PRIORIZING CLIMATE-SMART AGRICULTURE (CSA) PRACTICES IN VIETNAM

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Abstract

The study was carried out in the country wide, down to the provincial level. The result showed a potential of more than 807 CSA practices performing from 30/63 local provinces over the 8 ecological zones of Vietnam (including 776 CSA practices from crop production, 31 practices from livestock and a few from aquaculture). Through participatory approach (PA) with assessment of three pillars (productivity, adaptation and mitigation), 13 promising CSA were screened and selected from statistical 807 CSA practices, including 11 CSA practices from crop production and 2 practices from animal livestock) for in-depth survey. The filtering and priorizing result showed that relevant CSA practices for country should be in the following orders: in crop production: (1) 1 must 5 reductions (1M5R); (2) saving water irrigation for upland crop; (3) mushroom from rice straw; (3) shifting to early rice sowing in spring season; (4) rice-shrimp rotation; (5) 3 reductions 3 gains (3G3T); (6) shifting from two rice to rice and upland crop cultivation in upland area; (7) salt tolerance rice varieties; (8) shifting rice with low income and drought to Vietnamese apple; (9) shifting from two rice seasons to one rice and fish; (10) shifting from tobacco to Vietnamese apple and sheep raising. In animal livestock, (1) biogas from swine; and (2) biological bed for chicken. The study recommended that it needs further test of CSA within local provinces and ecological regions through field CSA performances and diversity fairs; measuring potential of GHG reduction prior CSA; develop guidelines of investment for CSA expansions and integrate CSA in restructuring programs, action plans and climate change response projects.

Keywords: Climate change adaptation, mitigation, crop production, livestock, food security, cost benefit

INTRODUCTION

In Vietnam, agriculture plays an important role for more than 67.7% populations and shares approximately 20% GDP and 11.9% of total national exportation value in 2015 (GSO, 2015). However, agriculture is facing serious impacts of climate change, soil and environmental degradation. It is also a big challenge for agriculture to ensure food security, greenhouse gases (GHG) emissions reduction and growth rate maintenance subject to climate change. In this case, CSA promotes triple-win options for food security, adaptation capacity and GHG mitigation potential. Widespread adaptation of CSA can create sustainable landscapes and built momentum towards climate smart food system (FAO, 2010).

Support for CSA, it creates opportunities for Vietnam to take a lead in establishing and modifying processes for scaling out CSA. By identifying what is needed nationally to take CSA to scale, links with donors and development organizations can be mobilized and moving forward. Hence, the prioritizing process of CSA is going to take into consideration of regional/local specificities, options, barriers, threats, costs and benefits and to guide for farmers and local authorities. Key characteristics of the prioritization process are that its use is driven by a participatory process to ensure that user priorities are effectively incorporated and reflected in all outputs and that it is flexible to meet the needs of various regions and stakeholders. Hence, site specific assessments, combination with participatory appraisal and expert methods are critical to identify relevant CSA for each agro-ecological and socio-economic context.

METHODOLOGIES

The logical framework of the study are to follow 7 steps as shown in Figure 1 (Catty A., 2014).

The study also conducted the review literature on important of agriculture, vulnerabilities and impacts to climate change (Tran Van The *et al.*, 2010 and 2012), expert knowledge and consultation, CSA distribution and application in general from published reports from local provinces, relevant documents, reports and database.

Primary data was collected by interviewing local people (19 CSA holders in 7 communes of 5 districts in three provinces (Nam Dinh, Ninh Thuan and Soc Trang). Participatory rural appraisal (PRA), face-to-face individual interview were applied in Nam Dinh, Ninh Thuan and Soc Trang provinces. Through expert meeting, the study also applied Strengths, Weakness, Opportunities and Threaten (SWOT), bottleneck

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analysis and group discussion to filter and priorize CSA practices among different ecological agriculture zone. Three pillars of productivity, adaptation capacity and mitigation capacity are selected to develop indicators and used to filter CSA practices.

