TRAINING MODULES FOR CLIMATE CHANGE ADAPTATION IN AGRICULTURE: PROVINCE AND SUB-PROVINCE LEVEL AGRICULTURE OFFICERS OF CAMBODIA

Asia Pacific Adaptation Network (APAN)
March 2013

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Suggested Citation
Chea Chanthou, Hok Kimthoun, Prof. Dr. Kang Kroesna, S.V.R.K. Prabhakar. 2013. Training Modules for Climate Change Adaptation in Agriculture: Province and Sub-Province Agriculture Officers of Cambodia. Hayama, Japan: IGES.

How to obtain the digital copy:
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ACKNOWLEDGEMENT

We would like to express our sincere gratitude to the Ministry of Environment, Japan (MoEJ) and Asian Development Bank (ADB) for funding this report.

We would also like to acknowledge the author team for preparing this report, namely Prof. Dr. Kang Kroesna, Dean, Faculty of Agricultural Technology and Management, Royal University of Agriculture, Cambodia; Mr. Chea Chanthou, Deputy Director, Department of Climate Change, Ministry of Environment, Cambodia; Mr. Hok Kimthoun, Ministry of Agriculture Forestry and Fisheries, Cambodia and S.V.R.K. Prabhakar, Task Manager and Senior Policy Researcher, Adaptation Team, Institute for Global Environmental Strategies

ABSTRACT

Pilot training programs were conducted in Cambodia for province and sub-province level government officers of the agriculture department to test the effectiveness of draft training modules on climate change adaptation. The pilot tested training modules include 'Agriculture extension staffs at provincial level' and 'District and commune officers'. The trainees were evaluated before and after the pilot training programs and their evaluation results were taken into consideration in modifying the training modules. The results are discussed and evaluation forms are inserted in the report as annexure.

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1.0 INTRODUCTION

The attention paid to improving public awareness and integrating the concepts of climate change adaption and mitigation of greenhouse gases (GHG) into sectoral and national sustainable development plans are becoming important concerns internationally and for Cambodia.

Climate change is an emerging concern for environment and for development. Both software and hardware of addressing climate change issues are of critical importance for better adaptation to climate variability and change that continue to threaten Cambodia. As a least developed agrarian country, Cambodia is highly vulnerable to climate change and has been categorized as having relatively low adaptive capacity to changing climate conditions compared to other Southeast Asia countries and thus is highly vulnerable to climate extremes (Dany, 2010).[1]

Most Cambodian households are engaged in agriculture. Rice is the main crop in Cambodia. Although the agricultural productivity has increased during the last decade, it is still lower in Cambodia compared to neighboring countries (Thoeun et al., 2001).[2] In recent years, Cambodia has witnessed more frequent and severe floods and droughts which have resulted in a significant impact to agriculture and other development sectors with considerable economic loss. In rural areas, the challenges caused by negative impacts from environmental changes are further intensified by the increasing population coupled with unavailability of agricultural land.

More than half of Cambodia's rural population depends on fish and aquatic resources for a significant proportion of their livelihood (Thoeun et al., 2001). Together with rice, fisheries form the backbone of the country's food security and provide invaluable revenue and employment (direct and indirect for over 2 million Cambodians). Besides agriculture, fisheries and forest resources play a critical role in supporting livelihoods, especially in providing diversifying subsistence and income-generating activities.

Hence, significant amount of efforts are required for capacity building of all ranking official on climate change adaptation, especially to official of agricultural forestry and fisheries, as they directly work with farmers for disseminating agro-technologies and improving their livelihoods.

1 Dany, V., U. Kamal and V. Chanmakaravuth. 2010. Report on climate change training need assessment for government officials, Academia and Media, Ministry of Environment, Cambodia.

2 Thoeun, H.C., C. Chanthou, P. Vanna, A. Pirum, V. Dany, Y. Dararath and R. Boer. 2001. Vulnerability and adaptation assessment to climate change in Cambodia. Ministry of environment and UNDP/GEF.

1.1 Objectives

The objectives of the project are

- to pilot test and evaluate two training modules developed during the first phase of the project; and
- to modify the training modules according to the evaluation results.

1.2 Methodology

1.2.1 Training needs assessment (First phase of the project)

Training Needs Assessment in Cambodia was conducted by a three-step process in the first phase of the project. [3] A set of questionnaires developed by the Institute for Global Environmental Strategies was used for conducting training needs assessment (TNA) surveys. Data was collected from key informant PDA staff at district and commune level, GDA staff at national level, and PDA staff at province level of the Ministry of Agriculture, Forestry and Fishery (MAFF).

Two target groups whose work is related to climate change and agriculture sector were selected for the study. The group division basically depended on the role and responsibility of each concerned institution. The two main target groups are: (i) the concerned trainer's institutions and (ii) trainee's institutions.

The first group consisted of Climate Change Department of Ministry of Environment (MoE), Department of Agricultural Extension, Department of Plant Protection, Sanitation and Photo-sanitation and Department of Agricultural Land Resource Management of Ministry of Agriculture, Forestry and Fishery (MAFF) (These institutions are at national level).

The second group consisted of 4 provincial agricultural departments such as Agricultural Department of Kampong Cham Province, Agricultural Department of Kampong Speu Province, Agricultural Department of Kampot Province and Agricultural Department of Kandal Province.

Subsequently, the team has reviewed training modules, materials and documents (such as workshops and training reports, personnel profiles etc.) related to TNA maters of different training institutions. The findings of the review process were eventually discussed in training needs assessment meetings conducted by APAN and IGES in Bangkok. A set of survey forms developed by IGES was employed for understanding the knowledge and skill gaps among the agriculture officers. These results were used for drafting the training modules.

3 For a full report of the first phase of this project, the reader is suggested to refer to its report at APN project database, http://www.apn-gcr.org/resources/archive/files/6e92ad7770b0d5a4364aeba58f9fb017.pdf.

