For many of us, the decision of what we want to do with our lives can be a long process. This was not the case for EAPS graduate student Youmi Oh. Since she was 11 years old, she said, she knew exactly what she wanted to do.

“I wanted to work at NASA because I thought a meteor would come to the Earth and we would all die,” she said. “My dream was to save the Earth.”

That mission led Oh to pursue a science education with intensity and vigor. In her home country of South Korea, she attended a specialized science school. After receiving her bachelor’s degree in Environmental Science and Engineering from the EWHA Women’s University in Seoul, she went to Princeton University for her master’s degree, with a focus on the Arctic methane budget. As she explains, this research has important implications for predicting climate change.

“Methane is the second most important greenhouse gas behind carbon dioxide,” she said. “In the Arctic, the soil has been frozen for a long time. Because the temperature increases from climate change, the frozen soil has started to defrost, and a lot of people expect that a lot of methane will be emitted from the Arctic soil, which will produce an enhanced warming effect.”

According to this model, as more methane is emitted from the soil, the temperature will rise further, creating a positive feedback loop. In her research at Princeton, however, Oh and her advisor focused on something modelers were not accounting for – bacteria.

“We found an interesting bacterium that absorbs a lot of the methane,” she said. “As the temperature increases, they absorb more methane.”

Once Oh’s advisor at Princeton discovered the bacterium, Oh adapted the model. This ultimately fit well with the work of Dr. Qianlai Zhuang, Oh’s co-advisor in EAPS.

“The model I worked on at Princeton is a very simple model,” she said. “Dr. Zhuang’s terrestrial ecosystem model is a very large model, so I want to implement my small model into his model and see how the whole Arctic responds to this temperature increase, and how this bacterium responds to the temperature increase.”

This was the topic of a publication in Geophysical Research Letters, titled, “A scalable model for methane
consumption in Arctic mineral soils,” of which Oh was the lead author. The article concluded that, “Because high-affinity methanotrophs may respond more strongly to temperature and less strongly to soil moisture than low-affinity methanotrophs, this feedback loop may be partially suppressed.”

Now a PhD student in EAPS, Oh continues to explore creative approaches to modeling. This has led to her receiving multiple accolades, including the NASA Earth Space and Science Fellowship, the Purdue Climate Change Research Center Graduate Student Initiative Award, and the Ross Fellowship in Natural Sciences and Engineering. This has not come from her work in the Arctic alone. She also works with Dr. Lisa Welp, her other co-advisor, studying connections between tree rings and climate change that she says many climate modelers have not taken into account.

“Basically, what Dr. Welp and I are studying is what climate change signals are recorded tree rings and what are not,” she said. “Climate change can change the isotope composition in the leaf and trees respond to drought and warmer temperatures, but there are a lot of complicated processes between the leaf and the tree ring. That’s important, because a lot of model validation just looks at the tree ring, and makes conclusions about climate change from that, and they may not be accurate.”

This research has large implications, but includes a local element. Oh goes to Monroe Morgan State Forest – roughly a two-hour drive from Purdue’s West Lafayette campus – every 10-14 days to collect leaf samples from the trees there to study in the Purdue Stable Isotope laboratory.

Oh anticipates graduating with her PhD in 2020, at which point she intends to bring her creative approach to research to a government laboratory. In the meantime, she continues to be involved in the department, participating in outreach events and continuing her research. It is a place, she says, that feels like home.

“Advisors here care, and take care of their students like family.”
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