Does bacterial drought tolerance influence greenhouse gas emissions from agricultural soils?

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PROJECT DESCRIPTION

Just 1 teaspoon of soil can hold up to 1 BILLION bacteria, and these bacteria have developed different strategies to cope with drought induced stress. Some bacteria hibernate (dormancy) during long periods of drought in hopes of better future soil conditions, while other bacteria stay active and manufacture nitrogen rich compounds (osmolytes) to maintain water inside their cells. Other bacteria do not have mechanisms to cope with long periods of drought. Upon a rain event, after a long drought, significant pulses of nitrous oxide (N_2O - a major greenhouse gas) are released from agricultural soil. These pulses of nitrous oxide are often larger than predicted by any biogeochemical soil models and comparatively, a pulse event can account for more N_2O emissions than if the soil never experienced drought-rewetting cycles.

The life history strategies of bacteria for surviving drought (dormancy, osmolyte regulation, and the lack of mechanisms to cope with drought) may mediate the magnitude of these N_2O pulse events. One hypothesis is that bacteria, which reduce the greenhouse effect by converting N_2O to nitrogen gas (N_2), do not have mechanisms to deal with drought or may respond slowly to rewetting, while bacteria taxa that produce N_2O have adopted drought tolerant strategies.

One of the primary goals of this research is to determine whether the differential ability of bacteria functional groups to respond to drought is the likely driver of N_2O pulses from agricultural soils. Another goal is of this project is to determine which bacteria are important in converting nitrogen to N_2O and which microbes are likely to reduce N_2O to N_2 and subsequently reduce the loss of nitrogen from agricultural fields to the atmosphere.

This project will be lab intensive, but will also have a field sampling component. The candidate must bring a smile to the agricultural fields in the mornings to sample! The URA candidate will gain a wide range of knowledge in soil science and microbial ecology.