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RESEARCH NOTES

Mainstreaming Climate Change Adaptation in the BS Agriculture Curriculum in Selected Commission on Higher Education Centers of Excellence in Agriculture

ABSTRACT

The agriculture sector is one of the major areas much affected by the current climate change risk. The Higher Education Institution (HEIs) specifically the SUCs centers of excellence in agriculture plays significant role to limit or lessen the impacts of climate change by promoting leadership in developing effective climate change adaptation strategies and creating public awareness. This study was conducted to assess the level of integration of climate change adaptation (CCA) in teaching courses under the Bachelor of Science in Agriculture (BSA) curriculum; determine the extent of influence of individual, organizational, external factors in the integration; and develop strategies how to mainstream CCA in the BSA curriculum program. Descriptive research utilizing survey and key informants interview (KII) of the deans and administrators were used to gather necessary data. A total of 103 faculties and 8 college administrators including deans from the four selected university became the respondents. The overall perceived knowledge, student needs to mainstream CCA in BSA is high. Majority of the respondents agreed that climate change adaptation principle is reflected to their organization mission. Minimal level of (CCA) integration observed among the agricultural colleges CHED Centers of Excellence. There is minimum integration of CCA in fundamental agriculture courses offered under BSA curriculum across the participating SUC-CA. Since there are existing legal basis such as; RA 9512 or the National Environmental Awareness and Education Act of 2008, section (3) which focus integration of environmental education in school curricula at all levels, whether public or private. RA 9729 or Climate Change ACT 2010. The respondents of this study from participating SUC–CA centers of excellence in agriculture believed that the specific policy from CHED through a circular memorandum order CMO mandating the SUC's to re-examine the existing BSA curriculum under CMO#14 and develop strategies on how CCA will be integrated /mainstream on the course program is effective approach in support to the result of this study.

Key words: *Climate change adaptation, Strategies on Mainstreaming CCA, CHED centers of excellence in agriculture*

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INTRODUCTION

Agricultural higher education institution HEI's plays a vital role in promoting the agricultural development of the country (*Villareal et al 2002*). Like any other organizations, educational systems operate under the impact of external forces from societal, political, economic, and environmental along with the institutional level. School systems are constantly in the process of change because it needs to respond and adapt to feedback received from their environment (*Ballantine 1997*). But how can higher education intitutions basically the Agricultural Colleges SUC's centers of excellence in agriculture respond and adapt to the issues and challenges brought about by climate change?

Presently, the occurrence and impact of climate change are experienced in the different countries and regions around the world specifically to developing and under developing countries like Philippines (*Lasco 2008*). The risk to human life from natural disasters in the Philippines has increased over the past generation (*De Souza 2005*). It is expected that climate change will exacerbate existing stresses in the country (*The Philippines Initial National Communication 1999*). The agricultural sector and production in the country are perhaps the major important sector directly threatened by climate change (*PTFCC 2007*). Moreover, the current agricultural practices in the country undeniably cause environmental problems through intensive farm mechanization and use of harmful chemicals and pesticides. At present, agriculture is one of the biggest polluter of the earth (*Maguire 2007 as cited by Tuquero, 2009*).

There are several ways to cope with this climate change risk. The *IPCC Fourth Assessment Report* (*2007*) affirmed that climate change can be limited by suitable adaptation

and mitigation measures creating public awareness from various institutions local, regional, national and global levels. It is increasingly being recognized that adaptation to climate change must be considered as an integral element of development and poverty reduction efforts (*Burton and van Alast 2004*). It is therefore important to promote early and cost-effective adaptation and mitigation to climate change risks using current adaptation measures to existing climate variability and extremes as a starting point (*Stern 2006*). Improving the capacity of local institutions and communities in adapting with current climate vulnerability is tantamount to improving their capacity to deal with future climate changes and risk (*CIRCA 2008*).

In relation to these issues and problems, the higher education institutions (HEI's) plays an important role in preparing and providing leadership to promote effective strategy for climate change adaptation and promote sustainable development (*Bloom 2005*). Section 3 of RA 9512 or the National Environmental Awareness and Education Act of 2008 states that the Department of Education (DepEd), the Commission on Higher Education (CHED), the Technical Education and Skills Development Authority (TESDA), the Department of Social Welfare and Development (DSWD), in coordination with the Department of Environment and Natural Resources (DENR), the Department of Science and Technology (DOST) and other relevant agencies, shall integrate environmental education in its school curricula at all levels, whether public or private, including in barangay daycare, preschool, non-formal, technical vocational, professional level, indigenous learning and out-of-school youth courses or programs. Environmental education shall encompass environmental concepts and principles, environmental laws, the state of international and local environment, local environmental best practices, the threats of environmental degradation and its impact on human well-being, the responsibility of the citizenry to the environment and the value of conservation, protection and rehabilitation of natural resources and the environment in the context of sustainable development. It shall cover both theoretical and practicum modules comprising activities, projects, programs including, but not limited to, tree planting; waste minimization, segregation, recycling and composting; freshwater and marine conservation; forest management and conservation; relevant livelihood opportunities and economic benefits and other such programs and undertakings to aid the implementation of the different environmental protection law.

Climate change adaptation is a component of this environmental education laws with this the development of relevant adaptation strategies at the SUC's level has given priority in this study, Presently, the impact of climate change had already experience by humanity in different regions around the world. Effective climate change adaptation strategies helps to increase the awareness of people to current climate risk and impacts basically in agriculture sector and to develop disasters preparedness to minimize damages and loss of lives.

