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Appendix 1. Trainings and workshops

TRAINING ON GEOGRAPHIC INFORMATION SYSTEM APPLICATION IN FIELD INVESTIGATION

I. BACKGROUND

Geographic location and object description are critical aspects of field research. In recent years, researchers have utilized various tools and methods to identify and record the locations/descriptions of observed objects. Increasingly, digital methods have gained popularity, and new technologies are garnering interest within the scientific community. Among these technologies, mobile mapping devices and applications have recently captured significant attention. Dedicated handheld devices like GPS (Global Positioning System) for research purposes have been supplanted by smartphones and tablets equipped with built-in GPS receivers for field mapping, making them more accessible to a wider audience. Moreover, utilizing GIS tools in investigations not only facilitates the collection of accurate data over time and space but also supports real-time decision-making.

With the aim of promoting and enhancing the accuracy and quality of data in research related to Climate Change, within the framework of the project "Citizen Science and Co-Experimentation for Replicating Smart Agriculture to Adapt to Climate Change (CSA) in the northern mountainous region of Vietnam," Thai Nguyen University of Agriculture and Forestry organized a training session on the topic: "Application of Technology in Field Investigation and Decision-Making Support."

II. OBJECTIVES

- Create a forum for academic exchange of recent advances on technology applications in field investigations;
- Promote cooperation and partnership networks among members in related fields.

III. TIME AND VENUE

- **Time:** March 5-7, 2022
- **Location:** Thai Nguyen University of Agriculture and Forestry

IV. PARTICIPANTS: 20

- Representative of the Board of Directors of Thai Nguyen University of Agriculture and Forestry
- Speakers come from institutes and research centres
- Officials, lecturers, students and interested people of Thai Nguyen University of Agriculture and Forestry

V. Agenda

Day	Time	Content	Implementer
March 6	8.00-8.30	Welcoming delegates	
	8.30-8.40	Opening speech	Dr. Truong Thi Anh Tuyet
	9.00-11.00	Application of Survey 123 and photo voice in surveys (Theory and practice)	Associate Professor, PhD. Aaron Kingsbury
March 7	8.30-11.00	Applying Mobile GIS technology in investigating and collecting field data	Dr. Nguyen Huy Trung

TRAINING FOR FARMERS

ON CLIMATE SMART AGRICULTURE PRACTICES TO ADAPT CLIMATE CHANGE

I. INTRODUCTION

Climate change stands as the paramount challenge confronting humanity in the 21st century, profoundly affecting production, livelihoods, and the environment on a global scale. Across Vietnam, observable temperature rises underscore the urgency of addressing this issue.

In striving for food security and the sustainable advancement of our region, it becomes imperative to seek intelligent and efficient solutions. Empowering farmers with requisite knowledge and tools to navigate climate change while capitalizing on emerging opportunities becomes paramount. Climate-Smart Agriculture (CSA), tailored to adapt to evolving climatic conditions, emerges as a promising agricultural practice. By employing technical measures that harmonize with the natural and ecological characteristics of crops, CSA holds potential for effective adaptation to climate change.

The proliferation of CSA practices attuned to climate change across various locales attests to their dual benefits, delivering economic prosperity alongside environmental sustainability. With the aim of guiding households in Van Ho towards sustainable agricultural practices, thereby aiding farmers in surmounting challenges posed by climate change, the University of Agriculture Lam Thai Nguyen is organizing a training session on "Climate Smart Agriculture Practices to Adapt to Climate Change."

II. OBJECTIVES

- Sharing about smart agriculture adapting to climate change (CSA).
- Guidance on technical measures in agricultural production to adapt to climate change

III. PARTICIPANTS

Total number of participants: 34 people are households in Van Ho, Son La

IV. TIME AND VENUE

1. Time: September 14-17, 2022;

2. ***Location*** : In Chieng Yen commune, Van Ho district, Son La province

V. AGENDA

September 14, 2022

Time	Content	Indicator
8:00 – 8:20	Introducing the climate smart agriculture and workshop program	Dr. Truong T. Anh Tuyet
8:20 – 8:30	Speech of local representatives participating in the project	Mr. Ha Trong Hieu
8:30 – 9:30	Organic standards and organic certification in agricultural production	MSc. Pham T. Thanh Huyen
9:30 – 11.00	Managing nutrients and pests in organic agriculture towards ecological agriculture	MSc. Ha Viet Long
14:00 – 16:00	Soil health and measures to protect soil health	MSc. Ha Viet Long
16:00 – 17:00	Livestock waste management towards a circular economy	Dr. Truong Thi Anh Tuyet

September 15, 2022

Time	Content	Person in charge
8.00 – 11.00	Hot composting method	MSc. Pham T. Thanh Huyen
14:00 – 17:00	Method of making compost from earthworms	Dr. Truong Thi Anh Tuyet
15:30 – 16:15	Prepare soil and design vegetable garden	MSc. Ha Viet Long

September 16, 2022

Time	Content	Person in charge
8.00 – 11.00	Instructions on techniques for growing vegetables, seasons and intercropping crops, crop rotation and using biological products to eliminate plant pathogens	MSc. Ha Viet Long
14:00 – 17:00	Prepare soil and design vegetable garden (practice at household)	MSc. Pham T. Thanh Huyen