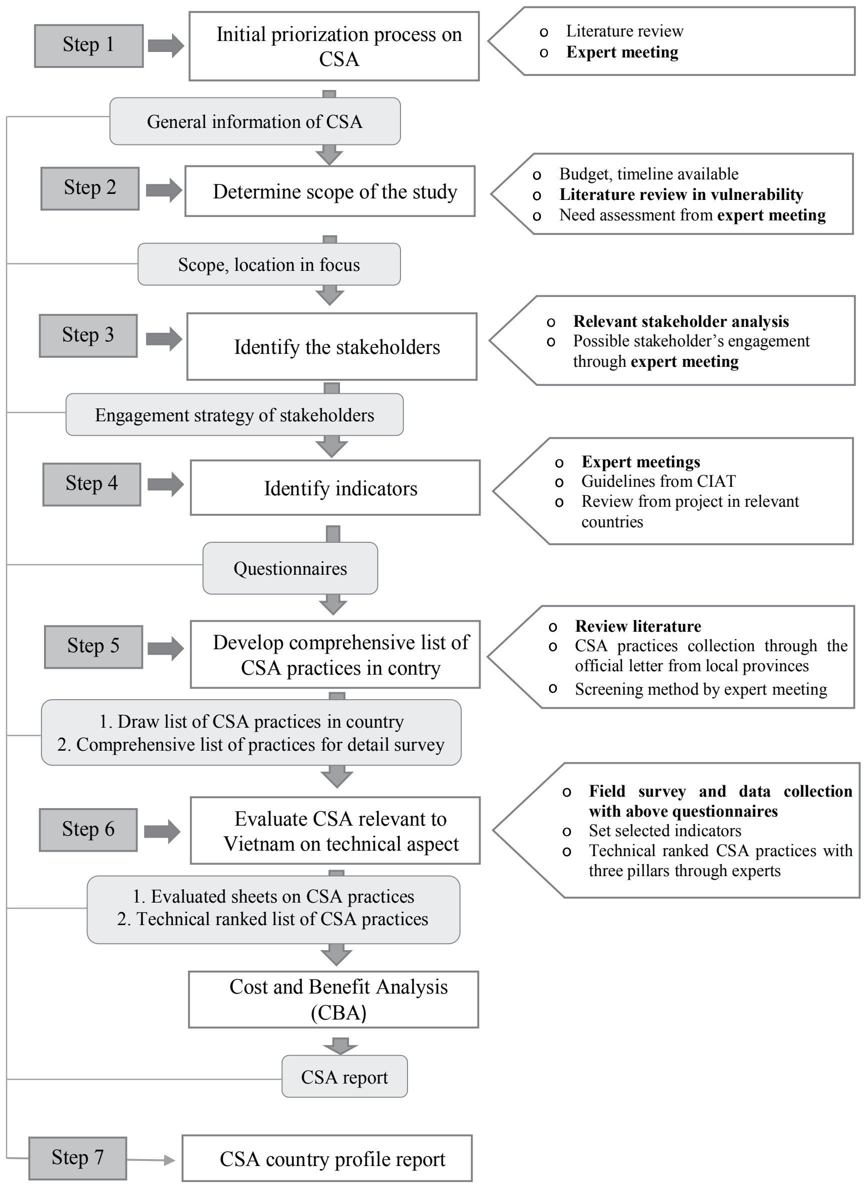

Figure 1. Logical framework of conducting the assigned activities of CSA prioritization

RESULTS AND DISCUSSION

Determination of CSA practices in country

The questionnaires were officially sent to Provincial Department of Agriculture and Rural Development (DARD) of 63 provinces, but we successfully received feedbacks from only 30 DARDs. Together with information from expert committee and relevant projects, the CSA database included more 807 CSA practices over 30 provinces, including 146 CSA practices in North Mountainous Region (NMR), 217 practices in the Mekong River Delta Region (MRD), 115 CSA practices in the Red River Delta Region (RRD), 56 CSA practices in South Coastal Central Region (SCCR), 60 CSA practices in North Coastal Central Region (NCCR); 151 practices in Central Highland Region (CHR), 62 practices in South East Region (SER). Thus, CSA practices seem widely applied and diversified over the ecological sites in Vietnam. The database shows that most of CSA have been practicing in Nam Dinh, Thai Binh, Ninh Thuan, Dong Nai and Ca Mau provinces (Table 1).