The CHED centers of excellence colleges in agriculture were selected in this study to assess their capability, resources and priorities and determine how these universities/colleges were ready to cope with the challenges brought about by climate change and determine their readiness to integrate CCA in the BSA curricular program. This program is a new undertaking which piloted in these colleges as basis of other SUC's, LCU's and private HEI's to develop their own programs and strategies to mainstreaming CCA in the curriculum.

Curriculum is the heart of the academic program for instruction it can be enchance and develop through the process of curriculum review, examination, modification, revision, institutionalization and implementation (*Sajise 1999*). Agriculture education curriculum program is built on inter-related concepts and combines practical, in-the-field knowledge with a scientific understanding of soil management and conservation, crop physiology, livestock production, integrated pest management, agro-forestry, human nutrition and community food systems (*Williams 2008*). Agriculture education curriculum is dynamic (*Villareal et al 2002*). Like any other curriculum, it must not only be a planned learning outcome but also a strategy, a careful evaluation of means and ends.

METHODOLOGY

This study was conducted in four selected CHED accredited National Centers of Excellence in Agriculture. These are the University of the Philippines Los Baňos (UPLB), Benguet State University (BSU), Visayas State University (VSU) and Central Mindanao University (CMU). The CHED centers of excellence in agriculture were selected as respondent institution because as centers of excellence agricultural colleges they have important roles to perform with regards to major issues like climate change. They should be more responsive, proactive to develop mechanism and strategies which support to the current needs and demand of agriculture education system.

This study was designed as a descriptive survey research which attempts to assess the level of integration of CCA in teaching fundamental agriculture course under BSA curriculum of the selected college centers of excellence in agriculture; determine the extent of influence of individual, organizational, external factors in the integration; and develop strategies to mainstream CCA in the BSA curriculum program.

The respondents consist of faculty members and administrators who were handling courses in the BSA curriculum of the four selected CHED centers of excellence. Individuals with equivalent position of administrators based on the existing organizational structures of the College of Agriculture (CA) were chosen as respondents. The respondents were generated from a list of faculty members provided by the respective college secretaries of the four selected SUCs. This provided baseline data on the number of faculty members who can serve as respondent. The total population of active faculty in the CA of the four respondent SUCs with the total of 192 was used as respondents, but of the 192 questionnaires sent out, 103 questionnaires or 54% returned rate and these were considered respondents. The VSU had the largest number of respondents in the study sample (28.15%) while BSU and UPLB had around 24.27% and CMU respondents comprised the smallest proportion, 23.30%.

The questionnaire was adapted from the study of *Cubelo* (*2002*) and *Tuquero* (*2009*) and which was later modified to make the questions relevant to the present study. Two sets of questionnaires were used in this study. The first was the questionnaire checklist intended for faculty respondents, and the second set was the guide questions formulated for interview intended for deans/administrators or any individuals with equivalent positions.

Simple statistical techniques (descriptive statistics) like frequency counts, percentages, and weighted mean and rank were used to analyze and describe the variables.

RESULTS AND DISCUSSION

Climate change is considered to be one of the most serious threats to current and future agriculture development, its adverse impacts already observed on the environment, human health, food security, economic activity, natural resources and physical infrastructure. Increasingly, climate change is becoming a challenge to academic institutions basically the agricultural colleges. Presently, there is a need to rethink and transform the tertiary agriculture education system so that it becomes responsive to the needs of the society (*Temu et al 2003*). Recognizing the role of education in response to climate change, effective adaptation strategies from individual and institutional level are needed in order to mainstream CCA concepts, principles and practice in agriculture curriculum program. There is a need for agriculture teachers and even the agriculture students to be well versed and aware with the current climate change risk and develop mechanism to lessen its impact.

This study analyzed how SUC's centers of excellence in agriculture respond to the issues and concerns about climate change adaptation. The units of analysis were based on theextent of integration of CCA as influenced by individual, organizational and external factors in relation to teaching fundamental agriculture courses as basis of developing strategies on mainstreaming CCA in BSA curriculum.

Observed experiences of the deans/department heads

The Dean/Department Heads from CMU-CA claimed that their faculty, staff and students presently become aware of the issues related to climate change. Specifically, some of their teachers were said to have already incorporated the issues, concepts and the impact of CCA in selected courses under BSA program. However, there has yet to be formulated policies or guidelines from the university or even from CHED to fully integrate the CCA concepts in the BSA curriculum. There have been options and suggestions offered by the administrators on how the college might be able to respond to the initiative of mainstreaming climate change adaptation in the BSA curriculum: Bring the issues to the college curriculum committee for further analysis and review; identify the courses where CCA must be integrated; schedule a workshop to discuss the issues and concern; and prepare standard procedures which can be used as guide by teachers on how they can enrich or revise their course outline/syllabus. The option to revise the whole curriculum is a least priority of the college because of the long process it entails. During the conduct of the study, it was found that the CHED issued a new Circular Memorandum Order #14, series of 2008 for the revision of the old BSA curriculum to new ladderized curriculum. The CHED required the SUC's primarily to SUC-CA which awarded Centers of Excellence in Agriculture for their strict compliance. The CMU College of Agriculture during that period was on the initial stage of the implementation of the CHED CMO-14. Based on the analysis and review of the new curriculum issued by CHED and the revised curriculum adapted, the new curriculum still lacked courses and topics that focus on CCA. Moreover, there are options that have already been mentioned by the dean/department heads to enrich their curriculum and to consider the issue of CCA specifically, its relationship to Sustainable Agriculture courses that was already integrated in their current BSA curriculum.