Time: *September 17, 2022*

Time	Content	Person in charge
7:00 – 11:30	Cultivation techniques on sloping land	Dr. Truong Thi Anh Tuyet
14:00 – 17:00	Design a hill garden model	MSc. Ha Viet Long

TRAINING FOR STUDENTS AND YOUNG RESEARCHERS IN USING GEOGRAPHIC INFORMATION SYSTEMS IN DECISION-MAKING SUPPORT

I. INTRODUCTION

In the current era, the continuous development of information technology and telecommunications has created many opportunities to support resource management and policy decision making. In this context, Geographic Information Systems (GIS) have become an important tool in collecting, analyzing and visualizing spatial data to support decision making. However, the application and understanding of GIS is still limited for many people, especially students and young researchers.

The objective of this training is to establish a platform for knowledge exchange and learning, wherein participants can collectively explore and deliberate on the application of GIS in decision support. Fostering an environment for sharing insights, experiences, and seeking innovative approaches will not only broaden horizons in the field but also engender novel solutions to societal and environmental challenges.

II. OBJECTIVES

- Sharing about GIS and Spatial Decision Support System (SDSS)
- Students and young researchers have the opportunity to practice skills related to SDSS

III. PARTICIPANTS

Total number of participants: About 51 people are young research staff, Northnet members and students at Thai Nguyen University of Agriculture and Forestry

IV. TIME AND VENUE

1. Time: October 5, 2022;

2. ***Location*** : At Thai Nguyen University of Agriculture and Forestry

V. AGENDA

Time	Content	Indicator
8.30-9.00	Register	
9.00 – 9.30	About Spatial Decision Support Systems (SDSS)	Dr. Truong T. Anh Tuyet
9.30-10.00	The importance of SDSS and its application in the decision-making process	Dr. Truong T. Anh Tuyet
10.00-10.15	Breaks	

10.15-10.30	Components of a spatial decision support system	Dr. Aaron Kingsbury
10.30-12.00	Practice	Dr. Truong T. Anh Tuyet & Dr. Aaron Kingsbury

STUDENT SEMINAR

"Harmonizing Agriculture with Climate Change: Applying Climate Smart Agriculture (CSA) to Enhance Resilience and Sustainability"

I. INTRODUCTION

The Student Workshop on "Harmonizing Agriculture with Climate Change: Applying Climate-Smart Agriculture (CSA) to Enhance Resilience and Sustainability" aimed to inspire and equip the next generation of agricultural leaders with the knowledge and skills necessary to address and mitigate the challenges presented by climate change, emphasizing the significance of adopting sustainable practices to bolster stability, ensure food security, and promote long-term sustainability in agricultural systems. Through interactive workshops, students from various countries studying at Thai Nguyen University of Agriculture and Forestry had the opportunity to explore innovative solutions, exchange insights, and establish networks to facilitate the adoption of CSA methods within their respective communities.

II. OBJECTIVES

The goal of the workshop is to provide an opportunity for Advanced Program (AEP) students to introduce and share their research initiatives, especially related to Climate Smart Agriculture (CSA). This opportunity allows AEP students to present their findings, insights, and creative solutions related to CSA practices.

III. PARTICIPANTS

Total number of participants: 50 students of Thai Nguyen University of Agriculture and Forestry

IV. TIME AND VENUE

1. ***Time:*** Expected to be held on December 22, 2023;
2. ***Location:*** At Hall A4, Thai Nguyen University of Agriculture and Forestry.

V. AGENDA

Time	Work	Present
2.30-3.00	Register	
3.00-3.30	Climate Smart Agriculture (CSA)	Dr. Truong Thi Anh Tuyet
3.30-4.00	Mapping CSA practices in the mountainous regions of northern Vietnam	Dam Ha Luong Thanh K29- Master of Environment
4.00-4.30	Home gardens: Alternative solutions to mitigate and adapt to climate change. Case study in Son La, Vietnam	Khuzaimah Khoirunnisa K29- Master of Environment
4.30-4.40	Break	
4.40-5.00	GIS-based crop suitability analysis under different climate change scenarios	King Joshua K29- Master of Environment
5.10-5.40	From farm to fork: Unlocking the potential of circular economy in agricultural value chains	Francis K31- Master of Environment
5.40	Wrap up	

WORKSHOP

SCALING UP CLIMATE SMART AGRICULTURE PRACTICES,
2 NOVEMBER 2023 IN VAN HO DISTRICT, SON LA PROVINCE

I. INTRODUCTION

In Vietnam, temperature increases have been recorded in many places. In Son La: during the period 1961-1970, the average annual temperature increased by about 0.51 ^{o} C. Summer temperature increased by about 0.2-0.6 ^{o} C. The dry season was longer and drier; floods, landslides, and adverse weather conditions (severe cold, damaging cold, frost...) appear with more frequency and are more difficult to predict.