1.2.2 Pilot testing of training modules

Some of the above developed modules were subsequently pilot tested after prioritizing training modules for two levels of agriculture officers: 'Agriculture extension staffs at provincial level' and 'District and commune level officers'.

Pre-training and post-training evaluation was conducted through administering a questionnaire consisting of open ended and multiple choice questions to test the knowledge of the trainee on climate change adaptation. Same procedures were followed for pre and post-training test. The results of these test sheets were analyzed in Excel and results are presented as pre- and post-training performance. The difference in responses before and after the training constituted the training effectiveness. The opinion of trainees were considered in various aspects of training such as course content, duration and method of delivery and necessary changes were made in the training modules. The final modules are presented in this report.

2.0 PILOT TRAINING EVALUATION RESULTS

2.1 Commune and District level Officers

Training sessions on climate change adaptation for extension officers in agriculture sector were held at the Royal University of Agriculture from 16 to 17 November 2012. The trainees from Kompong Cham Province were chosen to continue training other extension officers at commune and district levels between 27 and 28 December, 2012, at the Kompong Cham Provincial Department of Agriculture on the topic of climate change adaptation in agriculture sector, particularly in rice production.

The aim of the training was to enhance the capacities of extension officers at commune and district levels to gain an understanding of climate change and to modify training modules based on their feedback. The training was carried out at Kompong Cham Provincial Department of Agriculture from 27 to 28, December 2012.

2.1.1 Background of participants

A total of 15 participants have attended the training; 14 male and 1 female extension officers at commune and district levels working in the Kompong Cham Provincial Department of Agriculture (Figure 1). Most are in the age group of 36-45 years followed by 46-55 years.

Most of the trainees were responsible for training and extension on farming techniques to farmers (55% were head of office and have been working in that position for 11-15 years, Figure 2), including techniques for rice intensification, vegetable farming, growing forage, animal raising, and promotion of heat tolerant rice varieties introduced by the Ministry of Agriculture, Forestry and Fisheries.

