SYSTEMS THINKERS IN STEM

A CONVERSATION WITH:

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Which systems thinking skills do you use?

#2: Consider the Wholes and Parts
To understand changes in the Antarctic food web at the ecological level I need to understand the first player in the transfer of energy: the phytoplankton. To understand their communities, succession (ie who replaces who) as a season progresses, as well as each individual cell's genetic response to their environment.

#7: Maintain Boundaries
Scientists traditionally like to put things in boxes and characterize different components of a system. We have to tie all the relationships together in the greater system to understand the phenomena that is observed.

#9: Identify Relationships
Melting Glaciers "freshen" the saltwater coasts of Antarctica. The coast also happens to be the region where krill and whales congregate, seals haul out to rest on land, and penguins live in colonies. All of these big animals eat a small crustacean called krill and krill feast on phytoplankton.

1. **What is your role within the STEM community?**
   I am currently a graduate student at Scripps Institution of Oceanography under the advisement of Dr. Maria Vernet. I co-founded and manage the citizen science project FjordPhyto which engages tourists in polar research to understand phytoplankton communities along coastal fjords in Antarctica. I do education and research through boat tours and scientific diving. I am a member of many research and women-focused STEM organizations. To learn more about what I'm up to visit me at www.womanscientist.com.
2. **What complex problem do you address in your work?**
   I want to understand how the environment influences phytoplankton in Antarctica. The Antarctic Peninsula is the third fastest warming region in the world with increasing air and ocean temperatures. These warmer conditions have caused 87% of the glaciers on the Peninsula to melt bringing more freshwater into the marine environment along the coast, influencing the types of phytoplankton there.
3. **What elements do you need to consider when addressing this problem?**
   Large scale atmospheric events such as El Niño and the Southern Annual Mode determine the temperature of the ocean and air, as well as sea-ice cover each year. These factors can change how fast sea ice and land glaciers melt each season. I also need to consider all the aspects that govern phytoplankton such as daylight length, nutrients available, grazers and predators, viral attack, and sinking rates.
4. **How did you get to where you are today?**
   In high school I liked exploring and thought being an Astronaut would allow me to travel to the moon. Many astronauts have degrees in STEM, so I chose to study Biology and Geology in college. I didn't even think I wanted to be a scientist until my senior year. After college, I started gaining experience in labs and in the field through various internships, volunteering and jobs. When I went to Antarctica for the first time, I fell in love and decided I would spend the rest of my career dedicated to polar ecosystems and oceanography. I decided to attend graduate school to further the opportunities and impact I could have in polar science.
5. **What advice do you have for becoming a systems thinker?**
   My advise for a high school student is to explore any system you encounter, and don't feel overwhelmed by all the information and connections you need to consider. Instead, think of it like a fun puzzle! How do things fit together an feed back on each other? Also, engage with scientists in other disciplines! Talk to many many other scientists even outside your own interests. This will help sharpen your systems thinking brain. And always remember that your personal experiences will provide a unique and valuable perspective that others might not realize. Don't fall into the trap of Imposter Syndrome. Be confident in your ideas and share your thoughts in those collaborative systems-thinking settings!