Table 1. CSA statistic in 30 provinces in Vietnam, 2015

Criteria	NMR	RRD	SCCR	NCCR	CHR	SER	MRD	Total
Total	*146*	*115*	*56*	*60*	*151*	*62*	*217*	*807*
Crop production	*142*	*106*	*52*	*57*	*147*	*59*	*213*	*776*
* Rice	63	33	28	20	24	19	133	320
* Maize	16	3	-	-	1	-	-	20
* Soybean	-	-	-	-	2	-	-	2
* Sugarcane	10	-	4	1	15	-	-	30
* Potato	6	19	-	-	3	-	-	28
* Vegetable	14	16	9	22	48	5	11	125
* Fruit	12	10	7	-	-	11	18	58
* Industrial crops	11	-	-	5	50	18	-	84
* Others	10	25	4	9	4	6	51	109
Animal livestock	*4*	*9*	*4*	*3*	*4*	*3*	*4*	*31*
* Pig	2	2	2	3	1	-	2	12
* Cow	-	1	-	-	1	3	-	5
* Poultry	2	6	2	-	2	-	2	14
Fishery and Aquaculture	-	-	-	-	-	-	-	-

The database also showed that a lot of CSA have been practicing on rice cultivation (320/807 CSA practices), including 125 CSA for vegetable production and 84 CSA for industrial crops and only 31 CSA for animal livestock. However, excluding some mixed cultivated system with aquaculture, there are missing CSA practices that have been applying for aquaculture from the local provinces.

Screening CSA practices for priorization

The study used the three pillars (productivity, adaptive capacity and mitigation) to screen CSA practices from 807 practices to determine the priorizing CSA for in-depth study. The evaluating sheet was used by experts to screen CSA practices. The screened list of 13 CSA practices for in-depth study (including 11 CSA from crop production and 2 CSA from livestock) was shown in table 2.

The 1M5R, 3R3G, early rice sowing in spring season, vegetable production in sandy soil, using rice straw for mushroom production, system of rice intensification (SRI), rice - shrimp cultivation, salt tolerance varieties' application are high scores from experts to recommend for in-depth investigation in crop production. Bio-microorganism bed for poultry raising and biogas are recommended for in-depth investigation in animal livestock.

Filtering and priorizing relevant CSA practices in Vietnam

Based on the selected 13 CSAs at screened stage, the study has conducted field survey with 19 implementers (CSA holders) including 5 implementers in Nam Dinh province, 7 implementers in Ninh Thuan province and 7 implementers in Soc Trang province. All indicators have been selected to meet request from three pillars above (Table 3).

In crop production: 1M5R, saving water irrigation for upland crop, mushroom production from rice straw, shifting to early sowing in spring season and rice shrimp mixed system highly appreciated by experts and recommended potential for expansion with score varied from 76.3 to 81.6 points. In livestock, biogases from swine are good CSA practices to help animal livestock to increase productivity, adaptation and GHG reduction. However, there are still some arguments on definitions of CSA because almost selected CSA are mixed system, increase in productivity and economic benefit and adaptation capacity are clear but it is hard and complicated to measure GHG emission. Moreover, some CSA play very well at the field but it just for specific and typical areas (such as Vietnamese apple and sheep in Ninh Thuan province only) and hard to expand other ecological regions subject to ecological features. Hence, based on this evaluated order and priority, MARD should develop guidelines for local authority to select and develop right CSA for expansion of investment.