Agriculture is one of the sectors most affected by climate change. The agricultural sector in Son La in general and Van Ho district in particular has been seriously affected by climate change in recent years. Abnormal climate phenomena, such as prolonged droughts and high-intensity floods, are causing great challenges for farmers and agricultural production.

Climate-smart agriculture (CSA) is an approach that simultaneously enhances agricultural productivity, builds resilience to climate change, and reduces greenhouse gas emissions to ensure sustainable food security and livelihoods. With the goal of exchanging experiences and finding ways to scale up climate smart agriculture practices, helping Van Ho farmers overcome difficulties caused by climate change, Van Ho Agricultural Service Centre and Thai Nguyen University of Agriculture and Forestry jointly organized the workshop "SCAEL UP CLIMATE SMART AGRICULTURE TO ADAPT CLIMATE CHANGE".

II. OBJECTIVES

- Sharing about smart agriculture adapting to climate change (CSA).
- Analysing advantages and disadvantages when applying CSA models in Van Ho
- Introducing information technology applications in agricultural management for Van Ho District
- Discuss and find solutions to replicate the CSA model and deploy information technology applications to communes of Van Ho District

III. PARTICIPANTS

Total number of delegates participating: 40 people, including:

- Representative of Van Ho District Agriculture Department
- Representative of Tuyen Hoa District Agricultural Service Center

- Representative of Van Ho District Women's Union
- Representative of Van Ho District Farmers' Association
- Representatives of People's Committees of communes in Van Ho district (02 people: 01 PCT in charge of agriculture and 01 officer in charge of agriculture/01 Women's Union)
- Experts come from Thai Nguyen Agriculture and Forestry University and Centres

IV. TIME AND VENUE

1. Time: November 2, 2023;

2. Location: Van Ho District People's Committee.

V. AGENDA

Time	Agenda	Presenter
7:30-8:00	Participant Registration	
8:00-8:10	Delegate Introduction	Agriculture Service Center of Van Ho District
8:10-8:15	Opening Speech	Representative from Thai Nguyen University of Agriculture and Forestry
8:15-8:25	Speech by Van Ho District Representative	
8:25-8:55	Introduction to Climate-Smart Agriculture (CSA) and Exemplary Models	Dr. Truong Thi Anh Tuyet
8:55-9:15	Introduction to Smart Agriculture Models Adapted to Climate Change in Van Ho District. Advantages and Challenges in Scaling up CSA Models	Representative from Van Ho District Agricultural Promotion Center
9:15-9:45	Organic Agriculture Models and PGS Certification - Sustainable Directions for Agriculture in Van Ho District	MSc. Dinh Thi Huyen - Director of Northwest Development Cooperation Center (TABA)
9:45-10:15	Application of Information Technology in CSA Management and Scaling Up	Dr. Nguyen Van Hieu- Director of GeoInformatics Research Center
10:15-10:25	Coffee Break	
10:25-11:30	Plentary discussion: Mechanisms for Scaling up Climate Smart Agriculture Practices	
11:30	Meeting Conclusion and Remarks from District Representative	

VI. REMARKS FROM THE WORKHOP

In the plenatary discussions, it was emphasized that among various agriculture practices, organic farming should be prioritized and scaled up in Van Ho District as a

champion of climate-smart agriculture. Organic farming not only takes advantage of the land suitability but also supports the tourism development strategy, which has been successfully demonstrated in some villages of Van Ho.

However, scaling up organic farming for smallholders poses several challenges. These include the low awareness of farmers, entrenched habits in conventional methods, high labor consumption, and challenges in accessing markets. To address these challenges, there is a need to invest in capacity building for organic farming and facilitate connections with markets.

In the short term, efforts should focus on promoting the transition towards organic farming by changing the habits of farmers, such as making compost and reducing chemical usage. This can be achieved through Technical and Vocational Education and Training (TVET) programs targeted at young people and utilizing funds from annual environmental protection initiatives.

Besides, participants also discussed about the Van Ho PGS organic certificate group which established but not yet effectively. Need more commitment of the Van Ho district in promote activities of the group. Also, some CSA practices can be suitable for Van Ho and can gradually support for organic farming transition such as vermiculture and diversification of species. To promote CSA practices in general, it is necessary to promote them through cooperatives.

By prioritizing organic farming and addressing the associated challenges, Van Ho District can further enhance its resilience to climate change while promoting sustainable agriculture and supporting local economic development.

This addition highlights the importance of organic farming as a key strategy for climate-resilient agriculture in Van Ho District and provides recommendations for addressing the challenges associated with its scaling up.

Delegates express their satisfaction with the development of the website and mobile applications for Van Ho district by the project, recognizing them as crucial tools to showcase the district's products to a broader consumer base via e-platforms and facilitate timely communication between farmers and agricultural managers/extension staff. It will promote the contribution of farmers in the monitoring and reporting of agricultural practices, as well as pest and diseases detection. The Center for Agricultural Services will be entrusted with the responsibility of maintaining and regularly updating the website's information.

The workshop concluded with remarks from the district representative, expressing gratitude to all participants and emphasizing the importance of collaborative efforts in implementing sustainable agriculture practices in Van Ho District.