The VSU-CA Dean/Department Heads explained that it is a current concern of the university to adapt and integrate climate change concept and issues in selected courses in agriculture and even in the university research and extension programs. However, there are no existing policies and guidelines issued to institutionalize this approach in the university/college or even guidelines from CHED to formally integrate CCA in the BSA curriculum. There were some faculty/teachers who have already incorporated the CCA concept but it was based only on their advocacy, individual concern about the issues and its relevance to the courses taught. It was observed that VSU-CA was also at the the initial stage in the implementation of a new BSA

curriculum under CMO #14 s. 2008. The college curriculum committee is working to resolve some conflicts and issues brought about by the changes. They work out to equally balance the courses under BSA program and make it more responsive in both the concern and priority of the university and the standards provided by CHED under the new BSA curriculum. The copy of the revised BSA curriculum was discussed during the interview with the dean of the college of agriculture. It was analyzed to identify the courses that are related to CCA. Only one course offered under the new curriculum (Introduction to Ecological Agriculture) was found to emphasize the general issues of climate change adaptation. Moreover, it is interesting to note that the dean of VSU-CA is open for further enrichment of their curriculum, the dean also suggested options to integrate climate change issues and concern in Undergraduate Seminar (Major 99) which is composed of two seminars, A and B and a colloquium.

The BSU-CA was declared as the proponent university in organic agriculture. Part of their mission/goals is to promote sustainable agriculture through organic farming. With this, they had already recognized the direct link between climate change and the adaptation and promotion of sustainable agriculture. The promotion of the adoption of organic agriculture is the most valuable and concrete action in response to climate change adaptation and mitigation. There were claims that the university initiates different projects and program related to climate change adaptation. Examples include the university-wide awareness campaign for CCA through seminars, trainings, symposium, waste segregation/solid waste management; promotion of organic farming to vegetable farmers through their extension programs; and enhance their research capability to develop more resistant and tolerance variety specifically in the highland agriculture (vegetables crops) which can resist extreme weather condition. Moreover, the college provides strong encouragement and support to the teachers to incorporate the concerns and issues about climate change in their respective courses taught. The programs that were identified for integrating CCA include soils science, agronomy, entomology, plant pathology, agro-forestry and extension education.

The proposed strategy offered by administrators of BSU-CA were focused on the following concerns: attendance to seminars/trainings and symposia discussing policy issues affecting CCA; policy and guidelines that support their initiatives to integrate CCA from university or from CHED; building up, production and collection of CCA materials and have open subscription in the university; conduct in-house workshop on CCA strategies including the preparation of syllabi on integration; and establish link and network with other universities and agency both local and international.

Generally, UPLB CA supports the program for climate change adaptation. The evidence of this initiative and advocacy was corroborated by the program of the university to create a committee that promotes knowledge management, awareness, and adaptation on climate change. This committee called the Inter-Disciplinary Program on Climate Change which is under the coordination and supervision of the School of Environmental Science and Management, in cooperation with CFNR, CA, CAS. CEM, CPAf, and the College of Development Communication.

In terms of perceived strategies of UPLB respondents to mainstreaming CCA into the BSA curriculum, the respondents recommended to adopt the framework used in the integration of sustainable agriculture (SA) in the BSA curriculum. This strategy/ approach illustrate the whole process involved in curriculum change and development based on the experience of UPLB-CA in the integration of SA in the BSA curriculum. However, the whole process required deliberations before the approval of the committee/faculty. According to *Zamora* (*2010*), such experience and strategy of UPLB-CA in the integration of sustainable agriculture in the BSA curriculum is more acceptable and appropriate to use as framework in this initiative to mainstreaming CCA in the existing BSA curriculum of UPLB-CA rather than to adopt a new method.

Analysis on the Extent of Integration of Climate Change Adaptation into the BSA Curriculum

A major intent of this study was to determine the extent to which climate change concept, principles, issues and adaptation is acknowledged and integrated in the teaching of fundamental agricultural courses under the BSA program. This was analyzed in terms of the integration of climate change adaptation in the course content of the BSA curriculum; and the integration of climate change adaptation in the courses though as perceived by the faculty respondents.

Initially, the respondents' familiarity with the concept and issues about climate change was evaluated (**Figure 1**). Almost all CMU-CA faculty respondents (98%) were familiar with the issues. Almost all of the respondents (96%) from UPLB-CA (92%) from BSU-CA (82.72%) from VSU-CA have high familiarity. The overall extent of familiarity among faculty respondents from the four SUCs was 91.50% which is considered high.Overall findings imply that most faculty respondents among SUC-CA had higher familiarity about the concepts and issues on climate change.