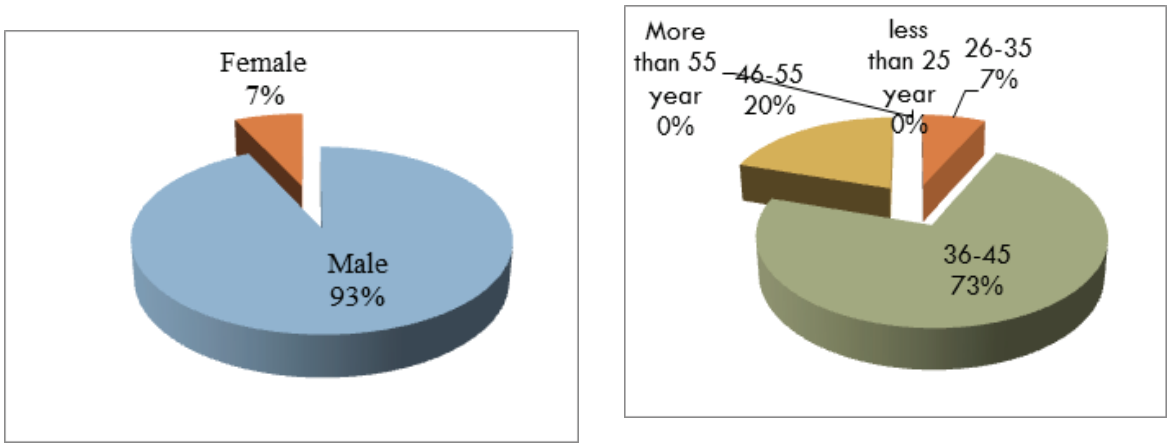


Figure 1: Description of the sexes and ages of the participants

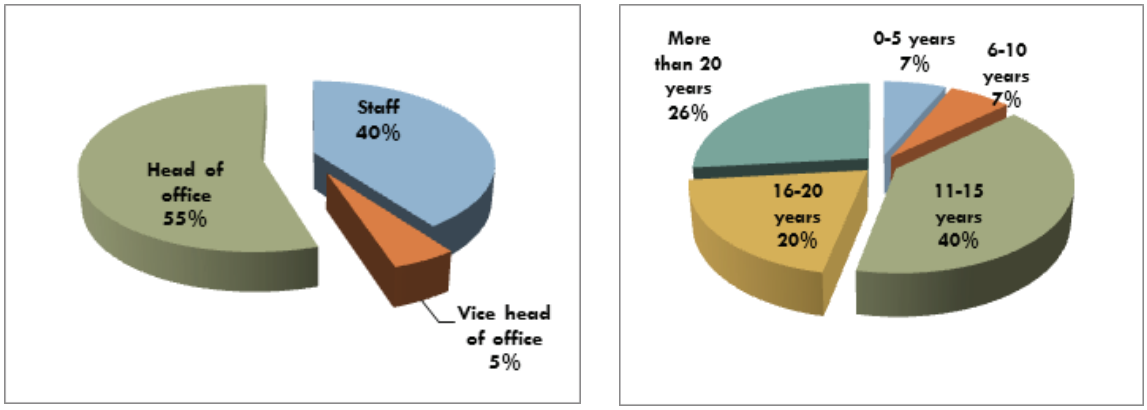


Figure 2: Working experience and positions of participants

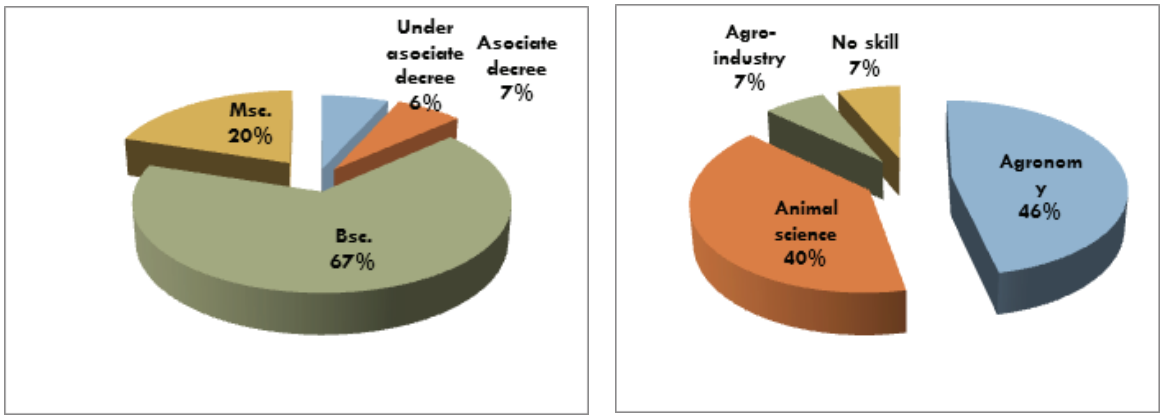


Figure 3: Level of knowledge and skill

Majority of participants have graduated (BSc, 67%, Figure 3) in the subject of agronomy (46%) and animal sciences (40%). Majority were engaged in extension work followed by training, administration and planning (Table 1). None of them had formal training on climate change adaptation before this pilot training program.

Table 1: Responsibilities of the extension officers

No.	Job responsibilities	Number of answers
1	Extension work	13
2	Training	9
3	Administrative work	5
4	Planning	2
5	Reporting	2
6	Rice data collection and statistics of local livestock	2
7	Cooperation	1
8	Collection of livestock taxes	1

2.1.2 General understanding on climate change

The trainees have answered the question of whether they know climate change and the responses are shown in Figure 4. It can be seen that the training has made significant change in their knowledge as reflected in terms of percent of responses. Before the training, 6 participants, accounting for 40%, said they knew about climate change and 60% reported as not knowing about the issue. After the training, all participants have reported that they know about it. Table 2 shows the distribution of responses on what the trainees thought the climate change is. Most pre-training knowledge on climate change and adaptation came to the trainees from radio and television (Table 3).

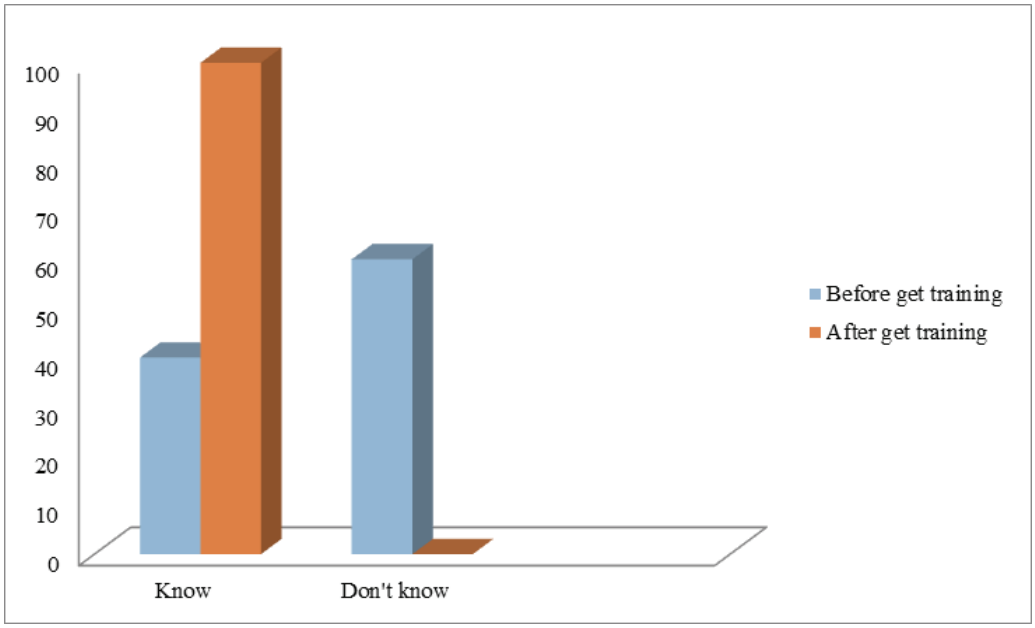


Figure 4: understanding on climate change

Table 2: answers on meaning of climate change

No.	Answer	No. of participants' answers before training	No. of participants' answers after training
1	Climate change is changes in seasons from cold to warm or from warm to cold	2	0
2	Climate change is increasing heat, stormy weather and irregular flooding	2	0
3	This issue refers to volatility of heat, extreme cold weather and abnormal natural disasters	1	0
4	Changing weather patterns are conversion of nature	1	0
5	Climate change is caused by nature and human activities that lead to global warming, rising sea level, storms, severe drought and flooding	0	11
6	Climate change increases global warming because of increasing GHG emissions	0	4

Table 3: Source of knowledge on climate change

No.	Methods	No. of answers before training	No. of answers after training
1	Study/education at school and university	0	0
2	Participation in training/seminars	0	15
3	Learning from newspaper	1	1
4	Learning from internet	0	0
5	Learning from the radio	2	2
6	Learning from television	6	6
7	Learning from colleagues	0	0

When asked about the impacts of climate change, only 10 trainees were able to answer. However, after the training, they all reported the enhanced understanding on the impacts of climate change.

Climate change consequences

Before the training, only one trainee specified the answer that climate change deprives animals of water and food. The trainees were also asked to elicit a list of factors contributing to climate change. In the pre-training evaluation, most have

attributed the cause to loss of forests. After the training, the responses were evenly spread to include other factors such as industrial and transportation related emissions indicating a change in their knowledge on the subject (Table 4). Before the training, 4 trainees were unable to answer the question on causes of climate change, but after the training all of them understood this issue and could able to answer.

