



Alaska Climate Teleconferences  
Hosted by the Alaska Center for Climate Assessment and Policy

THE IMPACTS OF CHANGES IN WATER RESOURCES ON NORTHERN SOCIETIES  
*Dan White, University of Alaska*  
Tuesday, April 8; 10:00-11:00AM (ADT)

SUMMARY

Dan White, the Director of the Institute for Northern Engineering at the University of Alaska presented the April Alaska Climate Teleconference, hosted by the Alaska Center for Climate Assessment and Policy, entitled THE IMPACTS OF CHANGES IN WATER RESOURCES ON NORTHERN SOCIETIES. We had over 40 participants including representatives from the U.S. Fish and Wildlife Service, Alaska Oil and Gas Association, Alaska Department of Natural Resources, Alaska Tribal Health Consortium, Chevron, Cook Inletkeeper, Fairbanks North Star Borough, Kawerak Inc, Denali National Park Service, NOAA, Selawik National Wildlife Refuge, as well as several students from the University of Alaska.

PRESENTATION

The teleconference presentation by Dan White is available as a .pdf file on the ACCAP Climate Teleconference Website under "Archive of Past Conferences":

<http://www.uaf.edu/accap/teleconference.htm>

**The Impacts of Changes in Water Resources on Northern Societies**

***Dan White, University of Alaska INE***

Summary Prepared by Kate Riffey

Fresh water is an important aspect of all successful communities, but with the warming temperatures and changing climates it's important to start looking at how these changes effect humans. Societies in Alaska rely on freshwater for many different uses including transportation to build ice roads in the winter and provide river transport in the summer, as a food source that provides fish, caribou, and waterfowl, and of course drinking, cleaning, cooking and other day to day activities. In spite of what may seem a water rich state with our glaciated valleys, wetlands and snow melt, the Arctic overall is a very arid region if you're measuring precipitation. The precipitation on the South slope is comparable to the south west desert regions of the U.S. The North Slope is wetlands complex mainly because the water is retained on the surface by the permafrost underneath. Arctic people have adapted to these conditions and have learned to use frozen water for most of the year. This also means that to have a supply of water during the winter months many communities requires large (7 million gallons) water holding tanks that have to be heated.

We know that climate change is having a major impact on available fresh water sources such as lakes and rivers. Particularly the ones contained by permafrost are particularly sensitive to these changes. The water absorbs heat, thawing the permafrost that keeps it parched. This then allows the water to drain into the land. Lakes that drain due to permafrost thaw will not be reformed unless and until the permafrost returns. Shorter winters and more precipitation are expected over the next 30 years and this could increase the amount of available surface water. However, evapotranspiration is expected to have a negative impact on the amount of water available for harvesting. So while we are likely to have more rain, available surface water may decrease. River levels also could decrease due to a decrease in snow melt and glacier run off. This impacts food sources and water way transportation as well as the decrease in usable water. In addition, there will likely be a decrease in water and snow available for building ice roads for oil and gas exploration and drilling. With out water to create these roads, access to some places could be severely limited. We do not know how fish, migrating caribou and other animal herds will react to these changes so it is unclear how much subsistence food sources will be affected. Growing seasons are changing and shifting so this could help or hurt, we are still unclear what kind of impacts these changes will have.

In order to solve these problems we need to engage Northern workers, scientists, researchers and the people of northern communities to collaborate and put our collective knowledge together. By doing this we can come up with different ideas and solutions in order to be ready for the changing environment.

To clear up some water miss-consumptions here are some Fact or Fiction Questions to inspire discussion:

**All our lakes will disappear with the permafrost:**

**Fiction:** All of our lakes are not going to disappear with permafrost. The lakes that are vulnerable are the ones that owe their existence to permafrost. So far lakes that are most vulnerable are in discontinuous permafrost areas. However more lakes have been forming in continuous areas.

**More rain in the future means more surface water:**

**Fiction:** Due to increased evapotranspiration and permafrost that with increasing temperatures, increased precipitation will not necessarily lead to more available surface water.