The other method used to determine the extent of climate change adaptation in the BSA curriculum was based on the perceived level of integration of CCA on the course/subject taught by the teachers. This was determined throughactual examination of agriculture curriculum programs,

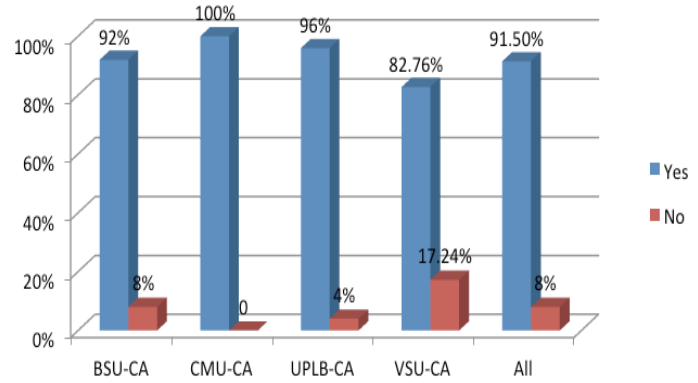
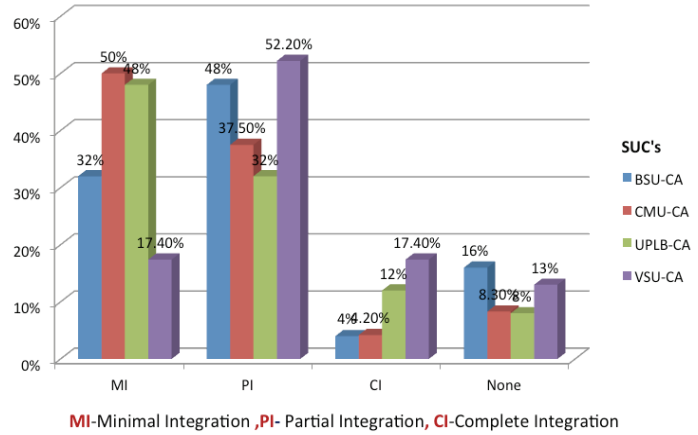


Figure 1. Respondents' familiarity with the concepts, principles and major issues about climate change.



MI-Minimal Integration ,PI- Partial Integration, CI-Complete Integration

Figure 2. Extent of integration of climate change adaptation in the BSA curriculum as perceived by the teachers' across participating SUC-CA.

course, topics, and the extent of integration of climate change concepts, principles and issues to fundamental agriculture courses as perceive by the teacher respondents using categorical variables for complete integration (CI), for partial integration (PI) and for minimal integration (MI).

More than half (52%) of VSU faculty respondents partially integrated the CCA concept, principles and issues in the courses they teach. Half (50%) of the CMU respondents had minimal integration of the concepts while almost a third (37.50%) partially integrated CCA. Less than half (48%) of UPLB respondents said that they minimally integrated the concepts, principles and issues of CCA while 32% partially integrated such concepts. Only 12% of the respondents completely integrated the issues. It was considered relatively higher compared to respondents from CMU and BSU. Almost half (48%) of BSU respondents partially integrated CCA while some (38%) had minimal integration. There were a high percentage of respondents from CMU (16%) who did not respond to the question. Generally, BSU faculty respondents had partial integration of the CCA concepts; minimal integration for CMU and UPLB faculty respondents while, more than half of VSU faculty partially integrated the CCA concepts in their teaching.

CCA integration in the fundamental agriculture courses under BSA program

The respondents' perceived level of integration of CCA was determined based on the extent of how teachers incorporate the issue of CCA on the major courses offered in the BSA program among colleges of agriculture of the respondent universities. Generally, the teacher respondents had minimal integration (MI) in the general agriculture courses (9%), animal science (7%), plant pathology (5%), agronomy (4%), food science (3%) and horticulture (4%) (**Figure 3**). However, partial integration (PI) was indicated in entomology and animal science (5%); General Agriculture and Agronomy (2.91%); and plant pathology and soil science (2%). On the other hand, complete integration (CI) in agronomy and plant pathology as indicated by 2% of the respondents which is considered low. Other subject areas have lower values

Overall, the extent of integration of climate change as perceived by the respondents in the different major fields is less than 10%, which is considered low.

The largest percentage of the CA across the respondent universities allotted less than one hour for the integration of CCA in all subjects combined. This was evident in the percentage of responses given by the SUC-CA: UPLB, 68%; BSU, 56%; VSU, 55%; and CMU, 54%. Overall, the SUC-CA faculty respondents have minimal integration of CCA in teaching and lessons (**Figure 4**).

Factors Influencing CCA Integration

Second objective of this study was to determine the influence of different factors in terms of individual, organizational and external in the integration of CCA in the BSA curriculum program as perceived by the faculty and administrator of the college.

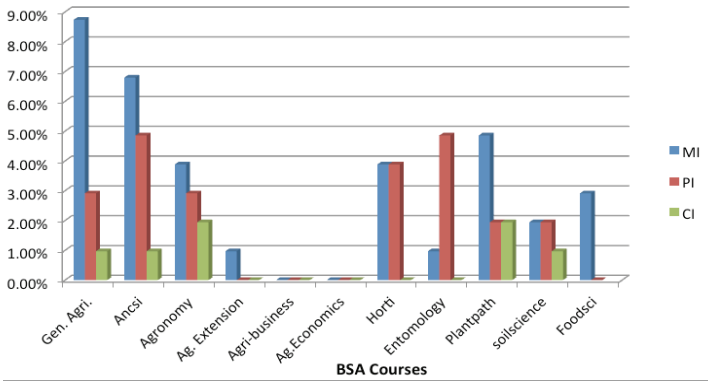


Figure 3. Faculty respondents' perceived level of integration of CCA in the fundamental agriculture courses under BSA curriculum.