Table 2. Comprehensive list of existing CSA practices

No.	Name	Average points (pointed, max 100 points)			
		Productivity (max 40 points)	Adaptive capacity (max 30 points)	Mitigation potential (max 30 points)	Total points (max 100 points)
I.	*Crop Production*				
1.	1M5R(1)	28.0	26.0	25.2	79.2
2.	3R3G(2)	27.0	24.2	26.0	77.2
3.	Early rice sowing in spring season	28.4	26.0	22.3	76.7
4.	Vegetable production in sandy soil	26.2	25.0	24.0	75.2
5.	Using rice straw for mushroom production	23.1	23.0	28.0	74.3
6.	System of rice intensification (SRI)	26.1	26.2	21.2	73.5
7.	Rice - shrimp cultivation	25.1	26.0	20.1	71.2
8.	Salt tolerance varieties' application	25.2	24.0	12.4	61.6
9.	Shifting two rice seasons to one rice and an aquaculture	22.1	27.0	24.0	63.0
10.	Drought tolerance varieties' application	24.0	24.0	12.4	60.4
11.	Shifting two rice to upland crop in drought area	14.7	22.0	16.1	52.8
II.	*Livestock*				
1	Bio-microorganism bed for poultry raising	25.2	24.1	27.0	76.3

Notes: (1) 1M5R: 1 must use of certificated seed, 5 reductions of water irrigation, seed, waste from harvest, pesticide, chemical fertilizer; (2) 3R3T: 3 reductions of seed, pesticide and nitrogen fertilizer, 3 gains of harvested yield, quality and benefit

CONCLUSION AND RECOMMENDATION

Conclusion

- CSA practices were found much diversified over the agro-ecological regions. Initial survey showed that there were more than 807 CSA practices over 30 local provinces and 13 CSA practices of them were considered and screened as high prioritized CSA selected for further detail surveying.

- The technical assessment result showed that CSA practices were prior and relevant to expand for agriculture in Vietnam as following prior order: In crop production 1M5R(81.7/100 points); saving water irrigation for rice (78.6/100 points); using rice straw for mushroom production (78.3/100 points); early rice sowing in spring season (77.1/100 points); rice-shrimp rotation; (76.3/100 points); 3R3G for rice production (75.6/100 points); shifting from two rice to one rice and upland crop (75.4/100 points); salt tolerance rice varieties for intrusive salt areas (74.0/100 points); shifting two rice to Vietnamese apple only (73.6/100 points); shifting two rice to one rice and catfish (71.9/100 points); shifting tobacco with high water demand to Vietnamese apple and sheep raising (61.3/100 points) and biogas from swine residues (85.73/100 points); biological bed for chicken (79.75/100 points) for livestock production.

Recommendation

The study recommended that government should invest for CSA performances according to typical ecological zones, measures GHG emission reduction potential of all technical aspects from CSA; developing guidelines in both technical and investment aspects for CSA and integrate CSA development in restructuring programs, action plans of climate change response, developing and agricultural extension programs and expansion of above CSA practices.

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Table 3. Priorization of relevant CSA for implementation

No.	Name of CSA	Average points from expert's ranked (point)				
		Production	Adaptation	Mitigation	Total	Ranked
I.	*Crop production*					
1.	1M5R (Nam Dinh, Ninh Thuan and Soc Trang provinces)	32.6	26.8	22.3	81.7	1
2.	Saving water irrigation for rice (as part of SRI, Ninh Thuan province)	32.3	25.4	21.0	78.6	2
3.	Using rice straw for mushroom production (Soc Trang province)	32.3	24.1	21.9	78.3	3
4.	Early rice sowing in spring season (Soc Trang province)	32.4	25.1	19.4	77.1	4
5.	Rice shrimp cultivation rotation (Soc Trang province)	31.7	24.3	20.3	76.3	5
6.	3R3G (Ninh Thuan, Soc Trang provinces)	29.9	25.2	20.5	75.6	6
7.	Shifting from two rice to one rice and a upland crop (soybean, vegetable, Soc Trang province)	31.3	23.1	21.0	75.4	7
8.	Salt tolerance rice variety in Nam Dinh province	29.5	25.4	18.1	74.0	8
9.	Shifting from paddy to Vietnamese apple only (Ninh Thuan province)	29.2	23.3	20.1	73.6	9
10.	Shifting two rice season to one rice and a catfish (Nam Dinh province)	28.1	24.3	18.5	71.9	10
11.	Shifting from tobacco with high water demand to Vietnamese apple and sheep raising (Ninh Thuan province)	25.8	20.8	14.7	61.3	11
II.	*Livestock*					
1.	Biogas from swine residues	21.6	26.16	25.43	85.73	1
2.	Biological bed for chicken	19.25	25.35	22.95	79.75	2