**Groundwater will benefit from more rain:**

**Fiction:** Groundwater would benefit from more precipitation as snow, but necessarily from more rain. Most of our groundwater recharge happens in the melting period in the spring, not from rain which has a greater chance of being intercepted by plants.

**There is no good news:**

**Fiction (for the most part):** Some things could be good. For example, there could be a lot of opportunities if for the first time King Salmon that are now regularly caught in Barrow. This used to be a special event, now they are caught on a regular basis. So, the movement of fish and the change in growing season could have some negative impacts and some positive ones. The overall impact to society will depend on how we look at potential changes in the future and how we manage ourselves.

**DISCUSSION COMMENTS AND QUESTIONS**

- You mentioned that the engineering design climate is 20 years out of date and does not account for changing climate parameters, is the engineering data that's being used as a design climate for new water supply technologies just for things in the North or the pipeline?
  - Response: No, whenever we build any infrastructure we look at the design climate, how much snow we're expecting on the roof, how much rain, are there rivers nearby? There is all sorts of data that go into a design climate that contributes to how we build the infrastructure. That data is being collected all the time and can be drawn from past data records or what we expect to find in the future.
- There has been some talk that the Interior especially has a direct need to update our frequency records. Are you aware of any activities that are addressing that?
  - Response: Yes, NOAA right now is actually in the process of updating frequency records for all the U.S. and Alaska is on that list. They are working with the University and the Department of Transportation to get those records updated here.
    - So would that be with recent recordings and historical?
      - Yes the updates would be from the most recent day recorded and then added to older records and then we can see a trend. The problem has been that there aren't a lot of data stations around Alaska to have solid past records in order to see a trend. If there are other departments, companies, anyone that has data from even just a year or two that data is needed. NOAA can incorporate it into their overall data. There are lots of holes and need to fill those holes.
- In the Bethel area we have a lot of systems that require pipes and systems that at this time are very old fashioned and use up a lot of extra water. Is any of these cautions that you've mentioned getting down to the engineers, design teams, VSW so they can implement new designs that don't waste as much water?
  - Response: I can't speak for all the engineers out there that designed these systems, but I do know I work with the Alaska Waste Water Management Association which is an organization of operators and engineers that work on teams around the state and climate change and its impact on water resources is always a subject at the meetings. I think as a community its worth thinking about and looking at how vulnerable might be a particular stream to changes in permafrost. We've done some vulnerability assessment to try and predict what's going to happen to the watershed, river, and lake in the future. I think it's important for everybody to be thinking about it.
- In Siberia we are noticing the same thing which is an increase in warming winters and a shift in precipitation from summer to winter. So even though the winter is shorter they're still maintaining a sufficient snow pack.
  - Response: Yes, that's a big question that we don't know and that's one of the predictions for Alaska. That we're going to get warmer, but we're going to get wetter. And one of the reasons is that if you have less sea ice or less extent of the ice pack there's more open water in the winter that can fall as precipitation. But from what we have seen so far that increase in precipitation does not account for the amount we loose in evapotranspiration in a warmer year.
- You mentioned the open area along coastal waters with out the sea ice. A Canadian researcher reported a change in the lakes in these river deltas near open water areas. They're noticing a rising lake level due to storm surges and other events. Do you know of any studies going on here that are looking at that or can you comment on that?