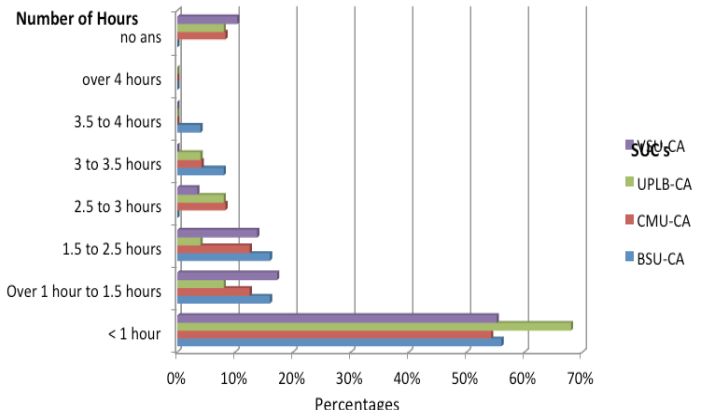


Figure 4. Average time per week allotted by the respondents in the integration of CCA to their teaching.

Individual Factors Influencing Climate Change Adaptation

Individual factors refer to the faculty-related variables which are posited to influence decisions to mainstream climate change into the BSA curriculum. These include the faculty perceived knowledge on CCA, perceived student needs and attitudes on CCA and exposure to climate change related incidence.. The respondents' knowledge of climate change-related issues was measured using a series of statements; eight were truly reflective of climate change adaptation while the rest were not.

The overall perceived knowledge of the respondents on climate change adaptation was high. They clearly identified those statements which support the integration of CCA in the BSA curriculum and those "not true" to the issues. The findings revealed that majority, SUCs CA faculty respondents had high perceived knowledge on CCA, this position of knowledge leading to adoption of what innovation has been initiated on the integration of CCA in the BSA curriculum. In support to this finding, *Dooley* (*1999*) cited that teachers acquired knowledge and confidence was open to integrate an innovation into their instructional programs. On the same perspective, *Brady* (*1990*) stresses that the failure of an educational innovation was rooted to lack of teachers understanding of the innovation, lack of understanding of the new role demanded by innovation, and lack of expertise in fulfilling that new role. To sum up, the faculty respondents across CA were open to integrate CCA based on the extent of knowledge of the faculty.

Student Needs of Climate Change Adaptation Instruction as Perceived by the Faculty Respondents

Majority of BSU faculty respondents had high perceptions of students' needs in mainstreaming climate change adaptation in the BSA curriculum. Similarly, CMU respondents strongly believed that "students need to develop awareness and positive attitude towards CCA" and that "students need to have knowledge and skills about CCA principles, concepts and practices". Also, the respondents believe that "students will be more competent and innovative to face agriculture related issues and problems if they are aware and trained to different approaches in CCA" and "students better be prepared to the challenges of the future specifically on global warming".

Majority of the UPLB respondents "strongly agreed" with the statements that "students need to have knowledge and skills about CCA principles, concepts and practices" and the "needs to develop awareness and positive attitude towards CCA". Some respondents strongly agreed that "the students become more competent and innovative to face agriculture related issues and problems if they are aware and trained to different approaches in CCA". Also, respondents strongly believed "the need to better prepare the students to the challenges of the future specifically on global warming. Moreover, most of the VSU respondents "strongly agreed" with all of the positive statements. Majority supported the statement that "students need to have knowledge and skills about CCA principles, concepts and practices".Others strongly believed that "students need to develop awareness and positive attitude towards CCA" and "better prepared the students to the challenges of the future specifically on Global Warming". More than half believed that "Students would be more competitive in the job if they are aware and exposed to different CCA strategies related to agriculture production and post production".

The overall perceived student need to mainstream climate change adaptation in BSA is high based on the responses of the participating institutions.

Respondents' Exposure to Climate Change Incidence and Impacts

Most of the faculty and administrator respondent from the different SUCs CA were exposed, experienced and recognized the impacts of climate change in their places. Most of the UPLB respondents' experienced flooding, El Niño phenomenon, crop failure, extreme precipitation, frequency and intensity of storm over the years, and flashfloods. In the case of CMU, respondents observed the occurrence of El Niño phenomenon during dry months, increased likelihood of crop failure, soil erosion and flooding, health related problems, heavy siltation and flashfloods, prevalence of pest and diseases, and extreme precipitation. In VSU, the impact of climate change in the ocean was noted such as increased incidence of coral bleaching, sea level rise and salt water intrusion. While in land-base, impacts results showed an almost parallel observations to the other SUCs in terms of soil erosion, and El Niño phenomenon including diseases and mortality of livestock. In the highland agriculture represented by BSU, the impact of climate change was mostly

related to soil erosion, increased frequency and intensity of storm, and flashfloods. During summer months BSU is not exempted from the effect of El Niño phenomenon while during cool months, Benguet province including Baguio City, experienced cold temperature to about freezing point leading to increased incidence of crop failure specifically for vegetable production.

Organizational Factors Support on Mainstreaming CCA in the BSA Curriculum

Organizational factors was described in terms of climate change concerns in the extent of organizational support, organization mission, and organizational resources and its influence to climate change adaptation. It was measured by asking the administrators and faculty to rate the institutional initiatives towards CCA integration using scale of 1 to 5 with 5 being the highest ("Strongly Agree") and 1 the lowest ("Strongly Disagree").

