authentic learning; focus on science and classroom - Park scientist 1 and course facilitator	-hands-on, immersive experience -"gorgeous" weather -after discussions, inspired to teach	-scenery/hikes/being outside/good weather -being with engaged, professional people -rich discussion

Question 7

"What suggestions do you have to improve the field course tomorrow?"

Question 7 Summary of Daily Responses			
Day 1	**Day 2**	**Day 3**	**Day 4**
- leave earlier - not too much time hanging around - continue good communication	- Keep up the good work - More clues on how to see evidence of change in our own school environments	- Share/pair during article activity - Keep up the good work - continued attention to appreciated details such as packing water for hike	- Keep doing these courses - Provide links as follow-up

Discussion

Participants overwhelmingly valued the deep commitment this course had to helping teachers discover ways they can link content and experiences from the course to their own classrooms back home. Both participants and staff attribute this to the role of the PolarTREC teacher-leader. In addition, both participants and staff perceived the trip facilitator as instrumental in facilitating the success of this trip. Respondents report the facilitator excelled at gauging group energy and maintaining enthusiasm for and coherence of content; several participants note in particular that they gained confidence to ask questions after hearing the facilitator asking her own questions in the field. Staff members who interacted with the facilitator during the course planning phase valued her work ensuring the course curriculum engaged with climate science on a sophisticated level, as well as with the practicalities that teachers face in the classroom.

All participants noted and valued the course's experiential approach to teaching content, giving them the experience of drawing their own conclusions for observations and experiences. All participants articulated developing a more-nuanced understanding of one or more aspects of climate change content, regardless of their level of knowledge going into the course.

The daily survey data suggest that staff refinement of course content was responsive to participant needs and was revised as the course progressed. One participant notes on Day 2 that they would like more tips on how to provide an immersive climate change learning experience in regions where, she perceives, climate change evidence might not be as easily seen as in Denali (i.e., no dramatic permafrost lens landslides, or difficult to find resources such as repeat photography). This request does not come up in the final interviews, nor is it repeated in Day 3 or 4 daily surveys. It is likely that staff addressed this point once the saw that it was a concern for this participant.

The daily survey data also point to possible room for improvement regarding participant perception of the management/policy aspect of dealing with climate change. Opinions diverged on the usefulness of Day 4's discussion about park management and policy. Interviewees did not provide negative feedback to the discussion per se, but daily survey data show this

divergence. In response to Question 2, “What did you learn today?” one participant noted, “Discussion on park management and climate change not useful.” A different respondent noted, “It was helpful to hear the policy considerations from [park scientist 2] as the role of the Park Service and their management policy. I really took away the perspective that many of the decisions are from the "human" lens.” In addition to these differences in opinion about the discussion of policy/management, some participants rated Day 4 with a slightly lower score (3 instead of 4) than other days.

Across all data, only some teachers articulated collaboration with other teachers as something they valued about the course. In the final interview data, two outgoing question-askers also report collaborating with each other on lesson plan ideas. Other teachers noted a reticence to ask questions for fear of being embarrassed, or because of general anxiety. In addition, staff and participants report a wide variation of existing climate change knowledge of participants, as well as a wide range of teaching foci of participants.

These differences in learning style, teaching experience, and existing understanding of climate change science may have acted as barriers to collaboration for some participants. Future courses, if outcomes are focused on increasing teacher collaboration, might seek ways to match participants with similar or relatable teaching backgrounds.

Appendix A: Participant Interview Questions

1. Describe what you did during the field course? Think about the activities in which you participated, your actions during those activities, and who you worked with during the activities.

2. Describe what you learned during the field course? Think about the climate science content you learned as well as ways in which you might implement the climate science content in your classroom.

3. How did [the PolarTREC teacher-leader] help you understand the climate change science content and how you might apply it to your classroom?

4. How did "being in the field" with a scientist help you understand the climate change science content and how you might apply it to your classroom?

5. What will you do next because of this field course? Think about activities with students, collaboration with other teachers, and/or collaboration with researchers/scientists.