Table 4: consequences of climate change

No.	Answers	No. of answers before training	No. of answers after training
1	Loss of forests	10	12
2	Increasing GHG emissions	0	10
3	Emissions from industrial factories	6	10
4	Growing number of vehicles	3	5
5	Use of chemical substances and fertilizer	2	4
6	Shallow rivers	1	0
7	Car exhaust	2	0
9	Drought, flooding and pest	1	0
10	Gas emissions from farming practices	0	2
11	Burning fossil fuels	0	2

2.1.3 General understanding on adaptation

Definition of adaptation to climate change

From the Table 5, nine participants were not able to give a general definition of climate change before the training. After receiving the training, most could provide the definition of climate change. The answers have varied on the definition before the training and most were not correct. However, after the training, the answers were similar. 12 participants said that adaptation to climate change refers to the adjustments human, animal and ecology make to climate change to minimize negative impacts, and only 3 of them answered that it is a balance between human, animals and environment.

Table 5: Various definitions of adaptation provided by the trainees

No.	Answers	No. of answers before training	No. of answers after training
1	Being accustomed to climate change	2	0
2	Proper use of natural resources	1	0
3	Stabilize the temperature	2	0
4	Reduction in natural disaster for rice, vegetables, animals and human	1	0
5	Achieving a balance between weather and human, animals and vegetables	0	3
6	Is the adjustment of human, animals and ecology to climate change to minimize its negative impacts	0	12

Agro-Technologies for adaptation to climate change

Before receiving the training, 7 participants could not answer the question, but after the training they could provide good answers. The answers before and after the training were not similar. With comparison of the answers before and after the training, it was clear that the pre-training participants were not able to give answers and were not correct. After the training, most of them could provide correct answers as shown in Table 6.

Table 6: Agro-Technologies for adaptation to climate change in agriculture

No.	Answers	No. of answers before training	No. of answers after training
1	Growing high-quality rice crops	1	0
2	Use of organic fertilizer, not chemicals	4	4
3	Growing forage	2	0
4	Reduction in pesticide use in agriculture	1	1
5	Use of off-season rice crops	1	0
6	Growing off-season vegetables	1	0
7	Reforestation	2	0
8	Construction of bio-digesters	2	0
9	Farming	1	0
10	Conducting rice field trials	1	0
11	Selection of new, short-duration rice tolerant of disease and drought	0	10
12	Good water management	0	8
13	Good practices of farming methods	0	2
14	Rice intensification	0	6
15	Punctual farming	0	4
16	Practices of farming diversification	0	4
17	Practices of IPM	0	5
18	Appropriate use of fertilizer	0	1

Farming activities with adaptation co-benefits

The table 7 indicates that 12 trainees did not answer questions and only 3 participants could provide answers which were not completely correct before the training. After the training, all of them could provide answers, which were mostly correct. The results show the effectiveness of the training. Thus, organizing training for provincial-level staff to understand concepts of climate change was found to be useful in enhancing their knowledge.

Table 7: Appropriate farming methods necessary for adaptation to climate change

No.	Answers	No. of answers before training	No. ofanswers after training
1	Growing forage	2	5
2	Animal raising	1	0
3	Growing various crops	2	0
4	Planting young trees	1	0
5	Use of organic fertilizer	1	3
6	Use of short-duration crops	0	7
7	Use of natural fertilizer, not chemicals	0	4
8	Keeping food for later use	0	3
9	Construction of bio-digesters	0	3
10	Farming diversification	0	6
11	Provision of information on time	0	2
12	Good irrigation management	0	3
13	Practices of IPM	0	4
14	Suitable Practices of farming methods	0	1
15	Good crop management	0	1
16	Reduction in pesticide use	0	1
17	Proper use of chemical fertilizer	0	1
18	Introduction of new crops	0	2
19	Practices of rice intensification	0	2

Trainees' awareness on GHG

It is clear from Figure 5 that none of the participants knew about GHG before the training and hence they could not describe them. After training, they gained an understanding about the gases, making it possible to provide a good description of different kinds of gases and their impact on global warming. Their answers are presented in Table 8. Although the gases mentioned were different, this definitely means that they are starting to have an idea of climate change, which is very crucial to find a reasonable solution to climatic problems.

