

Final Evaluation Report

Your Details	
Full Name	Victor Satoru Saito
Project Title	Ecological Impacts of Sugar Cane Intensification on Freshwater Biodiversity and Ecosystems
Application ID	26823-1
Grant Amount	£4,000
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Date of this Report	09/03/2022

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Provide evidence of the impacts of agriculture contamination to freshwater communities				We found clear impacts of pesticides and vinasse (a compound used as fertiliser) for aquatic invertebrates and plankton communities. We highlight the impact on aquatic predators that were virtually extinct in our experiments following the use of pesticides and vinasse. We also found that biomass stability of ecosystems was sustained by a diversity of invertebrates that recolonised freshwater systems after the vanishing of organisms following contaminations.
Describe the impacts of land use intensification to freshwater ecosystems				The application of vinasse led to a 3-fold increase in conductivity, a 20% drop in pH, and to 2.5, 1.5 and 1.3-fold increases in total dissolved carbon (TDC), total dissolved nitrogen (TDN) and orthophosphate (P), respectively. Because of the sharp increase in labile carbon sources, dissolved oxygen (DO) was virtually exhausted in sugarcane mesocosms. Phytoplankton standing crop was boosted by the addition of vinasse, with a 13-fold increase in chlorophyll concentrations peaking concomitant to TDC, TDN and P. The direct injection of fipronil in the soil along sugarcane rows, following agronomical recommendations, was not enough to prevent contamination of mesocosms by the insecticide. Mean and maximum concentrations of fipronil in water were 171.5 and 325.4 ng/l. More predictably, manual overspray of 2,4-D in sugarcane plots 2 weeks later led to a contamination of mesocosms by the herbicide.
Provide information for policymaking for the use				Due to COVID restrictions, activities related to discussions about

of agriculture contaminants in order to protect freshwater ecosystems				policymaking with environmental agencies were not possible to execute.
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2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

After the execution of experiments in two locations (Brotas and São Carlos municipalities), the analysis of the biological material was highly impacted and delayed due to COVID pandemic. Invertebrates, zooplankton and phytoplankton communities had to be identified in researcher's houses and physical and chemical analyses were delayed due to the limited access to laboratories. We followed Brazilian and institutional regulations for any activity during COVID pandemic. Besides the delay in activities, most of the programmed approaches were made.

3. Briefly describe the three most important outcomes of your project.

Due to all delays, the most important outcomes are still in preparation. One important output for now, is the master thesis of Ana Carolina dos Santos, from the Graduate Program in Environmental Sciences at UFSCar. Her thesis should be available online in this semester of 2022.

4. What do you consider to be the most significant achievement of this work?

With this project we found compelling evidence that agriculture contaminants have direct and indirect impacts on the structure of biodiversity and the functioning of freshwater ecosystems. These results were found in highly realistic situations, going beyond the common micro scale studies focused on model organisms.

5. Briefly describe the involvement of local communities and how they have benefitted from the project.

Unfortunately, we had a weak involvement of the local community. Initial meetings with farmers were made to decide the common agriculture practices that we would simulate, yet after the completion of the experiment, we were not able to share the results in new meetings and discuss best practices.

6. Are there any plans to continue this work?

This project is still ongoing from the academic and outreach perspectives. Several manuscripts are still to be written, as well as new meetings with the community of farmers in order to inform about the impacts of common practices and ways to improve.

7. How do you plan to share the results of your work with others?

Technical findings will be shared using scientific manuscripts. Outreach of results will be made with meetings with the surrounding community of farmers. The university have a whole department of divulgation in order to help researchers to translate complex results to non-technical language.

8. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The grant was used over 3 years, which is more than the initial plan. This was done because pandemic delayed several activities including identification of biological communities that had to be done by a master's student using a short scholarship.

9. Looking ahead, what do you feel are the important next steps?

Important steps will be the publication of several scientific manuscripts, and the development of meetings with farmers to inform better agriculture practices that lower the impacts on freshwater ecosystems and biodiversity. New grants about land use impacts are being submitted to FAPESP, NERC and other funding agencies to continue our research.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The logo was used in my website, in the part describing the executed projects:
<https://sites.google.com/view/victorsaito/research>

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Gedimar Barbosa: conducted mesocosm experiments in São Carlos

Neliton Lara: conducted mesocosm experiments in São Carlos

Camila Batista Vieira: conducted mesocosm experiments in São Carlos, identified zooplankton communities

Ana Carolina dos Santos: conducted mesocosm experiments in São Carlos, identified phytoplankton communities

Erick Mateus Barros: conducted mesocosm experiments in São Carlos, did microbial analyses

Tadeu Siqueira: designed experiments, provided ecological expertise

Gilmar Perbiche Neves: coordinated zooplankton communities' procedures

Jorge Portinho: conducted zooplankton identification

Hugo Sarmiento: designed experiments, provided laboratory expertise and microbial analyses

Luis Schiesari: designed experiments, conducted experiment in Brotas

12. Any other comments?

This grant was of major importance for the consolidation of these experiments as well as to support my early years of research at my institution. During the time of pandemic, this grant was fundamental to support all possible activities as well as a student that have her master delayed and her fundings ended. The results here will be of great importance for building a more sustainable agriculture in a scenario of land use intensification.