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Citizen science and co-experimentation for scaling up climate smart agriculture (CSA) in the northern mountainous region of Vietnam

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1. Summary

Climate-Smart Agriculture (CSA) has been widely adopted to achieve food security and support climate change adaptation and mitigation. However, scaling up CSA remains challenging, particularly in developing countries. To scale up CSA, mapping its practices, building capacity, and establishing platforms to share knowledge, and raise awareness have been identified as priority actions. To empower smallholder farmers to be resilient to climate change and catch up with the rapid pace of technological advance in the northern mountainous region of Vietnam, the project adapts CSA concepts to small farmers by identifying and assessing current CSA practices with a citizen science approach (co-assessing and co-experimenting). 18 households participated in an experiment from October 2022 to December 2023 through integrating fruit trees with organic vegetable model in home gardens. Households provided seeds, micro-organisim products, irrigation system, vermiculture and technical training to experiement organic fertilizers making, bio-treatment in pest and diseases. Also, the project collaborated with Northwest Development Centre (TABA) and Agritage Cooperative to promote market through tourism and connect market in Hanoi.

The project further strengthens CSA capacity among stakeholders through workshops, policy briefs, and peer-reviewed publications. It fosters the development of the next generation of CSA experts in the Asia-Pacific region by offering early career researchers and students' numerous opportunities to engage in project activities. Four papers have been submitted to peer-reviewed journals, and one paper has been published in the proceedings of an international conference. Additionally, the project has supported a female student and a young female researcher in conducting research on biochar production and its application in improving agricultural soil quality, particularly in response to chemical use in agriculture.

An electronic information portal and smartphone application have been developed to facilitate knowledge exchange on CSA practices and agricultural activities. This platform grants farmers access to valuable information on successful CSA practices, seasonal schedules, advanced cultivation techniques, and pest and disease management. It also delivers real-time updates on pest and disease status in Van Ho district and provides suitability maps for key crops. Furthermore, to promote the participation of communities in agricultural activities, the platform includes an interactive feature allowing farmers to upload questions and photos of production-related issues, detection of pest and diseases to the website and app. This information is directly accessible to agricultural officials and experts, enabling them to provide timely advice to farmers and analyze data for management and research purposes. The website serves as a platform to market agricultural products from Van Ho to consumers nationwide.

2. Objectives

Early career researchers, smallholder farmers, CSO practitioners, government officials, and policy makers will increase their capacity to promote CSA in the northern mountainous region of Vietnam. This overall aim will be realized through the following objectives:

1. To increase the capacity of smallholder farmers in identifying and applying CSA practices on their farms.
2. To increase the capacity of early career researchers, young female researchers, students, and CSO practitioners in the northern mountainous region of Vietnam in CSA research and practice.
3. To increase the capacity of government officials on the use of indigenous knowledge and local varieties combining a citizen science approach to scale up CSA through co-work, policy briefs, and communication activities.
4. To integrate CSA into the research and training curriculum of the TUAF with a focus on training subsequent generations of CSA leaders.

3. Outputs, Outcomes and Impacts

<table>
<tr><th>Outputs</th><th>Outcomes</th><th>Impacts</th></tr>
<tr><td>- 114 smallholder farmers participate in the survey on the existing CSA practices
- 60 smallholder farmers participate in co-assessing existing CSA technologies and practices
- 18 smallholder farmers participate in a co-experiment of potential CSA technologies and practices
- 18 smallholder farmers are trained in using cell phones and the Survey123 platform to update information</td><td>Outcome 1: Increased capacity of smallholder farmers to apply CSA on their farms. This outcome will be achieved through the establishment of a network of farmer-experimentation using a citizen science approach and online platform for the exchange of experiences and site-specific advice to scale up CSA.</td><td rowspan="2">The project significantly promotes the scaling up of Climate-Smart Agriculture (CSA) through various initiatives. Farmers received capacity building in CSA practices, directly implementing them in their home gardens, effectively utilizing land and resources. Integration of annual crops with fruit trees, coupled with provided sprinkler irrigation systems, enhances agricultural productivity and resilience to water scarcity.

Citizen science has been used to foster CSA adoption among farmers. Through mobile applications and a website developed by the project, farmers monitor</td></tr>
<tr><td>- 10 early career researchers and 10 students of the Thai Nguyen University, as well as 10 members of the</td><td>Outcome 2: Increased capacity of early career researchers, students, and</td></tr>
</table>

development NorthNet are trained and increase their capacity in the application of GIS in citizen science and conducting co-experimenting CSA practices - The active engagement of 04 young researchers in training and co-research with (local and international) students and CSO practitioners during project research activities - 5 student theses, and 4 articles for peer-reviewed submitted, 01 paper published in an internal conference - Early career and female researchers, students, and CSO practitioners participated in the project improve research and technical skills	CSO practitioners in the northern mountainous region of Vietnam in CSA research and practices. Most of these participants will also learn the theories and skills required to apply Photovoice qualitative methods and geospatial technologies in research.	crops and report disease outbreaks, while accessing agricultural knowledge, market prices, weather forecasts, and disease information. These tools aid local authorities in managing and offering timely consultancy for farmers. Additionally, policy briefs and training for local staff in CSA practices and digital platforms advance agricultural extension and citizen science, enhancing government officials' capacity to scale up CSA practices. Capacity building extends to young researchers, students, and CSOs, engaging them in project activities and research grants on biochar production experiments. Additionally, the introduction of a syllabus on sustainable agriculture, incorporating CSA principles, at Thai Nguyen University of Agriculture and Forestry signifies a crucial step in integrating CSA concepts into academic curricula, ensuring sustained knowledge transfer and capacity building for future agricultural professionals.
-A portfolio of existing CSA practices and policy briefs are developed and shared with policy makers, government officials, and stakeholders - 10 government officials participate in activities of project such as co-designing CSA assessment and workshop on scaling up CSA - Two workshops at district and national level were conducted - Local staff were trained on application of website and	***Outcome 3:*** Increased capacity for government officials on using indigenous knowledge and local varieties combining a citizen science approach to scale up CSA through co-work, policy briefs, and communication activities. This results in more effective policy decisions made to support CSA scale up and initiatives in climate change adaptation.	