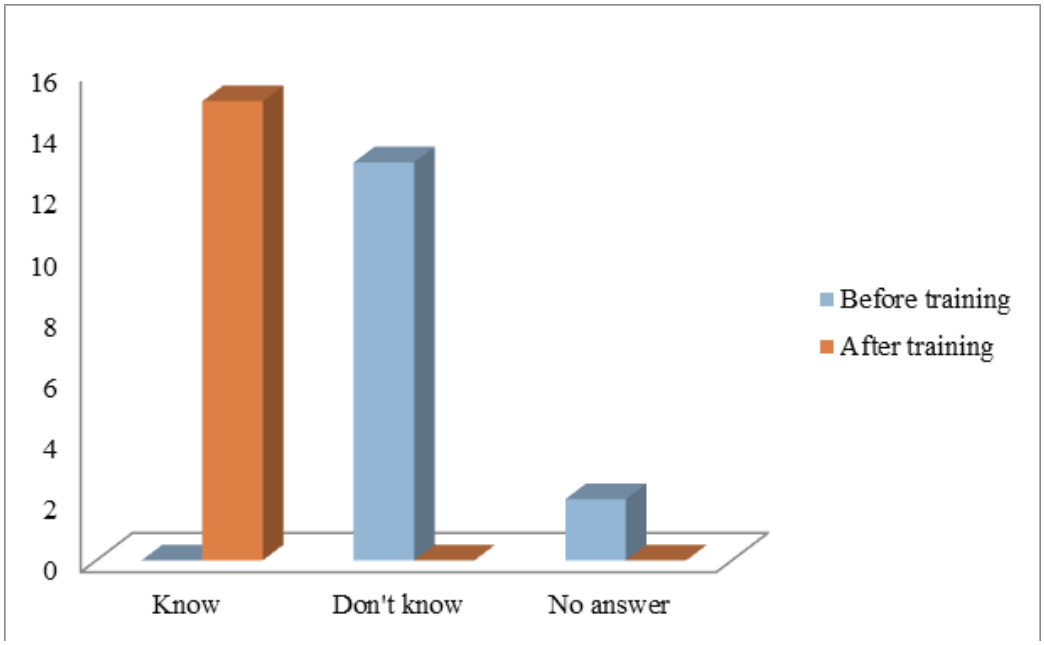


Figure 5: knowledge on GHG before and after the training

Table 8: Identification of various GHGs

No.	Types of GHGs	No. of answers before training	No. of answers after training
1	CH4, CO2	0	10
2	CH4, CO2, NO2	0	2
3	CH4, NO2, CO2, HFCs, PFCs	0	1
4	CH4, NO2, CO2, HFCs, PFCs, SF6, O3	0	12

Contribution of agriculture to warming

As shown in Figure 6, six trainees thought that agriculture contributes significantly to GHGs emissions before receiving the training, another 5 participants did not had any idea and the rest could not answer the question at all. As a result of the training, all of them said that farming practices contributes to GHG emissions. This points out that they considerably understood GHG emissions and the role of agriculture in global warming.

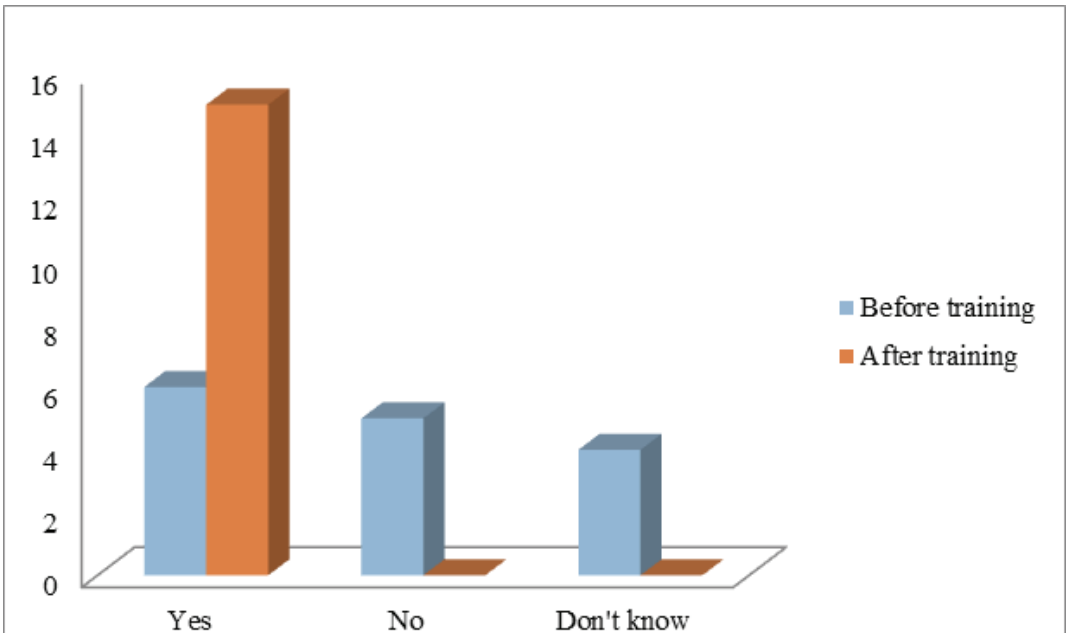


Figure 6: contribution of agriculture to GHG emissions

Potential for GHG emission reduction in agriculture

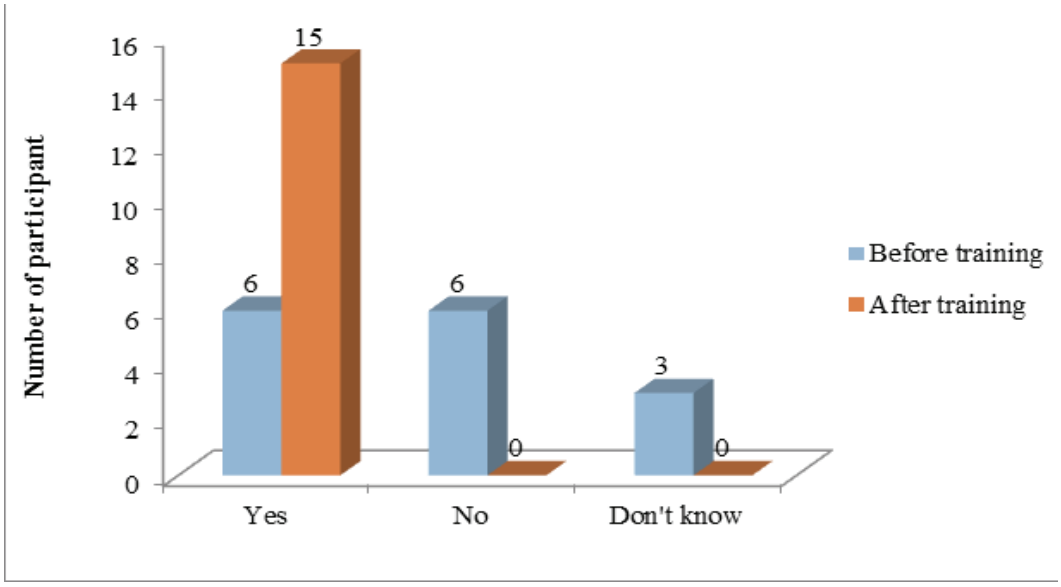


Figure 7: Ability to mitigate GHG in agriculture sector

Before the training only 6 participants thought that there is a potential for agriculture to reduce GHG emissions with adaptation benefits and another 6 participants reported that it is impossible for farming practices to reduce GHG emissions from agriculture. The rest of the participants were unable to answer the question. However, after the training, all answered that it is possible for agriculture to reduce GHGs substantially.

