Farmers and climate scientists have more in common than you may think

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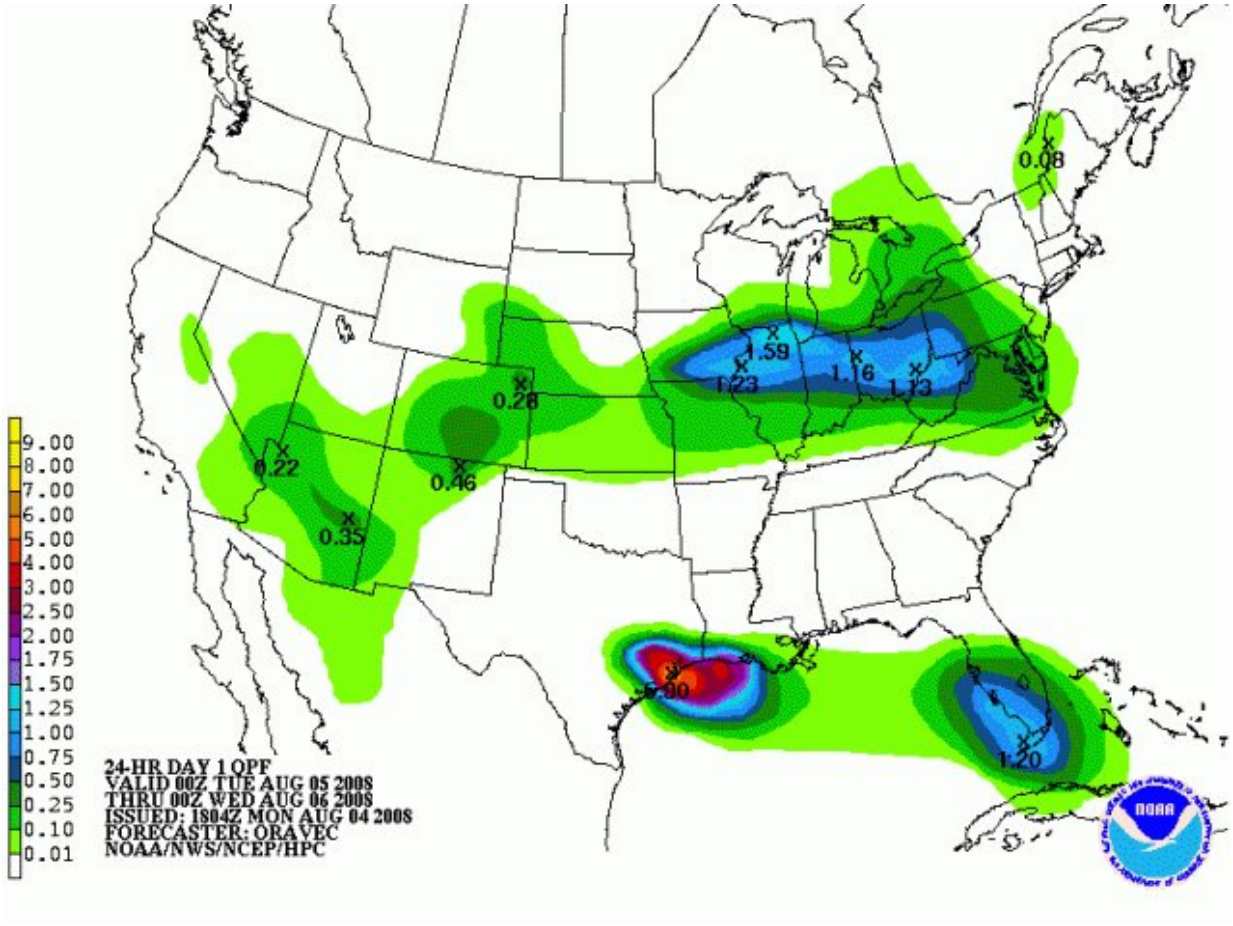

Without accurate sub-seasonal or seasonal forecasts, farmers have little to no ability to adapt to changing climate conditions. Credit: Cayobo/Wikimedia Commons

As the world's population increases, it will put more pressure on food resources. That makes it more important than ever to have accurate weather predictions that can help increase productivity. As a result of such demand, the market is reacting by increasing the funding universities and research institutes receive, in hopes of addressing this issue. In doing so, it has increased our awareness of the fact that, up to this point, we have never really had accurate forecasts that range between several weeks to months, timeframes scientists call sub-seasonal to seasonal.