6. What professional gains did you achieve overall?

7. What were the best aspects of the field course?

8. What would you suggest for improvements?

Appendix B: Staff Interview Questions

1. Can you describe your role in the field course?
2. What did you do in terms of instructing?
3. How much involvement did you have in developing the course/syllabus?
4. How did you work with the participants during the course?
5. What did a typical day look like?
6. What worked well in developing the course? Delivering? What didn't work well?

Additional question for park scientists:

1. How did you see the role of [the PolarTREC teacher-leader]? The [course facilitator]?

Additional questions for PolarTREC teacher-leader:

2. Could you describe in more detail the activities you showed the teachers?
3. How did your PolarTREC experience prepare you to be a teacher-leader in the field course?

Appendix C: Participant Daily Survey Questions

1. Describe in a few sentences what you did today as part of the field course? Think about the activities in which you participated, your actions during those activities, and who you worked with during the activities.

2. Describe in a few sentences what you learned today? Think about the climate science content you learned as well as ways in which you might implement the climate science content in your classroom.

3. How did [the PolarTREC teacher-leader] help you understand the climate change science content and how you might apply it to your classroom?

4. How did "being in the field" with a scientist help you understand the climate change science content and how you might apply it to your classroom?

5. Overall, how satisfied were you with the field course today?
(1 = not satisfied at all, 2 = somewhat satisfied, 3 = satisfied, 4 = very satisfied)

6. What aspects of today's workshop led you to be satisfied or not satisfied?

7. What suggestions do you have to improve the field course tomorrow?

Appendix D: Written Survey Participant Data

Question 1

Day 1

- We looked at repeat photography while we were looking at the actual site. That was very interesting. Then we looked at an example of gelufluction. Then set up an ice/glacial experiment!
- Walked along savage ridge and looked at permafrost sliding down mountain. Looked at repeat photography to determine vegetation changes. Did an experiment on cover type on glacier melting using ice cubes in paint trays. We all discussed this together as a group.
- Beginning to learn how to "see" the landscape. The guided walk near the savage river with [park scientist 1] was a great illustration of how the landscape is dynamic. The repeat photography photos presented a concrete example of what has changed over time.
- Today we met at the field/visitor center for introductions to one another and the material of climate change. We went to Savage trail to identify similarities and differences in repeated photography of the area. We discussed gelusolufluction along the mountainside soil. We set up camp, had dinner and discussed teaching climate change concepts in our classrooms and what that might look like and what we hope to learn. Then we conducted a glacier cover experiment.

Day 2

- We had an incredible morning hike along the creek to Tyler's Pass to see permafrost detachment site. Then we made our way to Tolklatt to observe the braided river pattern and the effect the bridges had on it. We went to Eilson to tour the amazing sustainable facility. We also tested the soil in cabin. We stopped at Polychrome Pass to observe the alluviated terrace and show insulation.
- Traveled to Eilson visitor center. Stopped to look at a spot on the road where the permafrost slide. Talked about the Tolklatt river and braiding, human impact on the park. Saw many animals. Ecofriendly Eilson.
- We did all sorts of field activities and experiments with [park scientist 1], [the course facilitator], and [the PolarTREC teacher-leader]. And had a great tour of Eilson visitor center by [visitor center tour leader]. All the activities were great.
- Stopped and looked at slide with short walk. Talked about melting permafrost. Visited Platinum green visitor center/tour of center, Co2 monitoring/carbon cycle.
- We started the day with a hike to look at recent permafrost detachment site that was a highly unusual occurrence. The repeat photography activity at Tolklatt and the discussion about "braided river" dynamics helped illustrate cause and effect, both natural and manmade.

Day 3

- Today we hiked through 3 biomes. Boreal Forest, which consisted of trees and very little undergrowth, the broad leaf biome consisting of willow and ground growth, then alpine which contained small wildflowers and very low broad leaf vegetation.
- We were at Tolklatt we hiked up a drainage/stream bed to measure carbon in 3 different areas: taiga, broad leaves/low shade, alpine. We learned about dall sheep and other animals.