Agricultural practices with GHG mitigation and adaptation potential

Before the training, 9 participants could not answer this question. They gained a wide understanding on this issue and answered the question in detail (Table 9) after they received the training.

Table 9: agricultural practices with GHG mitigation and adaptation potential

No.	Answers	No. of answers before training	No. of answers after training
1	Organic fertilizer use	2	3
2	Use of natural pesticide	1	0
3	Agricultural diversification	1	5
4	Growing rice crops	1	0
5	Construction of bio-digesters	1	9
6	Use of long-duration crops tolerant of drought and flooding	1	5
7	Proper use of chemical fertilizer	1	2
8	Reforestation	0	2
9	Farming methods for animal penning	0	1
10	Growing short-duration crops	0	3
11	Reduction in fuel use	0	1
12	Good water management	0	6
13	Technical animal raising	0	2
14	Growing forage	0	3
15	Dig of ponds or canals	0	2
16	Keeping animal food for shortage period	0	1

Regarding planning tools for adaptation to climate change, 6 participants were not able to answer this question before the training and all could answer the question after the training. This shows that the training was beneficial in obtaining knowledge on this issue, which can help them to train their subordinates to involve in activities related to climate change adaptation (Table 10).

Table 10: planning tools to facilitate work of subordinates in adaptation to climate change

No.	Answers	No. of answers before training	No. of answers after training
1	Providing training	5	10
2	Spreading information about climate change and its impacts on agriculture	6	10
3	Sharing information about new chosen crops, bio-fertilizer use and appropriate farming techniques	8	10
4	Spreading information about selection of long-duration crops tolerant to extreme weather conditions and diseases	0	10
5	Techniques for growing forage	0	5

Awareness on rice varieties

Before the training, only 5 participants could answer this question, and those who provide the answers were not sure about their answers. However, after they received the training, all the participants could answer this question by naming 5 different kinds of rice varieties that are suitable for changing climate in Cambodia. Their answers are shown in Table 11.

Table 11: rice varieties important for climate change adaptation

No.	Khmer Rice varieties	No. of answers before training	No. of answers after training
1	Neang Chin	1	0
2	Kangok Pong	1	0
3	Padoa Pen	1	0
4	Neang Pun	1	0
5	Srov Bei	1	0
6	Raing Chay	5	11
7	Sen Pidor	6	14
8	Sen Sor	1	2
9	Khar 4	4	6
10	Khar 6	4	11
11	IR 66	5	12
12	Phkar Rumdoul	2	9
13	Phkar Rumdeng	2	5
14	Chulsar	3	4
15	Phkar Romeat	1	1

Animal and crop production techniques for climate change adaptation

Before the training, 12 participants were unable to answer this question. After the training, most of their answers were correct. As given in the Table 12, the answers reflect that the participants were able to identify possible techniques that may be adapted to the harsh environment in which crops and animals can be farmed.

Table 12: animal and crop production techniques for adaptation

No.	Answers	Answers before training	Answers after training
1. Animal production			
1.1	Growing forage	3	9
1.2	Construction of bio-digesters	2	2
1.3	Farming technique for animal penning	1	0
1.4	Selection of animal breeds resistant to extreme weather	1	13
1.5	Improving animal feed quality	0	5
1.6	Animal vaccination	0	4
1.7	Weed control	0	2
1.8	Animal healthcare	0	1
2. Crop production			
2.1	Organic fertilizer use	2	4
2.2	Rotational crops	2	0
2.3	Use of crops tolerant of weather and disease	1	12
2.4	Water management	0	5
2.5	Practices of agricultural diversification	0	4
2.6	Soil fertility management	0	2
2.7	Practices of rice intensification	0	3
2.8	Growing cover crops	0	2
2.9	Changes in farming calendar	0	1
2.10	Use of short-duration crops	0	2

2.1.4 Need for future training on climate change

The trainees who participated in this training showed enthusiasm to participate in further training programs on climate change so that they have even better understanding on the subject. They found that the training program was important for them to build their capacity. Further, the trainees have suggested additional topics to be included in the future training programs (Table 13).

Table 13: Various training required by the trainees

No.	Types of training	Number of answers
1	The effects of climate change on agriculture sector	8
2	The effects of climate change on Cambodia	8
3	Seed selection and farming methods suitable for climate change adaptation	7
4	Preventive measure and response to climate change	7
5	Adaptation measures for climate change	5
6	Construction of bio-digesters to reduce GHGs	5
7	Use of renewable energy	4
8	Animal protection during flooding and drought	4
9	How to select suitable crops	4
10	Training to farmers on passable disease and preventive measure	3
11	Water management technique	3
12	Strategy for water management and irrigation system	2
13	Farming diversification	2

2.1.5 Conclusion

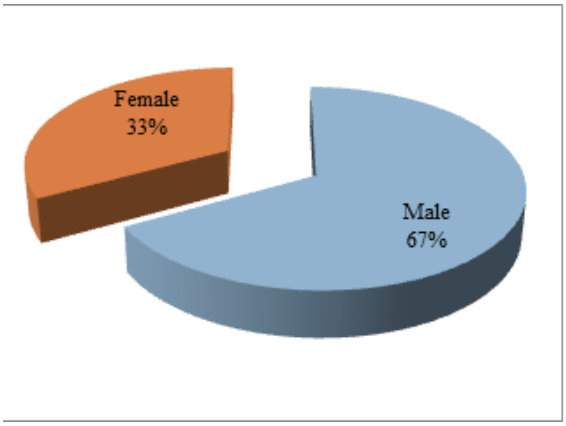
The facilitators have used simple methods to teach participants by giving presentations, explanations on the whiteboard, showing pictures, and by asking questions to create interest among the participants. All of the participants have received the training in climate change for the first time and they showed significant improvement in their understanding on this issue as a result of the training. The evaluation results before and after the training showed that 90% of the officers were not aware of climate change and how to adapt to it before the training and hence were not able to answer the questions. However, after the training, they could answer all the questions although it was not 100% correct. This indicates that the training could able to impart significant improvement in the knowledge of the participants on the issues related to climate change adaptation. It can be concluded that the current training and the module has made significant contribution to enhance the capacities of extension officers at commune and district levels in relation with climate change adaptation.

