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Hearing on the High Plains:
Combating Drought with Innovation

U.S. Committee on Agriculture, Nutrition and Forestry
Subcommittee on
Conservation, Climate, Forestry, and Natural Resources

Good morning, everyone. My name is Peter Goble and I am a climatologist with the Colorado Climate Center at Colorado State University in Fort Collins. I am grateful for the opportunity to testify today and consider it an honor and a privilege to participate in this panel. My professional background is in researching climate change and variability, as well as water availability, in Colorado and the western United States.

The Colorado Climate office collects and observes data with the purpose of monitoring the climate, placing individual events into historical perspective, disseminating climate information to the public, and providing climate expertise as part of the decision-making process. The Center is dedicated to the development of tools and methods to better communicate the climatology and climate variability of Colorado to scientists, educators, stakeholders, media, and the general public. To better understand Colorado's climate, and how it is changing, the staff also regularly conducts (and collaborates on) research projects. The ability to participate in numerous climate service activities has also given me the chance to regularly communicate climate issues to the public, including farmers.

Our office recently completed a project funded by the Colorado Water Conservation Board where we synthesized the observed and projected changes to temperature, precipitation, water resources, and natural hazards across the state¹. I want to thank my colleague Dr. Becky Bolinger for leading this effort, as well as State Climatologist Russ Schumacher and Jeff Lukas of Lukas Climate for their enormous roles writing this report.

A study of Colorado's historical climate record tells us that farming and ranching in Colorado is not for the faint of heart. Our farmers in eastern Colorado and western Kansas rely on an average of only 15-20 inches of precipitation annually, about half of what falls over America's heartland. Furthermore, this precipitation is highly variable from year-to-year. Right here in Burlington, a wet year like 2015 can bring over 25 inches of precipitation, whereas a dry year, like 2002 brings less than 9 inches. A bad crop destroys a farmer's profit margins, and a bad year of forage can force a rancher to make difficult decisions about culling the herd. Moreover, our precipitation does not always fall as cold, soaking, million-dollar rains. Sometimes it is from an intense thunderstorm whose bounties run off the field before soaking into the soil, sometimes it is hail that shreds the corn, millet, and triticale. Sometimes it is a spring blizzard threatening livestock during calving season.

¹ climatechange.colostate.edu

Unfortunately, one other lesson our climate data tells us is that our climate is warming; a trend consistent with warming temperatures around the globe, which is driven primarily by human emissions of greenhouse gases. The National Center for Environmental information estimates that Colorado has warmed by an average of 2.9 °F over the last 125 years. The warming trend is significant with high statistical confidence and has accelerated since the 1980's. Precipitation has not significantly increased or decreased in the long term in Colorado. Even so, there is widespread evidence that our warmer temperatures are lowering annual mountain snowpack here in Colorado and across the western United States. Over the last seventy years our peak season snowpack in Colorado has declined by 5-10% in our northern river basins, and 10-20% in our southern river basins. These declines are troubling because streamflow from snowmelt is important to farmers across our state for irrigation. Warmer temperatures also impact our summer water balance. Hotter weather raises evaporation rates from bare soil and transpiration rates through crop root systems. Under this added stress, crops can either lose their soil moisture more quickly to the atmosphere, or simply shut down in the blistering heat. Hotter summers lead to more frequent and severe droughts, which decrease crop yields, and impact the bottom line for our honest, hard-working farmers.

The wet years are not without challenges either. Our climate models indicate that even though precipitation may not decline in the future, a higher fraction of it will fall in extreme events, including, but not limited to, large hail. While trends in extreme events are less clear than they are for temperature, 2023 set records for severe weather reports in Colorado. We saw more storms with one, two, three, and four-inch diameter hail than any other year. We even saw our first hailstone of over 5 inches in diameter. I have brought a 3-D printed mold of the previous record hailstone, which fell in 2019, just five years ago. The stone from last year melted too much to make a similar mold before being preserved, but keep in mind it was larger than this stone.

In most challenges there are opportunities, and as a soon-to-be father I can't help but see the value in a message of hope. The impacts of climate change can be combated through mitigation and adaptation. From a mitigation standpoint, renewable energy has become much more cost-competitive over the past decade. We are emitting carbon at rates well below what was projected in what climate scientists called "business as usual" scenarios 15 years ago. We still have lots of work to do, but we have already come a long way.

Humans are also highly adaptable creatures. By continuing to study, update, and adhere to the best crop and land management practices we can continue to thrive in the face of intensifying natural hazards.

Finally, as a scientist, I cannot pass up this opportunity to stress the importance of continued data collection. Long-term, consistent climate observations are the backbone of our understanding of climate globally and right here at home. It is vital that we continue to invest in networks like the National Weather Service's Cooperative Observer Network, state mesonets — like the one Chip runs in Kansas, and the one we run in Colorado — and even community science efforts, such as the Community Collaborative Rain, Hail, and Snow Network, that allow people from all walks of life to contribute to our understanding of weather and climate. Together we can learn and adapt to ensure our food system is resilient to an ever-changing environment.

Thank you.