Day 4

- We hiked Primrose and bushwacked Elders. We discussed the NPS role in decision making in the park and the future of park management.
- The students in the group presented a summary of the various readings they/we had done and then we hiked to the Alpine and had a good discussion led be [park scientist 2] about climate change and park management. [the PolarTREC teacher-leader] also demonstrated a decay lab.
- Book/article review. Hike discussion led by [park scientist 2]. Teaching activity on decomposition described by [the PolarTREC teacher-leader].
- Hiked primrose and discussing policy in Park and how and if resources should be managed.
- We began with a "share fair" concerning the scientific articles or books we chose to report out on. Next, we ventured back towards the park entrance and gathered at the popular "social trail" at Primrose hill to discuss the challenges of managing wildlife and issues climate change.

Question 2

Day 1

- I learned about gelufluction and the importance archiving landscape photographs for use in comparing change over time, repeat photography. I may try to do something on gelufluction and melting permafrost in my class.
- Learned about gelofluction and its impact on human activity (trails) discussed whey it is important for teachers to be involved in field work. How important it is to know your content and facts when teaching because there are always nay sayers. The need to present information data objectively.
- Some terminology learned today included genufluction, the sloughing off of the surface of permafrost. Repeat photography, taking photos of land and land forms over time. Squirrel midden, leftovers from a tasty meal!
- I learned about gelufluction and thermokarst. I also learned about the significant carbon and methane release of melting permafrost……also now I know what to do if/when I see a moose, bear, or wolf.

Day 2

- I learned about CO2 in the atmosphere. I picked up on instruments used to collect data on landscape and carbon collection.

- The way glacial river work. Human impact on the carbon cycling and using CO2 probes. I would do this with high school students and have them investigate various scenarios. Ecofriendly building materials hydro energy sources.
- I learned about the carbon cycle and how to measure some sources of CO2. I learned how climate warming may be changing permafrost and how different animals may react positively or negatively to climate change/warming.
- Lots about melting permafrost. How climate change may impact different animals. May focus unit on this idea.
- I really enjoyed learning about the sustainable building attributes of the Eilson visitors center. I am inspired to have students design a sustainable house using the Eilson visitor center as a design model.

Day 3

- [park scientist 2] did a great job explaining about the changing vegetation that is becoming evident on the high slopes. This change in habitat can and will impact the Dall sheep population from the impact of predators and prey cycles.
- Dall lambs can move after 3 days. Soil is living microbial thing. Wolf cycles fluctuate every 10 years. Willows have a lower life expectancy than spruce, so even though willows can convert carbon CO2+O2 "faster and more efficiently", spruce but they decay then emit/release carbon.

Day 4

- I learned that Elder trees Nitrogenate Alaska Soil. Also the temperature can go from hot to cold.
- I may do a modified decay lab! I think I could do a lab based on the principals of [the PolarTREC teacher-leader]'s lab, but using materials more pertinent to my area of instruction.
- The book/article review was good to hit on good articles that I may want to browse before teaching a climate change unit. Discussion on park management and climate change not useful. Decomposition lesson idea was great. I would definitely use this.
- How and why resources should be managed in National Parks. Roll of Park service in teaching public about climate change.
- It was helpful to hear the policy considerations from [park scientist 2] as the role of the Park Service and their management policy. I really took away the perspective that many of the decisions are from the "human" lens.

Question 3

Day 1

- [The PolarTREC teacher-leader] drove home the part that you as the teacher, need to have your facts together. "We need to do our research."
- I liked the graphics he used. The short clips that clearly showed change-temperature average during different months, measuring in modern times and then looking at geologic history. How do we know climate from past. I would use these in my class and have students explain. I want to do repeat photography with them.
- The take away was "do your homework." Understanding the process of how scientists arrive at their conclusions is core to understanding the issue.
- He made me feel better about it being an ongoing process, understanding and teaching climate change.

Day 2

- [The PolarTREC teacher-leader] got me thinking about laying a foundation for my students to think about carbon. My goal is to get students to know that carbon is matter.
- He is a great wealth of knowledge and understands the issue well even beyond Denali. He questioned us and challenged us to hypothesize impacts instead of just telling us everything.
- The co2 monitoring exercise was great! I may try to get some and do some labs in applied technology.
- Great ideas for co2 monitoring and getting students into monitoring
- Using the "hands on" instruments to show how scientists collect data and learning how to interpret data was very helpful.