- Response: I can't comment on that study, but I do know there are other studies going on between British Petroleum, the University, ConocoPhillips, Department of Transportation and Department of Natural Resources here in the state that are looking at lakes in the Canning region and others. They're looking at them as a water resource and in the 5-6 year study period that we've been studying them we have not seen that kind of change or any marine input. But it is interesting because this summer was a very dry year as well as 2005; however after the dry year in 2005 we saw lakes returning to their normal level with a normal winter. But if it's a dry winter as well then levels have been lower. We're still trying to get our arms wrapped around the regional distribution of precipitation and seasonal variability.
- Is the Seward Peninsula an area of discontinuous permafrost and are you seeing changes in the lakes there?
  - Response: The lakes that were studied in the Seward Peninsula were reducing in size during the study. The peninsula is basically split in half as far as permafrost goes. The southern half is discontinuous permafrost and the top half is continuous. A group at the university has done a forecast for the permafrost action over the next 100 years so we have an estimate of what the permafrost is going to do so you can make estimates as to what the lakes are going to do and you can email me if you want that study or it might be online.
- In Bethel we have the discontinuous permafrost in major areas and we have two major rivers, but the deltas are not acting similarly and then we have the sea. The saltwater is supporting some of these freshwater services and I'm wondering if anyone has done a vulnerability study on this or if anyone has looked at these factors and how these things might interact.
  - Response: We are finishing now a four year study on the Seward Peninsula that asks that question. How is the permafrost melting and how does that affect freshwater supplies, industrial water supplies and how do we manage the water. One of things that has come out of that is a model or set of guidelines that was developed at the University of Alaska Anchorage that is called the Arctic Water Resource Vulnerability Index. It's a checklist of questions to go down and answer questions about your population dynamics, your approach to water management, your water supply that will help any community, person or business that can help people figure out the vulnerability. It's still being developed but I see it as a practical tool that can be used within the next year or so.
- How would base flow in rivers change and how does that affect use of water for ice roads and other structures?
  - Response: It's really a function of the size of the river and most of the rivers in the Arctic really don't have a substantial base flow. So if we saw what we expect which is a smaller contribution to ground water then we would see base flow decrease, but that's a little bit of a guess because one thing that we have on the slope is that there's no contribution to the groundwater because of the permafrost so if the permafrost thaws there will be a new contribution so it will be interesting to see how that affects it.
- You referred to the joint community Alaska study on lakes; can you tell me where to find that?
  - Response: It's online in the Journal of American Water Resources Association, it was a special issue on Arctic lakes that was put together and Sarah can send out the

link to that. The link below will take you to the special issue of the Journal of American Water Resources Association on Water Use from Arctic Lakes: Identification, Impacts and Design Support mentioned during the teleconference. PDF files on the articles should be available to the public until June 2008.

<http://www.blackwell-synergy.com/toc/jawr/44/2>

- Where do you think we are at having the data to start predicting wetness or moisture levels across the state? We're trying to manage birds on the slope with very little data on the hydrology levels of the area.
  - Response: ACCAP is working very close with a group on campus called SNAP (Scenario Network for Alaska Planning) that is working on downscaling climate models. John Walsh and others are working on taking the climate models and looking at which ones have been the best at predicting different regions around Alaska and then taking that and using it to predict smaller regions around the state. For more information about SNAP visit the website: <http://www.snap.uaf.edu/> or contact Nancy Fresco, [ffnlf@uaf.edu](mailto:ffnlf@uaf.edu).
  
- Your consensus seems to be that evapotranspiration will increase and despite more water, less will be available to us. Is that based on modeling and/or has that taken into account areas where there will be more water and more growing opportunities?
  - Response: It's a really complicated system and we don't have a complete understanding of all the factors involved in it. The specific comment I made was based on a study done in Fairbanks that found that there's no infiltration in forested areas or in the summer because the precipitation events are not enough to overcome the soil and water deficit and it only happens in winter. We took that study and tested it in Nome and what is needed to maintain the aquifer there. We looked at if there was no evapotranspiration would there be enough water to offset the soil/water ratio and that answer was touch and go. We might not have enough to balance out and if there was increased evapotranspiration then that problem would grow.
    - Did that study take into account increased precipitation?
      - No, that was back casting, now we're taking that model and looking at what happens when we increase precipitation.
        - Is it possible to take that model and combine it with the regional climate model to determine how an area will react?
          - Yes, we hope to be able to do that soon or have that available.

Additional questions or comments can be directed to Dan White: [ffdmw@uaf.edu](mailto:ffdmw@uaf.edu)

For more information on the Alaska Climate Teleconferences or to suggest topics for future teleconferences please contact: Sarah Trainor, [accap@uaf.edu](mailto:accap@uaf.edu), 907-474-7878.