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ATSAF - CGIAR++ Junior Scientists Program Final Report

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Country: India
Supervisor at IARC: Dr. Andrew Smith
Start and end date of stay at IARC: -
Start and end date of remotely supervised project: 15 Oct 2020 - 15 Jul 2021
Title: Comparing improved management strategies in rainfed cropping systems to increase SOC stocks and water-use efficiency in the semi-arid tropics of India

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Overview

The following paragraphs describe why and how I got involved with ICRISAT for doing the master thesis, and what steps were followed during the thesis project which started on October 15th 2020 and ended with the submission of the thesis on July 15th 2021.

Project involvement

In the spring of 2020, I was working as a student assistant for the department "Tropical Plant Production and Agricultural Systems Modelling (TROPAGS)" at the University of Göttingen. Collaborations between TROPAGS and ICRISAT had been taking place before, and when the ATSAF scholarship announcement was circulated via email, I approached scientists from ICRISAT to set up a videocall to introduce myself and discuss which ongoing projects I could get involved in. My aim was to do a thesis project in a working group, such that I can contribute to current research and set up connections for possible future work opportunities. After a video call, Dr. Andrew Smith and I came to an agreement that I can join his and Dr. Thomas Falk's working group under his supervision to do research on soil health and carbon sequestration using an existing dataset, since data collection in person and on-field was not possible. Still, later visits at research sites of ICRISAT as an intern were mentioned as potential alternative to doing field work and I prepared for a possible stay at ICRISAT in India. With this agreement, I searched for a supervisor from the University of Göttingen who was interested in the proposed thesis project and in supervising me, wrote a project proposal, and applied for the ATSAF scholarship.

Data acquisition and analysis

The data used for the thesis was generated using APSIM (Agricultural Production Systems sIMulator) simulations by Dr. Dakshina Murthy from ICRISAT for a project called "Soil protection and rehabilitation for food security in India; An Economics of Land Degradation (ELD) study" and described in the report "Advancing Knowledge on the Costs and Benefits of Sustainable Soil Fertility Management in Maharashtra and Madhya Pradesh, India" by Falk et al. (2018). However, the mentioned project had its focus mostly on economic parameters and evaluated ecosystem services in terms of financial returns. My thesis project focussed on soil carbon changes which previously had been calculated as one of several provisioning ecosystem services. A full dataset was provided by the working group, and during data cleaning and preparation, I uncovered shortcomings in the data concerning the carbon measures. Those measures had been retrieved from the simulation runs but had not been used in the previous study and therefore the uncovered shortcomings had not been noticed before. Thus, the simulations had to be re-run several times, and in April 2021 a useable

dataset was obtained from the ICRISAT working group. Re-running the APSIM simulations was done by ICRISAT, whereas doing the calculations and transformations was part of the thesis project.

Data analysis was done largely without the support from ICRISAT, but with the help of statistical advisors who I contacted. Dr. Andrew Smith and Dr. Thomas Falk expressed not having expertise with the statistical data analysis in R but suggested that I find advisors through my university contacts. Still, they gave feedback about my progress when I explained the different stages of analysis, i.e., the application of different algorithms and how I evaluated their strengths and weaknesses. Again, my connection to TROPAGS helped me find support as well as contacting various authors of scientific publications that used similar methodologies as the one that I was suggested by Dr. Andrew Smith and decided to apply.

Interaction with ICRISAT

The interaction with Dr. Andrew Smith as my supervisor was on very good terms. He offered help, but the interaction was mostly limited to irregular email conversations and commented word documents when I needed feedback on my current progress. For the main part of the project, my supervisor could not personally answer my questions, but forwarded me to different researchers within the working group who knew the dataset better and could explain details to me and eliminate mistakes through re-running the simulations. During 2021, Dr. Thomas Falk started supporting Dr. Andrew Smith in supervising me, and he became my contact person to discuss the progress of data analysis and to ask questions. Dr. Andrew Smith later continued to give much advice for structuring and formulating the thesis and for placing the results into the broader context.

In finding statistical advice, which was the core issue in the thesis project due to the complicated structure of the data, ICRISAT could not or did not provide much help. Still, through open communication, especially with Dr. Thomas Falk, and also through frequent progress updates as well as video calls with ICRISAT working group members and my German supervisor, I had guidance to lead me through those problems despite the distance, and a trusting relationship was established to express when I needed support or when I needed a spontaneous meeting.

Further, the ICRISAT working group valued my contributions and let me know that uncovering shortcomings in the dataset already helped their research. They also expressed the wish to publicise the findings of my project as a scientific paper and encouraged presenting the results at the “Tropentag” conference in Hohenheim in September 2021.

Conclusion

My personal conclusion is that doing a thesis project with ICRISAT gave me a realistic impression of being part of an international, multidisciplinary team. I highly value the skill of clearly and carefully communicating problems during the work progress, of taking constructive criticism and of discovering the unique expertise of the different team members. Establishing a mentor-student connection with a trusted person helped me when personal issues like frustration about uncovering more mistakes in the dataset or about not finding a suitable, reliable algorithm arose during the work process. Lastly, I am grateful for ATSAF's financial support which made it possible for me to take nine months for working on the project. The scholarship was also an encouragement for me as a master student to approach scientists to ask to participate in their research and to make a meaningful contribution.

References

Falk, T.; Murthy, D.; Gumma, M. K.; Kumar, S.; Whitread, A.; Limberger, S.; Bartels, L. (2018): Advancing Knowledge on the Costs and Benefits of Sustainable Soil Fertility Management in Maharashtra and Madhya Pradesh, India. Final Report. a contribution to the project "Soil protection and rehabilitation for food security in India - An Economics of Land Degradation (ELD) study".

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