NATIONAL WORKSHOP

GROWING GREENER: SCALING UP ORGANIC FARMING FOR

CLIMATE SMART AGRICULTURE

1. **Time and location of the workshop**
   - Time: 8:00 AM, March 23, 2024
   - Location: Thai Nguyen City, Thai Nguyen Province
2. **Chairperson, co-chairperson:**
   - Chairperson: Assoc. Prof. Tran Van Dien
   - Co-chairperson: Dr. Truonng Thi Anh Tuyet
3. **Participants:**

Total number of participants: 80 people including

*** National delegates, experts:** Vietnam Association of Organic Agriculture; Ministry of Science and Technology; Vietnam Institute for Agricultural Policy Research and Development (IPSARD);

*** Delegates in the province and northern mountainous region:**

a. Delegates of Thai Nguyen province and provinces

+ Department of Agriculture and Rural Development of Thai Nguyen province; Thai Nguyen New Rural Coordination Office; Department of Plant Protection, Thai Nguyen Agricultural Service Center; Thai Nguyen Farmers' Union; People's Committee of Ie Tranh Commune, Thai Nguyen City

+ Thai Nguyen Tea Association

+ Department of Agriculture, Agricultural Service Center of Van Ho District, People's Committee of Chieng Yen Commune, Son La

+ Department of Agriculture and Rural Development of Bac Kan province

+ Department of Agriculture and Rural Development of Cao Bang province

b. Delegate of Thai Nguyen University of Agriculture and Forestry, Vietnam University of Agriculture, University of Economics and Business Administration

c. Representatives of enterprises, production cooperatives and households producing and processing organic agriculture.

d. Local Press Agencies.

4. Program contents

Time	**Content**	**Presenters**
8.00 - 8.30	Delegate registration	Organizers
8.30 - 8.45	Delegate introduction and opening remarks	Organizers
8.45 - 9.05	Overview of organic agriculture in Vietnam	GS. Dr. Dao Thanh Van, Vice President of Vietnam Organic Association

9.05 - 9.20	What is the policy for organic model development in Vietnam? Lessons from countries around the world and Vietnam	TS. Pham Hai Vu- IPSARD & Lecturer, Institut Agro Dijon, France
9.20 - 9.40	Lessons learned from organic models in Thai Nguyen	Representative of Thai Nguyen Department of Environmental Protection
9.40 -10h00	Application of Biotechnology in sustainable organic agricultural development	Assoc. Dr. Pham Cong Hoat - Ministry of Science and Technology.
10.00-10.20	Success story from developing organic tea model at Khe Coc Cooperative, Thai Nguyen	Mr. To Van Khiem- Director of Khe Coc Cooperative
10.20-12.00	Plenary discussions 1. Connecting farmers, government, businesses and research institution in scaling up organic models 2. Output for the organic market 3. Organic production associated with tourism- A solution for smallholders 4. Application of technical advances in organic production 5. Research and training in organic production 6. What policies to promote organic agriculture	1. Chairperson: Assoc. Prof. Tran Van Dien 2. Co-chairperson: Dr. Truong Thi Anh Tuyet
12.00	Workshop Conclusion	Dr. Truong Thi Anh Tuyet
12.00-14.00	Lunch	
14.00 -16.00	Visit and experience activities at the organic tea production	

5. Remarks of the workshop

In conclusion, the workshop has shed light on the pressing challenges faced by agriculture in ensuring food security and combating climate change. It is evident that adopting climate-smart agricultural practices is essential for sustainable farming in the face of climate variability. Organic farming, which integrates many climate-smart agricultural practices such as water and soil conservation and reduced chemical usage, not only contributes to human well-being but also mitigates greenhouse gas emissions, aligning with Vietnam's commitment to achieving net-zero emissions.

Notably, national and provincial policies are increasingly promoting organic farming as a climate-smart agriculture practice to simultaneously increase income, adapt to, and

mitigate climate change impacts. In Thai Nguyen, recent organic farming programs have significantly reduced the use of chemical pesticides, resulting in tangible benefits for tea-growing households and facilitating increased tea exports to the global market. Despite these successes, several challenges persist in the development of organic farming in Vietnam:

- Lack of transparency in the market, leading to consumer distrust due to organic products being often mixed with conventional ones.
- High prices of organic products limiting market accessibility.
- High cost of agricultural inputs.
- Difficulty in selecting inputs for organic farming according to state-issued lists.
- Stringent technical requirements.
- Limited availability of biofertilizers.
- The need for comprehensive regional planning rather than piecemeal approaches.

To address these challenges and promote sustainable agricultural practices, several solutions are proposed:

1. Establishment of a centralized steering committee from national to local levels, akin to successful programs like the New Rural Development Program and One Commune One Product (OCOP).
2. Implementation of clear regulations to ensure market transparency in organic farming.
3. Enhancement of consumer and producer awareness through education and outreach initiatives.
4. Collaboration with scientists to pilot and scale up successful models.
5. Formation of groups, associations, and cooperatives to link small-scale producers and facilitate market access for organic products.

By implementing these solutions, Vietnam can overcome the challenges facing organic farming and realize its potential as a sustainable and resilient agricultural practice, contributing to both economic prosperity and environmental sustainability.