Overall, majority of BSU respondents perceived high support (52%) from their organization. A similarsupport (52%) was perceived by the VSU respondents while, majority of CMU respondents (54.16%) perceived inadequate support from their institution. UPLB respondents perceived (36%) a moderate support from their organization while 20% said there is inadequate support. Sixteen percent (16%) said there is no support at all. A considerable 20% of UPLB respondents did not respond to the question which is comparably higher in terms of the results obtained from the other three SUC-CA.

When faculty respondents were asked about the best situation or condition that can support the integration of CCA concept, principles and issues in teaching fundamental agriculture courses, the general response of most of the SUC-CA respondents were focused on the conduct of seminars and trainings on climate change which they believe would help raise awareness of CCA issues, develop advocacy as well as individual concern. This was shown by 76% of BSU respondents, 75% of CMU respondents, 69% of VSU respondents, and 64% of UPLB respondents. Likewise, a high percentage of BSU respondents (72%) indicated the access to resources and teaching materials. This was the same for UPLB (68%), CMU (67%) and majority of VSU respondents (52%). Similarly, VSU (68%), CMU (67%) and BSU respondents (52%) perceived that support from the administration should be encouraged. A considerable percentage (36%) from UPLB respondents also considered this factor. Almost half or 44-48 percent of the CA respondents considered "individual teachers preparation" while majority or 48% of BSU respondents considered "funding support"as best condition.

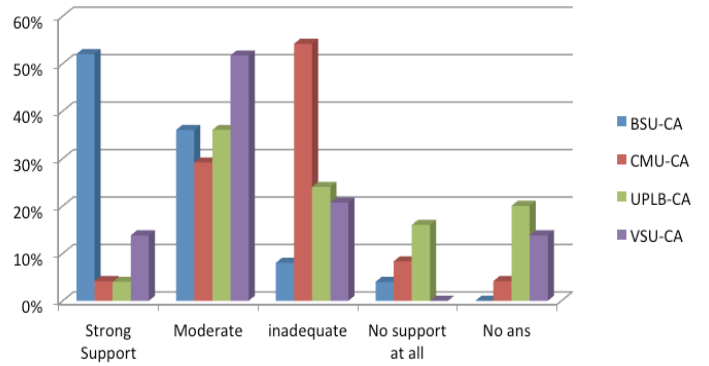


Figure 5. Extent of organizational support among CA respondents mainstreaming CCA in the BSA curricular programs.

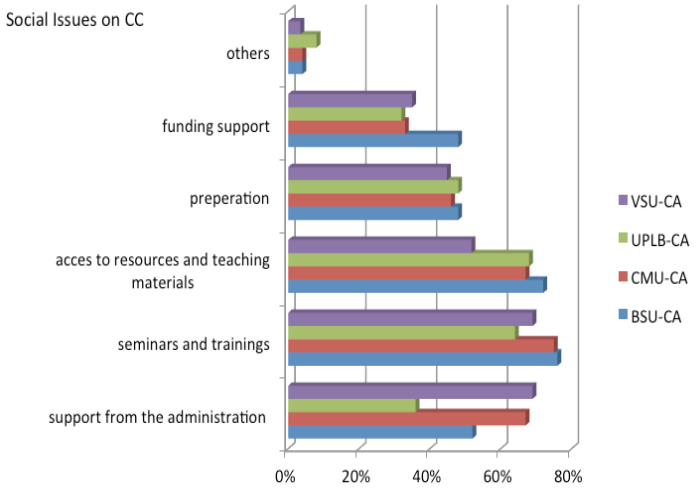


Figure 6. Conditions that support the respondents' initiative to integrate CCA concepts and issues in teaching fundamental agriculture courses.

Climate Change Adaptation Concern of the Organization Mission

Generally, BSU-CA agrees that CCA is reflected in their organizational mission. Same with the overall response of the UPLB-CA respondents supports CCA. However, the CMU-CA respondents were almost neutral in describing the relationship of their organizational mission to CCA. While, VSU-CA also "agreed" on the relationship of CCA on their organizational mission.

Extent of Organizational Resources Support in Mainstreaming CCA in the BSA Curriculum.

Faculty respondents were assessed on the extent of organizational resources which are considered essential factors in integrating climate change issues, concepts, principles in their teaching. Generally, the faculty respondents of BSU-CA agreed that they have facilities used for CCA integration. However, more than half (52%) said that their organization had inadequate institutional framework, policies and guidelines to mainstream climate change adaptation

in the curriculum. Less than half (48%) agreed that they had inadequate number of personnel such as faculty/staff who are knowledgeable and have expertise on climate change. Most CMU respondents (71%) believed that their organization had inadequate resources in terms of reading and instructional materials, references, personnel, linkages and training program for personnel and staff. However, 50% said that they have adequate in-campus facilities, experimental areas where use for the program. Generally, most of UPLB respondents agreed that they have inadequate support for CCA-related resource while almost half of the respondents said that their organization has task force and committees created to handle the programs related to climate change. The VSU-CA believed that they have adequate resources in terms of (ICT) materials, experimental areas, campus facilities and equipment, linkages. However, almost half (45%) of the respondents believed that their organization had inadequate programs and initiatives to mainstream CCA in the BSA curriculum and project undertaken by the college to promote local adaptation of agricultural system related to CCA.