Day 3

- Continued to take Co2 readings in various elevations on the slopes to illustrate the co2 effect of vegetation, sunlight, and shade.
- We did carbon readings, it helped to discuss them analyze and ask questions. He reassured me, I was asking good questions and felt encouraged to deepen my knowledge and felt support and comfortable in discussions.

Day 4

- He reminded me of the Dept. of clean energy. We discussed some steps we're taking and I'll look into their efforts. Perhaps my class could attempt design.
- [The PolarTREC teacher-leader] helped by demonstrating a lab exercise in a very clear and precise manner!
- Decomposition activity and info is very classroom friendly.
- [The PolarTREC teacher-leader] did a great job. He is very well informed and his classroom experience with Teaching environmental issues. He was great at explaining things to people at different levels.
- [The PolarTREC teacher-leader] shared a wonderful activity on measuring decomposition with a user friendly screen/paper device. Loved the simplicity and the link to research sites to compare research.

Question 4

Day 1

- Being in the field with a scientist (s) helped me understand some of readings I have done, and got to thinking and speaking in scientific terms, which will be helpful to me in the classroom.
- Can ask questions as they come up. They discuss topics that never occurred to you to be an issue, ie. Wasp/catepillar and phenology.
- Terminology and vocabulary can be confusing, but when you are standing there looking at it while you are learning the concepts creates a more meaningful and longer term memory.
- It made climate change "immediate". I'd like to try to re-create it for my students somehow.

Day 2

- It is helpful because I can be honest and reflective about what I know, what my own conceptions are, and I can ask clarifying questions. I will have confidence in my classroom from a stronger and validated knowledge base.
- I want to do more with permafrost and CO2 measurements. I could do mini experiments with this in my class. Glaciers.
- It helped actually see and do and that is way I will teach.
- It's great to soak in the information from a scientist. I would love to find a local scientist to visit our classroom because it is different than a teacher.
- It was great to have other teachers in the group to discuss the concepts with. [the PolarTREC teacher-leader] did a great job explaining the Co2 cycle to a non-scientist.

Day 3

- [park scientist 2] really helped to "tie" the cause and effect together with the big picture of how predator/prey populations will be affected by climate change.
- Hearing [park scientist 2] talk renewed my sense of wonder about animals, their habitat and an ecosystem's interconnectivity.

Day 4

- Being in the field makes the elusive subject matter of climate change seem more tangible.
- Not so much today.
- the conversation between the scientists and participants was very helpful as opposed to reading the same information.
- Wonderful….again the "hands on" component is much appreciated.

Question 6

Day 1

- The instructors were very nice and professional when addressing the students' questions and thoughts.
- Listening to people who know and understand the issue, how they teach it, why they are interested in it. Interacting with people who are also interested in the topic or passionate about it.
- The flexibility of the staff to help me explore my interests and "lens" that will fit into my teaching.
- The friendliness, genuine interest in helping us and our students of instructors. Suggestions of gear and clothing communication was helpful and appreciated.

Day 2

- The food was awesome, the views spectacular, the people friendly, I learned and was validated in what I already know.
- I liked that it was fairly laid back and lots of time for discussions. A lot of information came from these issues. I wasn't aware of.
- It was outside and hands on.
- Great diversity of some combo of science and how to use science in the classroom in a meaningful way.
- The "hands on" and authentic learning experiences. [park scientist 1] is such a wealth of information and [the course facilitator] is an excellent facilitator.

Day 3

- It was awesome! Again the "hands on," living, breathing, touching, seeing experience will stay with me forever.
- It was a gorgeous day and my questions were answered. I feel inspired to teach!

Day 4

- The views, rich discussion.
- Being outside with a group of engaged and professional people.
- Great hikes, more good discussions.
- Getting into Park, doing a little hike.
- Certainly the weather was a major player!

Question 7

Day 1

- none
- Leave early, not too much time hanging around.
- Just excited to be here!
- Keep it up, thanks for the communication.

Day 2

- Keep up the good work.
- none
- More clues on how to see evidence of change in our own school environments.
- I'm eating too much!

Day 3

- Share/pair the articles to make it move along faster.
- Keep it up. Thanks for packing water for the hike!!

Day 4

- Keep doing these courses!
- It's the last day.
- would love the links!