WORKSHOP TO REVIEW THE CSA PILOTS

Project "Citizen science and co-experimentation to scale up climate-resilient smart agriculture (CSA) in the mountainous regions of Northern Vietnam

I. INTRODUCTION

Within the framework of the project "Citizen science and co-experimentation to scale up climate change-adaptive smart agriculture (CSA) in the northern mountainous region of Vietnam, 18 pilot models applying adaptive smart agriculture Climate change adaptation project has been built in Chieng Yen Commune, Van Ho District, Son La Province from October 2022 to December 2023. To evaluate and learn from experience for experimental implementation activities, the project conducted a review session in Chieng Yen District, Son La.

II. OBJECTIVES

- Promote the replication of organic agriculture models (organic agriculture)/organic orientation as a sustainable solution to adapt to climate change
- Units share experiences and difficulties in developing organic agriculture
- Policies and directions to promote administrative agriculture in Vietnam
- Integrating organic farming practices in training and research
- Connection between businesses, training and managers in developing organic agriculture

III. PARTICIPANTS

Total number of delegates participating: 40 people, including:

- Village leadership representative
- Project members and experts
- Buot village households (30 people)

IV. TIME AND VENUE

1. Time: March 26, 2024;

2. Location: Chieng Yen Commune, Van Ho, Son La.

V. AGENDA

Time	Content	Indicator
8.00-8.30	Register delegates	
8.30-8.40	Introduce delegates	
8.40-9.00	Summary of project activities	Dr. Truong Thi Anh Tuyet
9.00-15	Representatives of commune leaders	
9.15-9.30	Representatives of households participating in the project spoke	
9.30-10.30	Discussion groups ● What support and changes has the model created for households and villages (income, awareness, community relationships)? ● What are the difficulties in implementation? ● What solutions and plans are there to promote the model's continued development? ● Develop a roadmap to integrate ecological agriculture into existing programs and policies of the commune	
10.30-10.45	Breaks	
10.30-11.20	Groups present the results of their discussions	
11.30	Summary of the meeting	
12.00	Having lunch	

VI. REMARKS FROM THE WORKSHOP

1. **Achievements and Outcomes of the Experiments**
   Positive outcomes achieved in the experiments, as reported by project participants, include:
   - Acquisition of fundamental knowledge in cultivation and propagation of various vegetables to meet household needs as well as cater to tourists visiting the area.
   - Intercropping multiple types of vegetables and fruit trees in gardens has increased income for households.
   - Automatic irrigation systems have reduced manual watering efforts, thus creating spare time for other tasks.
   - Harvesting and marketing of clean vegetables have been more favorable for certain types of vegetables.
   - Expansion of the earthworm breeding model to multiple households has reduced the need to purchase feed for animals and fertilizers for crops, significantly improving income from breeding and selling earthworms.

- Awareness of traditional production methods causing environmental pollution and health risks.
- The project has boosted the confidence of Bản Bướt residents in generating income for their families.
- Households intend to continue implementing the organic farming model even the project ends

2. **Challenges and Constraints During Project Implementation:**
   Alongside the positive outcomes, there are still several challenges and constraints faced by participants during project implementation:
   - Lack of consensus among individuals and households in the production of vegetables leading to duplication of vegetable species in the same time and difficulty in marketing.
   - Vegetable consumption markets mainly cater to local residents and foreign tourists, leading to surplus and unsold produce.
   - Irregular maintenance of products resulting in severe shortages when needed.
3. **Proposals and Recommendations:**
   Proposed solutions and recommendations to address the aforementioned challenges include:
   - Support in packaging, transportation, and marketing of products.
   - Establishment of a business cooperative to generate income.
   - Product certification.
   - Establishing connections with purchasing parties to facilitate the sale of local products.

Appendix 2: Journal Articles

AGROECOLOGICAL RICE FARMING: AN APPROACH FOR ECONOMIC BENEFIT AND ENERGY EFFICIENCY IN THE NORTHERN MOUNTAINOUS REGION OF VIETNAM

Abstract

Agroecological production strategies not only accomplish goals of food security (SDG #2- zero hunger) but also contribute to mitigating climate change (SGD #12 action for climate) through utilizing biological processes to reduce chemical dependence that creates hazards for the environment and human health. To provide an explicit picture of how agroecological rice cultivation can promote sustainable development through economic improvement and energy-saving, in-depth face-to-face surveys of 30 households who are applying organic rice farming and ecological practices in Chieng Yen communes, Son La, Vietnam were conducted between January and June of 2022. Comparative analysis of energy input-output balances and economic efficiency analysis between conventional and agroecological methods of rice production showed that the agroecological rice cultivation method can save up to 63% of energy inputs. The economic benefits of organic rice farming per hectare also rose 3 times compared to conventional paddy. Hence, agroecological rice farming in the study area is recommended to adopt and scale up among smallholders in the northern mountainous region of Vietnam as a successful example of climate-smart agriculture which ensures food security, adaption, and mitigation to climate change. A comprehensive approach is taken in the study to analyze energy use and efficiency as a tool of the circular economy at the sectoral or activity levels, something rare of studies in Vietnam.