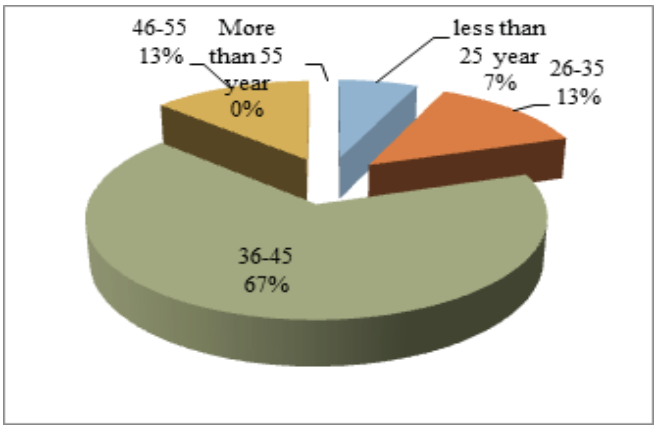
2.2 Sub-Assistant Agriculture Officers (SAAOs) of the DAE

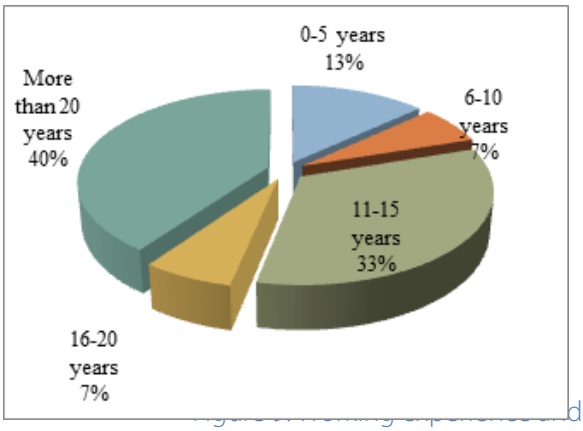
2.2.1 Background of participants

Most of the participants attending the training were in-charge of providing training and agricultural extension services to farmers, including techniques for rice intensification, dissemination of newly-introduced rice varieties resistant to climatic vagaries, methods for vegetable cultivation, forage farming, and techniques for lilvestock husbandry. In addition to disseminating information to farmers, each participant was given additional tasks as shown in the Table 14.

Most of the participants were male (67%), and were in the age group of 36-45 years (Figure 8). They had working experience in the range of 20 and above years and most of them are general staff (54%) followed by vice-heads of offices (Figure 9). Most were educated until BSc in the fields of agronomy and agriculture economics (Figure 10).







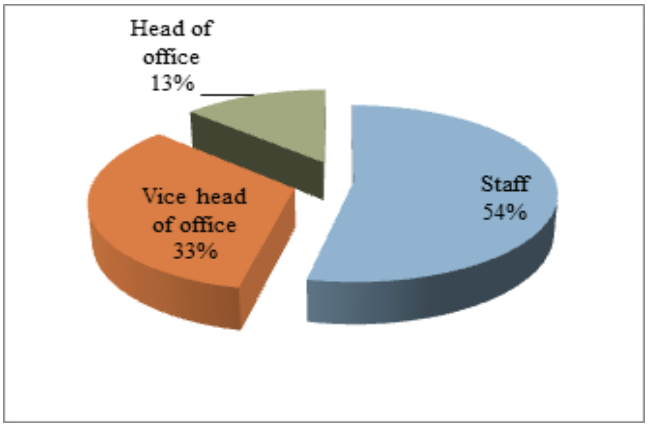


Figure 8 Working experience and

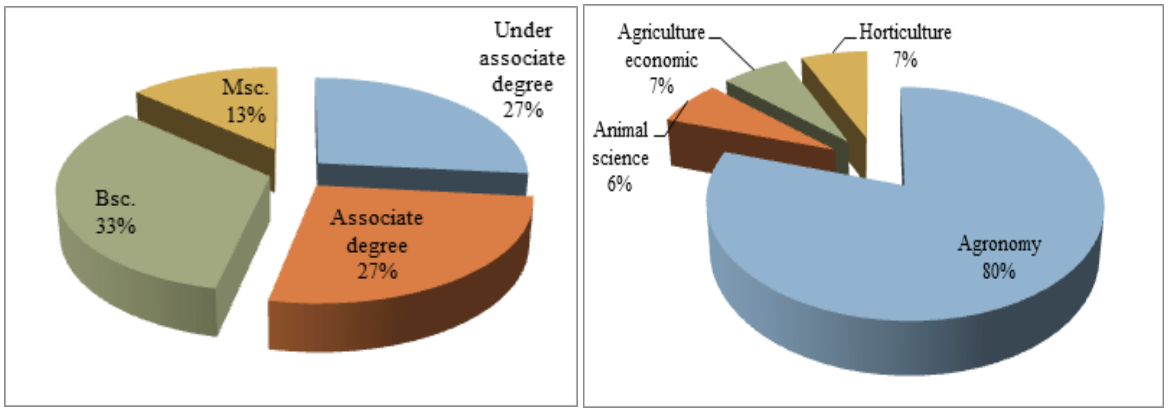


Figure 10: Level of knowledge and skills among the participants

Table 14: Responsibility taken by the provincial extension officers

No.	Job responsibilities	Number of answers
1	Training	10
2	Extension work	9
3	Planning	3
4	Savings account	1
5	Drought intervention and rice damage caused insect	1
6	Targeting bird influenza at district level	1
7	Prevention of flooding and other problems	1
8	Animal trafficking	1
9	Agronomic and environmental analysis	1
10	Experiment on rice crop	1
11	Mushroom cultivation	1
12	Accounting	1
13	Computer	1