CONCLUSION

None of the agriculture colleges recognized as CHED centers of excellence manifest high level of integration of climate change CCA in the BSA curriculum. In terms of integration of CCA in Fundamental and major Courses offered in BSA curriculum across the participating SUC-CA, the study showed minimal integration.

Overall, the average time allotted by the respondents across SUC-CA was minimal, which was less than one hour per week per subjects. The overall perceived knowledge, student needs to mainstream CCA in BSA is high. Overall, the respondents agreed that CCA is reflected on their organization mission. However, the SUC-CA had experienced inadequate resources and policy framework on how to mainstream CCA in the curriculum. There were laws which support this initiative, such as the RA 9512 or the National Environmental Awareness and Education Act of 2008 and RA 9729 or the Climate Change Act of 2010, an act "mainstreaming climate change into government policy formulation, establishing the framework strategy and program on climate change, creating for this purpose the Climate Change Commission, and for other purposes." These laws and policies are very broad, these did not consider the specific strategies and approaches for the academic institution, specifically to HEI's to develop specific climate adaptation strategies, to promote awareness and advocacy among teachers and students.

Mainstreaming CCA in new undertaking majority respondents across SUC-CA believed that continuously enhancing faculty capability by providing seminars and trainings coupled with support from the organization in terms of resources, funds etc., clear policy framework, establishing partners and linkages with experts from other organization and agencies would help them to develop high level of awareness, advocacy and commitment to mainstream CCA concepts, principles and practices in their teaching/lesson.

RECOMMENDATIONS

Proposed Mechanism to Mainstream CCA in the BSA Curriculum

The strategy for CCA integration in the BSA curriculum stemmed from influences of individual faculty members advocating CCA, coupled with organization support in terms of resources, funds etc. external support through partnership and linkages and clear and specific policy and guidelines from CHED to give mandates the SUCs to re-examine, prioritize the mainstreaming of CCA in the BSA curriculum.

The proposed strategy on how CCA can be mainstreamed in the BSA curriculum involves: university/ college level examination and evaluation of approved CMO compare to revised proposal of college, curriculum committee review; preparation a resolution to endorse the program to university academic council; and endorsement to BOR for final evaluation and approval.

For individual faculty level: the process of integration involves the revision/enhancement of course outline or syllabus: incorporate potential topics on CCA concepts principle and practice in the lessons and teaching; formulate matrix of courses, topic, CCA issues and impacts,; and integration note and methods of CCA integration. Finally, the individual decision and commitment to integrate CCA in teaching goals, contents, methods and evaluation is the most important component of the process. Majority of the teacher's respondents integrate CCA in their lesson for a very minimal time- less than one hour per week. Thus, the proposed strategy for CCA integration suggests that 30 minutes to one hour lecture per week per 3 unit-subject and 1 to 1.5 hours in the laboratory. This scheme of integration may be much acceptable to the teachers handling agriculture courses. The proposed scheme also suggests increasing integration period in the practicum subjects to expose and train the students with the basic CCA principles and practice, basically its application to student's project activities.

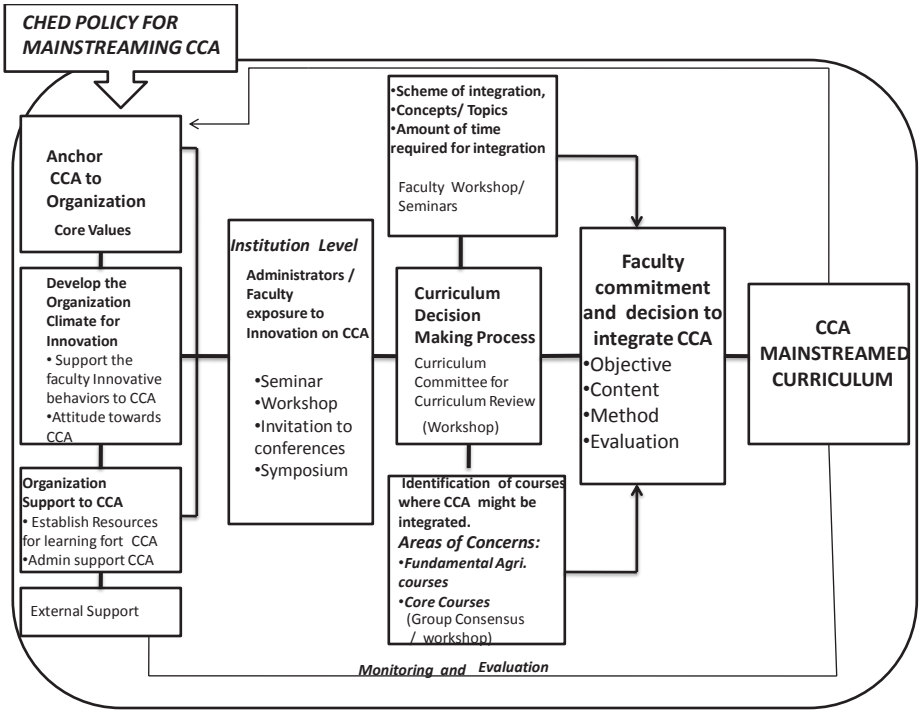


Figure 6. Proposed strategies of mainstreaming CCA in the BSA Curriculum.

Table 1. Proposed CCA Integration Process in the BSA Curriculum.