MAPPING AND PRIORITIZING CLIMATE-SMART AGRICULTURE PRACTICES IN VAN HO DISTRICT, SON LA PROVINCE, VIETNAM

Abstract

Introduction: As the problems attributed to climate change continue to escalate, there is a growing need for climate-smart agriculture (CSA) practices as a partial remedy. These practices not only aid in adaptation and mitigation efforts but also hold the promise of increasing income for farmers. **Objectives:** To identify, evaluate the potential CSA practices adopted by local farmers and explore the obstacles hindering the widespread adoption and scaling up of these practices within Van Ho district, Son La province, Vietnam. **Methodology:** Interviews with households, focus group discussions, interviews with key informants, and interviews with experts were conducted through the combination of participatory rural appraisal (PRA) and rapid rural appraisal (RRA) tools to engage a diverse range of stakeholders and capture a broad spectrum of perspectives. **Main findings:** The study yielded valuable insights into the current state

of CSA practices including their effectiveness, adaptability, and scalability at the study sites. Furthermore, results unveiled the challenges and barriers faced by farmers in implementing and expanding CSA initiatives, ranging from limited access to resources and technical knowledge to socioeconomic constraints and institutional barriers. This study goes beyond mere identification and assessment by determining prioritized CSA practices with high potential for promotion and future scale-up. **Implication**: Analyzing the feasibility, socioeconomic implications, and environmental impacts of these practices provides actionable recommendations for agricultural extension services, development practitioners, and policymakers. **Conclusion:** The study contributes to the advancement of sustainable agricultural strategies tailored to address the complex and evolving challenges posed by climate change.

Keywords: Climate-smart agriculture; sustainable agriculture; climate adaptation; mitigation; Vietnam

A GIS–DRIVEN SUITABILITY ANALYSIS OF CROP RESILIENCE TO CLIMATE CHANGE IN SON LA PROVINCE, VIETNAM

Abstract

Climate change presents a pressing challenge to various regions worldwide. This study investigated how it impacts land suitability for key fruiting trees and crops – mango, longan, custard apple, paddy rice, and maize in Son La Province, Vietnam. Using a weighted linear combination (WLC) approach, environmental factors such as annual temperature, accumulated precipitation, slope, soil type, humidity, and depth were modeled in a GIS to generate suitability maps for each species under current (1970 – 2000) and two future (2081 – 2100) climate change scenarios using Shared Socioeconomic Pathways (SSPs) 1–2.6 (optimistic) and 3–7.0 (pessimistic). Results showed various suitability across districts in Son La Province with the expansion of suitable areas under the pessimistic future climate scenario as being most pronounced. Findings also indicate a significant shift in growing areas in the region. Implications for policymakers and opportunities to form adaptation strategies based on more nuanced and informed decision–making for agricultural development are posited.

Keywords: Future climate, Climate suitability mapping, Mountainous region, Agricultural sustainability, Geospatial analysis,

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

The Happy 6 yellow melon variety is a newly developed cultivar by the Fruit and Vegetable Research Institute, known for its high yield, quality, and economic efficiency, leading to an expansion in production. To determine the most suitable growing medium

for this melon variety, a trial study involving six types of growing media was conducted during the Spring-Summer crop of 2023 within the plastic greenhouse at the Faculty of Agronomy, TUAF. Research findings revealed that treatment 4 (consisting of 60% soil, 20% rice husk, and 20% vermicompost) exhibited the best growth and development. This treatment demonstrated early female flowering and a harvest completion within 63.26 days after planting. Additionally, the average number of female flowers and pods reached 11.13 flowers per plant and 5.5 fruits per tree, respectively. The average fruit weight was 397.33 grams per fruit, resulting in an actual fruit yield of 28.8 quintals per 1,000 square meters, significantly higher than other treatments. Furthermore, treatment 4 produced the best fruit quality with a fruit pulp ratio of 74.04%, brix level of 14.1%, total sugar content of 3.81%, and vitamin C content of 16.83 mg/100g of fruit flesh. Notably, the Happy 6 yellow melon variety in the experiment exhibited minimal susceptibility to insects and remained free from diseases.

KEYWORDS: Growing medium, Happy 6 melon, Plastic greenhouse, Growth, Pests

RESEARCH PRACTICAL APPLICATION OF VARIOUS BIOCHAR TYPES DERIVED FROM AGRICULTURAL WASTE FOR SOIL REMEDIATION IN AGRICULTURE

Improper agricultural practices have inflicted soil pollution, marked by the accumulation of heavy metals and chemical fertilizers, resulting in the degradation of soil quality and reduced crop productivity. Biochar, a product derived from carbon-rich organic biomass via pyrolysis, emerges as a promising solution for soil enhancement, offering agricultural and environmental benefits. In a laboratory-scale experimental study, the efficacy of biochar application in soil remediation was evaluated. Four treatments were analyzed, encompassing biochar derived from rice husk (TSH01), sawdust and compost (TSH02), wood chips (TSH03), alongside a reference plot (TSH04). Various blending ratios of biochar with soil, ranging from 0% to 10% by weight, were examined to ascertain the optimal concentrations for soil amelioration.