mobile application to sacle up CSA practices		
- A course on CSA developed and reviewed for teaching at both the undergraduate and graduate-levels at the TUAF - A detailed CSA syllabus is built and accredited for teaching - A field visit for TUAF students to learn about CSA practices	***Outcome 4:*** CSA is integrated into the research and training curriculum of the TUAF. Undergraduate and graduate-level students of the TUAF are trained in CSA and geospatial technologies through research and curriculum developed for them.	

4. Key facts/figures

- 34 farmers trained to use smart weather app
- 10 early-career professionals, 10 members of the NorthNet trained.
- 40 local authorities were introduced about CSA practices, 10 are trained in applying website and mobile application in agricultural extension activities
- 04 peer-reviewed publications submitted.
- 02 policy briefs
- 01 proceedings in an international conference
- 02 events workshops to scale up CSA at district and national levels
- 02 student seminars
- 01 training workshop for farmers (4 days)
- 01 website and 01 mobile application were developed.
- 05 student thesis were developed from the project
- 01 syllabus on CSA was developed

5. Publications

1. Truong Thi Anh Tuyet, Ho Ngoc Son, Aaron Kingsbury, Bui Tuan Tuan, Pham Thi Thanh Huyen (2022). Agroecological Rice Farming: An Approach for Economic Benefit and Energy Efficiency in the Northern Mountainous Region of Vietnam. International Research Symposium on Bioeconomy and Sustainability 5th and 6th October 2022, University of Applied Sciences Jena, Jena, Germany

2. Le Thi Kieu Oanh, Tran Dinh Ha, Truong Thi Anh Tuyet, To Mai Toan (2023). Effect of Growing Medium on Growth, Yield and Quality of Happy 6 Melon in the

Plastic Greenhouse during the Spring-Summer Crop 2023, Thai Nguyen Province. TNU Journal of Science and Technology 229(01): 127 - 134

3. Duong Minh Ngoc, Nguyen Duy Hai, Truong Thi Anh Tuyet, Nguyen Chi Hieu (2024). Research and Application of Biochar Derived from Agricultural By-Products to Improve the Quality of Degraded Acrisols. *Scientific Journal of Tan Trao*

4. Truong Thi Anh Tuyet, Dam Ha Luong Thanh, Gio Marcaida, Aaron Kingsbury, Ho Ngoc Son, Bui Tuan Tuan, Pham Thi Thanh Huyen, Ha Huy Hoang (2024). Mapping and Prioritizing Climate-Smart Agriculture Practices in Van Ho District, Son La Province, Vietnam. *Tropical and Subtropical Agricultural System (Under review)*

5. Truong Thi Anh Tuyet, King Joshua Almadrones Reyes, Aaron Kingsbury (2024). A GIS–driven Suitability Analysis of Crop Resilience to Climate Change in Son La Province, Vietnam**.** *Agriculture and Natural Resources (Under review)*

6. Media reports, videos and other digital content

VAN HO DISTRICT TOURISM PORTAL. Organic farming and tourism. Accessed at https://dulichvanho.com/tin-anh/san-xuat-huu-co-ket-hop-du-lich-215.html

THAI NGUYEN TV BROADCAST (Video). Organic farming - a sustainable agriculture. Report on national workshop in Thai Nguyen province
https://www.facebook.com/watch/?v=8254488097899296

Workshop on scaling up CSA in Van Ho district.
https://khuyennongvanho.tuaf.edu.vn/news/hoi-thao-nhan-rong-mo-hinh-nong-nghiep-thong-minh-thich-ung-bien-doi-khi-hau-csa-tai-huyen-van-ho-son-la

7. Pull quotes

“Given the remote nature of Van Ho District, accessing households for information dissemination is challenging. The online platform holds significant implications for the district's agriculture sector in transitioning to the digital age and fostering market connections for agricultural products.”

Mr. Nguyen Huu Hung
Director of Agricultural Service, Van Ho district, Son La province

"We hope the project will continue to expand to other villages in Chieng Yen, so that they also can learn and improve livelihood."

Ms. Ban Thi Kieu
Chairwoman of the Chieng Yen Women's Union

"Although my home garden is not large, through participating in the CSA model trial from the project, I have witnessed many positive changes. The irrigation system has significantly reduced manual labor. Especially, organic vegetable production have enabled us to sell products at higher prices. With the support, we have sold vegetables in Hanoi market and see this as a promising direction. We aspire for more villagers to expand, not only to provide vegetables for their families but also to sell to visitors."

Ms. Ha Thi Hiem
A farmer participating in the project

"Organic vegetable gardens have brought new vitality to Buot village"

Ms. Dinh Thi Huyen
Director of Northest Development Cooperation Center (TABA)

"Learning CSA not only enriches my understanding of agriculture but also empowers me to apply its principles in everyday life. Utilizing food waste and plant residues as organic fertilizer or mulch is crucial. Engaging in this CSA project enhances my career prospects, particularly in regions like Indonesia grappling with climate change"

Khuzaimah Khoirunnisa, an Indonesian student pursuing a Master program
at Thai Nguyen University of Agriculture and Forestry.

8. Acknowledgments

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9. Appendices

Appendix 1. Trainings and workshops

Appendix 2: Journal Articles

Appendix 3: Thesis Abstract