BSA Courses CMO#14	Topics	Climate Change Issues & Impacts	Methods CCA Integration
Introduction to Agriculture	Status/direction of agricultural development in the country (1 hour/week)	• Declining production due to disasters, extreme climate events • Increase pest population which resulted to crop failure	• Integration of survey/assessment of current agricultural production and practices (local, national level)
Introduction to Ecological Agriculture	Ecological balance, food change, food web	• Species Extinctions. • Increase of hazards (flooding, soil erosion etc.)	• Identify issues/concern which related to CCA • Lecture/discussion on conservation methods • Adopt diversified natural farming practices • Lecture about biodiversity and environmental principles
Crop Science	Status of Crop Production	• Crop failure • low yield • Poor quality of harvest (drying, storing etc.)	• Adapt/change cropping schedule base on climate adjustment. • Discuss the kinds of variety that can resist to climate variability ex. (drought, floods resistant variety)
Crop Protection	Pest and Crop management Practices	• Increase population pest and damages to crops • High resistance pest to pesticides and other control measures	• lecture/ discussion on Integrated Pest Management • use of natural control in spite of chemical • Transition to adopt natural/organic farming practices
Animal Science	Status of animal industry under different production systems considering the impact of CC specifically	• Declining production due to effect extreme temperature (high/ low) to health, reproduction, nutrition of animals basically	• Development of housing design that can regulate the effect of high/low temperature e to the farm animals. Ex. Use of litter materials rather of

Table 1. Proposed CCA Integration Process in the BSA Curriculum. (cont.)

BSA Courses CMO#14	Topics	Climate Change Issues & Impacts	Methods CCA Integration
	extreme weather; (El Nino phenomenon, Floods, typhoons etc.) to livestock, poultry, ruminants	poultry and swine. • Damages to farm houses due to disasters	concrete houses in growing pigs • Improve feeding programs (ex. combination of natural feed source and commercial feed. • Identification and promote the conservation of indigenous animal genetic resources adapted to extreme climatic condition (swine, poultry, ruminants) • Integration of waste management program to crop production ex. Composting
Soil Science	Soil status, classification, inventory	• Effects of climate change in terms of: heavy rains, floods, droughts, siltation etc. to soil property, density, fertility and other characteristics including topography.	• Promote and adopt conservation farming techniques i.e., composting, terracing, multiple cropping etc. • Organic agriculture • Appropriate irrigation and drainage program • Soil, water conservation through rehabilitation/protection of watershed • Assessment of erosion hazard and erosion modeling considering the current climate change impact.
Agriculture Extension and Communication	Status of agricultural extension programs and projects	• Low success rate and sustainability of extension programs • Poor organizational management because; • Stakeholders/famers are pressured of poor economic status • Farmer's resistant attitude on conservation efforts and program. • Poverty, scarcity of resources which resulted to unsustainable farming practice.	• Conduct community/organization assessment to identify common problems (PRA etc.) • Organized Value formation seminars target clients. • Develop interventions and identify appropriate extension tools and strategies. • Identify and prioritization of projects based on the needs, resources and capacity of beneficiaries. • Set monitoring and evaluation guidelines and criteria.
Methods of agricultural Research	Status/Impacts of agricultural researches in agriculture and natural resource development	Gaps of current agricultural researches in relation to CCA issues	Development of researches that promotes measures to adapt current climate rsik and impacts impact • ex. Social science research "Vulnerability impact assessment of flooded communities in relation to agricultural production , environmental awareness and conservation efforts."

Table 1. Proposed CCA Integration Process in the BSA Curriculum. (cont.)

BSA Courses CMO#14	Topics	Climate Change Issues & Impacts	Methods CCA Integration
			• Ex. Experimental "development of heat or flood tolerance variety"
Agriculture Engineering	Status of agriculture farm mechanization in the country Management of water resources for Irrigation and Drainage program	• Carbon emission /footprints • Proper disposal of synthetic agricultural waste • Draughts • Flooding	• Lecture/ discussion on Carbon Cycle, nutrient and nitrogen cycle • RA. 9003 Solid Waste Manage Act • Lecture/discussion on Hydrological cycle • Crop water irrigation management./ scheduling • Adapted design of irrigation and drainage construction
CORE COURSES			
Post Harvest Technology	Maintaining the quality of agricultural products/harvest	High losses due to disaster/extreme weather events	• Lecture, discussion, on improves agriculture post harvest handling and processing, the use of equipments, and adjusted cropping schedule to minimize losses.
Principles and Practices of Plant Breeding,	Development of adapted crop varieties to extreme climate events	• Crop failure • High losses due to disasters • Low resistant crop varieties	Development of new varieties resistant to drought and extreme precipitation events.
Propagation and Nursery Management	Development of fast growing and high yielding crops (fruit trees) through asexual propagation	• High mortality rate of newly propagated fruit trees due to high temperature and extreme precipitation • Destruction/collapse of nursery houses due to calamity.	Adjust the propagation schedule to season favorable for high recovery and growing of propagated crops varieties. Develop a design and construction of nursery houses that can resist to strong typhoon, floods and prolong droughts
Animal Nutrition and Feeding	Effects of temperature to feeds and feeding programs	• High mortality rate of poultry and swine due to heat stroke.	• Improve feeder design and feeding system ex. Use of tunnel vent houses for poultry and swine. • Use of litter floor materials ex. Rice hull • Apply combination feeding system of concentrate and high fiber source feeds in feeding program.

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