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TEMPERATURE AND RAINFALL IN RELATIONSHIP WITH RING DENSITY AND RING TOTAL NITROGEN OF *Pinus merkusii* IN THE CENTER OF VIETNAM

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Abstract

Tree growth is affected by the environment changes. Mean temperature and annual rainfall at Quang Binh province were used to be representatives of climate. Tree ring density (TRD) and tree ring total nitrogen (TRTN) show the tree growth of pine merkusii in Quang Binh of Vietnam. This paper aimed to study influence of mean temperature and rainfall on TRD and TRTN. Physical method was applied to analyze density based on Archimedes principle and chemical method was used to analyze total nitrogen in the Lab of Institute for Agricultural Environment (IAE) by using the standard of Chonnam National University (CNU) Lab. Tree growth (TRD and TRTN) depends on temperature or rainfall in an linear equation. The results in 12 months of a year showed that August was the most sensitive month relating to environment change and tree growth. The correlation between monthly average temperature and TRD (R square = 0.75**) and TRTN (R square = 0.84**) was positive. The correlation equation between mean temperature and TRD and TRTN was Y = 0.49X1 + 11.97X2 + 26.4. There was no significant correlation between rainfall and TRD and TRTN. In conclusions, the result was meaningful for interpolating the environment change (mean temperature) from tree ring disk (TRD and TRTN) in a linear equation. Y = 0.49X1 + 11.97X2 - 212337

Keywords: *Pinus merkusii*, temperature interpolation, tree ring physical and chemical

INTRODUCTION

When determining the ages of a tree and tree growth manually in relationship with climate change, natural phenomenon and process can be restored (Bitvinskas, 1974). By planted climate method, Vuong Van Quynh (1990) showed that tree growth change and breadth of pinus sylvestris in Vaconhezo (Russia) were clearly affected by climate condition. Oberhuber (2002) has established the relationship of temperature and rainfall with change of tree ring of pinus Longaeva, and reported that tree ring widths which are small are caused by low temperature. Tree growth is affected by various environmental factors associated with climate change including changes in air temperature, air precipitation (Giradin *et al*, 2008).

In the beginning of 20th Century, Duglas conducted to research of many big tree having long age with tree ring and he had conclusion: change of tree ring width show the signature of nature, especial in activated periods of the Sun (Schulman, 1956). In America, scientists had used big amount of tree ring and with modern method to find out the relationship between nature phenomenon change and wood ring change. However, up to now, they did not concern much with tree ring density and tree ring total nitrogen. In this study, TRD and TRTN are two factors reflect most sensitive of tree growth (one for physical quality and one for chemical quality). The width of tree rings (TRW), and the maximum density achieved in their latewood (MXD) are the parameters most often used in dendroclimatology (Hughes 2002). There is a strong positive relationship between maximum latewood density and tree-ring width data in larch growing at high latitude. This relationship is pronounced for narrow rings (< 0.3–0.7 mm) (Alexander et al. 2006). Because of this correlation, a mixture of climatic signals is contained in the variation of each tree-ring parameter. Conditions leading to cool or warm early summer may have little connection with those controlling late summer temperatures (Vaganov and Shashkin 2000). Wolfgang Gindl (2000) confirmed that a cool short growing season produces a narrow, low-density growth ring, whereas more favorable warmer conditions will lead to wider rings with higher latewood densities. Dendro-climatologists make use of this relationship to reconstruct summer temperatures of the pre-instrumental era (Eckstein and Aniol 1981; D'Arrigo *et al*. 1992; Briffa et al. 1998). Reduced N uptake under acidic soil conditions results in lower radical growth of Pinus Densiflora via non-stomatal limitation of photosynthesis (Hung Dinh Viet *et al*, 2012). There are some studies of N uptake from soil, delta N 15 and TRTN in tree ring (Choi *et al*. 2013), but no research about relationship between TRTN and temperature or rainfall.

Correlation, response function and partial correlation analysis indicate that prior year annual (January - December) minimum temperature is most responsible for the higher belt juniper radial growth, while more or less precipitation signal is contained by the tree-ring width chronology at the lower belt and is thus excluded from further analysis (Minhui He

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