Initial phosphorus (P) content in grayish-black soil stood at 11.70 mg/kg, indicative of poor nutrient levels, significantly bolstered by biochar (BC). The 10% BC blend (TSH01) notably elevated P to 13.02 mg/kg. Similarly, nitrogen (N) content, initially at 0.068%, experienced substantial increments due to BC, with the 10% blend (TSH02) displaying the most pronounced enhancement to 0.13%. BC also induced a shift in soil pH from acidic (pH 4.92) to alkaline (pH 6.16 with TSH02 10% blend). Moreover, potassium (K) and calcium (Ca) levels witnessed augmentation with BC, with TSH01 10% exhibiting the most promising results for K (439.41 mg/g) and TSH03 for Ca (62.57 mg/kg). Electrical Conductivity (EC) post-BC incorporation rose, with TSH02 10% yielding the highest EC of 0.67 mS/cm compared to the initial 0.138 mS/cm. Recommendations include further exploration of biochar properties for soil enhancement, large-scale trials, and the utilization of biochar as organic fertilizer for sustainable agriculture.

Moreover, the exploration of biochar's potential as an organic fertilizer for sustainable agriculture is proposed, offering alternatives to conventional fertilizers with potential long-term benefits for soil health and environmental sustainability. Overall, the study underscores the potential of biochar derived from agricultural residues in mitigating soil degradation and promoting sustainable agricultural practices, underscoring the importance of environmentally friendly solutions for soil improvement and agricultural sustainability.

Keywords: biochar, agricultural waste, soil improvement, agricultural sustainability, mitigate climate change

Appendix 3: Thesis Articles

ASSESSING RESILIENCE AND ADAPTATION OF CLIMATE-SMART AGRICULTURE PRACTICES IN VAN HO DISTRICT, SON LA PROVINCE, VIET NAM

Ms. Dam Ha Luong Thanh, Vietnam, Master student

Abstract:

The agricultural productivity in Van Ho district is limited by climate-related hazards, such as extended periods of aridity and an increased frequency and severity of droughts, and an increase in pests and diseases. In order to tackle these challenges and ensure food security in the face of climate change, the implementation of Climate-smart agriculture practices (CSA) is suggested. This approach aims to transform and align agricultural systems towards more sustainable methods. A study was conducted in Van Ho District, Son La Province, Viet Nam to assess climate variability and trends, as well as the adoption of CSA practices among local farmers. Primary data was gathered using a multistage sampling technique, which involved selecting farm households and administrative units. A combination of numerical and descriptive data was gathered through surveys conducted with households, utilizing semi-structured questionnaires, as well as through group discussions and interviews with key informants. The findings indicated that the majority of the households surveyed had made efforts to adopt at least one CSA practice, such as implementing agronomic techniques, practicing soil and water conservation, integrating pest management, and utilizing rainwater harvesting. Drawing from these findings, a number of suggestions are put forth. It is advisable to promote educational programs that focus on practical farming techniques for farmers in the area. Furthermore, enhancing the availability of credit and market services is recommended, alongside strengthening the connections between research, extension services, and meteorology institutions. This is vital for effectively distributing weather information and aiding decision-making processes pertaining to agricultural activities.

Keywords: *climate change, climate smart agriculture, assessing resilience, adaptation*

CASE STUDY OF SOCIO-ECONOMIC DETERMINANTS ON CROP DIVERSITY OF HOME GARDEN: BUOT VILLAGE IN SON LA PROVINCE.

Marcaida, Gio Serafin Ivan J., the Philippines, Undergraduate student

Revisions of agriculture system has been demanded. A focus on crop diversity as one solution for current agriculture practices. We studied a village in Viet Nam to see the crops condition, structure and composition and identify its socioeconomic characteristic. This paper is design to show 3 factors; the commonly found crops in the village, see the current condition of the crop diversity of the village of Buot, Son La Province and see the current socioeconomic factor that affects the status of Crop diversity. To assess garden level crop diversity, three indices (Species richness, Shannon-Wiener Index, Simpsons' diversity index) and analyze effects of

socioeconomics characteristic to crop diversity. Overall, crop diversity was average, but the village had more desirable diversity. This indicates that, while common diversity indices may look interchangeable in basic analyses, the choice of index can radically impact the interpretation of results when complex relationships are considered. The age does show an impact on the home gardens' crop diversity.

KEYWORDS: Socioeconomic *Determinant, Crop Diversity, Shannon Wiener Index, Simpsons Diversity, Index Species Richness Index*

COMPLEX MANAGEMENT TO IMPROVE SOIL HEALTH AND FERTILITY IN NO-TILLAGE FOR CONSERVATION AGRICULTURE BY USING ORGANIC AGRICULTURE IN SUGARCANE CROP/CASE STUDY MALANG- INDONESIA

Sanad Y.H. Sabri, Palestine, Master student

Conservation agriculture (CA) is considered as one of the most important basic concepts for promoting the principle of sustainable agriculture among farmers, which positively affects soil health and organic carbon content in the soil and thus enhances Soil Fertility. In this research, the sugarcane crop in Indonesia was selected in the Malang region, specifically in the village of Kepanjin, by conducting a comparison between lands planted with organic agriculture by sugarcane under conservation agriculture management (No-tillage), and lands planted with Non-organic agriculture by sugarcane under Conventional agriculture management (Tillage), where soil samples were taken from both sides and the following tests were conducted: Microorganisms (earthworms), Macrofauna, Soil Litter, Bacterial Enumeration, Soil Respiration, and Soil Organic Carbon.

