

OECD COOPERATIVE RESEARCH PROGRAMME

FELLOWSHIP SUMMARY REPORT

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Title: Nematode trait-based indicators of climate change in semi-arid agricultural systems

Theme 1

Hosting institution: Colorado State University

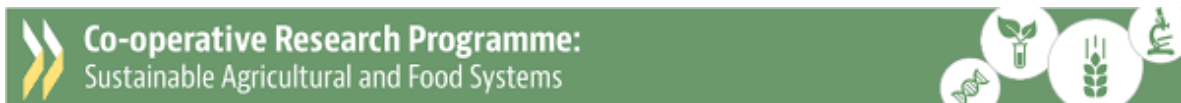
Host Collaborator: Dr. Diana Wall

Dates: June 1st – August 31st 2022

I consent to my report being posted on the Co-operative Research Programme's website.



**COLORADO STATE
UNIVERSITY**



1. What were the objectives of the research project? Why is the research project important?

Soils are extremely complex living systems inhabited by thousands of species responsible for multiple soil functions, playing a key role in the delivery of ecosystem services. In this context, this project explored the effects of climate change on soil organisms in arid and semi-arid agricultural systems. Specifically, we did study the response of nematodes, some of the most abundant and diverse animals in the soil (and for instance on earth), to climate change stress. Nematodes are used as bioindicators of soil quality and soil health in many agricultural and natural ecosystems, but the effects of climate change (drought and warming) on nematode communities have only been partially explored. In this project, we explored the use of nematode-based ecological indices and nematode functional traits as indicators of the effects of climate change on the biodiversity and functioning of agricultural semi-arid soils. We assessed nematode anhydrobiosis as the main mechanism affecting nematode survival under extreme climatic stress, and studied other functional traits (sex ratio, juvenile-adult ratio, and body mass) and changes in nematode community dynamics as the most relevant responses to drought and warming. Our results will increase our understanding on how climate change affects soil biodiversity in agricultural systems and the ecosystem services they provide.

2. Were the objectives of the fellowship achieved? Or are they on the way to being achieved?

Yes. Although data analyses have not been completed yet, preliminary results showed that some of the indicators proposed did respond significantly to drought and warming. Such findings open a new research line in the development of ecological sensors of climate change.

3. What were the major achievements of the fellowship? (up to three)

In this project, we have a) Performed 3 experiments on the effects of drought, warming, and heat waves on nematode community indices and functional traits. Two of them were performed in field conditions, and one was performed in the laboratory, b) We developed a new methodology to assess nematode anhydrobiosis in field and lab conditions, and c) We have proved that under-studied functional traits such as sex ratio, juvenile-adult ratio, and body mass can be used as relevant indicators of climate change stress on soil organisms.

4. Will there be any follow-up work?

Yes. Some results will be communicated at the Global Soil Biodiversity Initiative Conference (13-15 March 2023, Dublin, Ireland), one of the most relevant scientific forums on soil biodiversity. Additionally, at least two scientific publications will be published (planned to be submitted before June 2023, no decision on the journal chosen so far).

If possible, the collaboration between the two institutions involved in the project will continue in the future.

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

Climate change is the most relevant threat agroecosystems will face in the near future. In most semi-arid agricultural systems, climate change will reduce water availability, increase the frequency and intensity of droughts and heat waves, and increase summer length reducing crop cycle periods. To cope with all these changes, agricultural systems will have to adapt to new conditions. Agricultural soil management should play a relevant role in such adaptation, by implementing practices that mitigate climate change effects on soil carbon, soil structure, and soil biodiversity. To assess the efficiency of such and other mitigation strategies of climate change effects, scientists should develop efficient tools to perform such assessments, which should be available to technicians, farmers, and citizens. On the other hand, raising public awareness of the critical situation we are experiencing in relation to the climate on earth should also be part of the scientific efforts to ensure human well-being and agroecosystem sustainability in the future. This project aimed to contribute to both the assessment of the effects of climate change and mitigation strategies in agricultural systems and increasing public awareness of its effects on agricultural sustainability.

6. How was this research relevant to: The objectives of the CRP? The CRP research theme?

We know that soils sustain life on earth and are at the base of agricultural production. However, we have recently become aware of the relevance of soil biodiversity to sustain soil-driven ecosystem services. In agroecosystems, soil organisms contribute to soil fertility, plant growth, and pest control. By studying how climate change affects soil organisms, this project aimed to generate scientifically relevant information on the sustainable use of soils as a natural resource in the face of climate change.

7. Satisfaction.

Did your fellowship conform to your expectations?

Yes, it did.

Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities?

I think so. I have open new innovative research lines in my group and my institution, which I think will enhance the scientific and social impact of my research.

Did you encounter any practical problems?

No, I didn't.

Please suggest any improvements in the Fellowship Programme.

Increasing economic support for researchers with family responsibilities, especially for female scientists with kids.

8. Advertising the Co-operative Research Programme.

How did you learn about the Co-operative Research Programme?

I knew about it through a colleague in my institution.

What would you suggest to make it more “visible”?

Organizing virtual or on-line seminars to support and guide applicants.

Are there any issues you would like to record?

Just my gratitude to the Programme (CRP – OECD) and the host institution (CSU). Thank you very much!