One group of stakeholders that is arguably most impacted by this lack of forecasting are farmers whose crops are directly impacted by weather. Without accurate sub-seasonal or seasonal forecasts, farmers have little to no ability to adapt. Instead, they must plant their seeds at the beginning of each season and hope that they can sustain their crops in the face of whatever weather comes their way.

As an eighth-generation farmer in Canada, I found it both enlightening and motivating when I was given the chance to see the other side of the forecast coin through working with a climate research team at the Swiss Federal Institute of Technology. Being exposed to the techniques and challenges of producing accurate weather predictions this summer has been a stark contrast from the teachings that were passed down on the farm.

As a farmer, you have a feeling for how the weather patterns are changing over a long period of time, given that you typically work alongside your father and grandfather. In this family dynamic, your elders would pass information down through stories which allow you to better grasp the evolution of the land you're working on. When I was a kid, my grandfather always described the height of snowbanks when he was younger by comparing it to the fence posts, and explained how it had decreased since he was a child.

This ended up being my first interaction with the idea that the climate might be changing. In comparison, climate scientists often avoid human testimonials since they might be biased, and instead rely on data collected at nearby weather stations or satellites that provide estimates of our weather on the ground. In this sense, switching from a farmer mindset to a scientist mindset changes the interpretation from qualitative descriptions (word-based) to quantitative descriptions (number-based).

The most fundamental shift in my understanding during this process was to really understand what the climate system is and how predictions were produced. As a farmer, you really only care about the temperature and amount of rain, because this was what influences your crops, but you would never put much thought into the mechanisms that control it. This leads to placing a lot of emphasis on understanding climatology, which is just the average weather for a given location and time of year. In addition to this, farmers try to determine if the temperature or precipitation is changing in a specific direction by drawing on personal accounts, such as the snow height.

One of the main difficulties for a farmer using this technique is to understand when exactly a trend stops, since the trend is independent of yearly variability. Variability simply refers to the fact that some years might be particularly warm, followed by particularly cold years, all while the overall climate is getting warmer. So, in order to understand a trend through firsthand experience, you need to wait several years before drawing any conclusions to ensure it was a trend and not just a random event. This became evident to me after witnessing my elders complain about how the variability between seasons has increased over the years, making it much harder for them to predict trends.

In contrast to this, climate scientists focus on the mechanisms of weather, which are the very basic ways in which weather comes about. This could include simple things like how sunlight causes water to

evaporate into the atmosphere or how winds affect clouds. From here, they then determine what effect these mechanisms have on temperature and precipitation and look for special events or long-term patterns that might change these mechanisms, which could make them more predictable. They also look mostly to the atmosphere (such as clouds, and winds), as well as the oceans (such as sea surface temperatures) for hints about what's going to happen.

Most people have intuitively felt the relationship between these two systems for weather, such as a hot summer day, which can heat the ground and is often followed by a strong thunder storm. This can be explained simply by how hot air rises, so clouds can grow, and eventually produce rain. It becomes immensely more complex when you consider the interaction between different systems and how they influence each other to create different outcomes. This is my main area of study at the moment.

In the end, being able to see what it takes to create more accurate predictions, ones which stretch weeks or months into the future, and contrasting this process with how farmers determine weather is enlightening. It really illustrates how the main stakeholders for weather impacts haven't changed for millennia—only that as the system grows more complex, specialists are now leading the way to improve forecasts and ensure farmers continue to have a leg up on the weather.

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