The results indicated that No-tillage agriculture under conservative agricultural management was better, as the soil maintained its cohesion, its content of microorganisms, macrofauna, soil litter, and the soil's organic carbon content, thus improving soil health and fertility, which leads to increased productivity, and It helps achieve sustainable agriculture , in addition to the environmental impact of conservative agriculture, whereas (No-tillage) reduces greenhouse gas(GHG) emissions and Zero Waste for agriculture residue, which leads to achieving sustainable development goals(SDGs).

Keywords: Conservation Agriculture; Conventional Agriculture; Organic Agriculture; Soil Respiration; Organic Carbon; No-tillage

RESEARCH ON AGRICULTURAL DYNAMICS: AN ANALYSIS OF FARMER PROFILES AND AGROECOLOGICAL METHODS IN MALANG, EAST JAVA'S COMPLEX RICE SYSTEM LANDSCAPE

Pham Tien Dat, Vietnam, Undergraduate student

This study presents findings from a comprehensive survey to investigate agroecological practices, resource utilization efficiency, and social dynamics within the Complex Rice System landscape of Malang, East Java, with a specific focus on the Dhoho, Jenggolo, and Kepanjen areas. Divided into four sections, the survey gathers data on farmer demographics, farm characteristics, resource use efficiency indicators, and perceptions regarding social equity and responsibility.

The survey reveals nuanced insights into farmer profiles, including their demographics, farming experience, objectives, and land use practices. Furthermore, it examines resource use efficiency indicators such as fertilizer application, greenhouse gas emissions, waste management, and nutrient content, elucidating farmers' practices and perceptions in these domains.

Additionally, the study assesses farmers' perspectives on social equity and responsibility, covering aspects such as community involvement, governance structures, economic systems, and gender equity. The findings underscore the interconnectedness of agroecological practices with broader social dynamics, emphasizing the importance of inclusive and equitable approaches in agricultural development.

Overall, this survey provides valuable insights into the agroecological practices, resource management strategies, and social dynamics shaping the Complex Rice System landscape of Malang, East Java. These insights are essential for informing policy interventions aimed at promoting sustainable agriculture and fostering socio-economic development in the region.

RESEARCH PRACTICAL APPLICATION OF VARIOUS BIOCHAR TYPES DERIVED FROM AGRICULTURAL WASTE FOR SOIL REMEDIATION IN AGRICULTURE

Duong Minh Ngoc, Vietnam, PhD student

Improper agricultural practices have led to soil pollution, including the accumulation of heavy metals and chemical fertilizers, diminishing soil quality and crop productivity. Biochar, derived from carbon-rich organic biomass through pyrolysis, is a promising solution for soil improvement, offering benefits in agricultural production and environmental sustainability. Experimental research was conducted at the laboratory scale aimed to assess the impact of biochar application in soil remediation. Four treatments were examined: rice husk-derived biochar (TSH01), sawdust and compost-derived biochar (TSH02), wood chip-derived biochar (TSH03), and a reference plot (TSH04). The study evaluated different mixing ratios of biochar with soil, ranging from 0% to 10% by weight, to determine optimal concentrations for soil improvement.

Based on research, initial P content in grayish-black soil was 11.70 mg/kg, indicating poor nutrient levels, significantly enhanced by biochar (BC). The optimal 10% BC blend (TSH01) raised P to 13.02 mg/kg. Similarly, N content at 0.068% was notably increased by BC, with the 10% blend (TSH02) showing the most significant improvement to 0.13%.

BC also adjusted soil pH from acidic (pH 4.92) to alkaline (pH 6.16 with TSH02 10% blend). Additionally, K and Ca levels were boosted with BC, TSH01 10% showing the most promising results for K (439.41 mg/g) and TSH03 for Ca (62.57 mg/kg). Electrical Conductivity (EC) increased post-BC incorporation, with TSH02 10% resulting in the highest EC of 0.67 mS/cm compared to the initial 0.138 mS/cm. Recommendations include further research into biochar properties for soil amelioration, large-scale trials, and utilizing biochar as organic fertilizer for sustainable agriculture.

Additionally, exploring the potential of biochar as an organic fertilizer for sustainable agriculture is suggested, offering alternatives to conventional fertilizers with potential long-term benefits for soil health and environmental sustainability. Overall, the study underscores the potential of biochar derived from agricultural residues, in mitigating soil degradation and promoting sustainable agricultural practices, emphasizing the importance of environmentally friendly solutions for soil improvement and agricultural sustainability.

Keywords: biochar, agricultural waste, soil improvement, agricultural sustainability, mitigate climate change