2.2.2 Gerneral understanding of participant on climate change

It could be clearly seen that, nine participants (60%) have reported to have a moderate understanding on climate change before the training. All the participants said that they became familiar with the issue after receiving training (Figure 11). The significance here was that the climate change was known differently to different participants as indicated by their responses (Table 15). Most trainees learned about climate change through radio and television before the training and had no formal training on climate change and adaptation (Table 16).

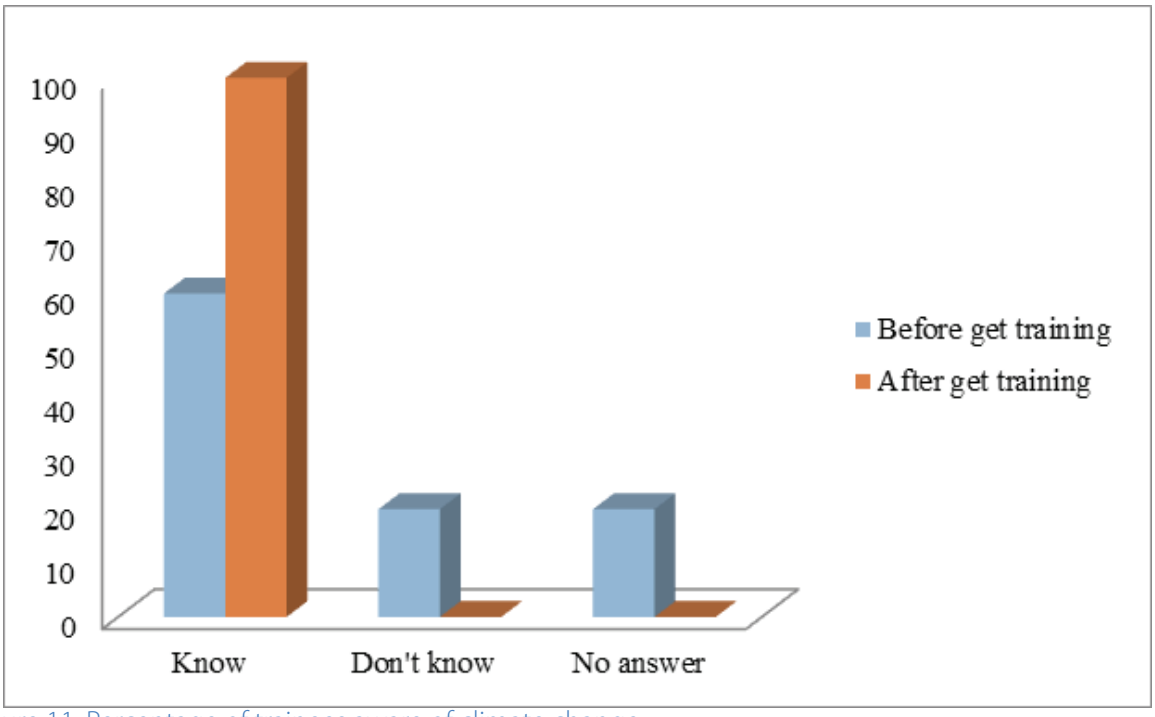


Figure 11: Percentage of trainees aware of climate change

Table 15: meaning of climate change

No.	Answers	No. of participants' answer before training	No. of participants's answer after training
1	Climate change refers to variable temperature	1	0
2	Climate change means increasing global heat, flooding, drought, storms and abnormally torrential rain	4	10
3	It is defined as nutural changes	1	0
4	Climate change means increasing global heat, flooding, irrigular rainfalls, storms and decreased ozone layer	1	5
5	Changing weather is irregular rainfalls and storms	1	0
6	Climate change means using chemical substances and poisonous gasses	1	0

Table 16: Ways to know about the climate change issues

No.	Methods	No. of answers before training	No. of answers after training
1	Learning/education at school or university	1	1
2	Training/seminars	4	15
3	Learning from newspaper	1	1
4	Learning from internet	1	1
5	Learning from radio	6	6
6	Learning from television	6	6
7	Learning from friends	2	2

Climate change impacts

Asked about the impacts of climate change, 12 pre-training officers could answer this question and other 3 did not reply. However, all could answer it after the training (Table 17). Although their answers varied considerably, this shows that the participants are starting to develop understanding on the consequences of climate change.

Table 17: Bad consequences caused by the issue

No.	Answers	No. of answers before training	No. of answers after training
1	Forest losses	8	12
2	Increased GHG emission	0	14
3	Population growth	2	0
4	Growing industrial factories	2	5
5	Surging number of vehicles	1	3
6	Use of chemical sustances and fertilizer	1	2
7	Groundwater extraction	1	0
8	Increasing use of modern equipment (air-conditioner, fridge)	1	0
9	Scientific progress	1	0
10	Gas emissions	1	0
11	Improper disposal of waster	1	3
12	Forest fire, spontaneous combustion, methane emission	1	1
13	Gas given off by glass houses	1	0
14	Technically unreasonble farming	1	0
15	Global warming	2	2
16	Environmental pollution	1	0
17	Use of second-hand products	1	0
18	gas emissions from farming	0	2
19	Fuel burning	0	3
20	Polar ice melt	0	1

Before joining the training, two officers were not unable to answer these questions and all were able to answer the questions after the training. Most of the answers given by eight trainees before the training were related to forest losses. After the training, the answers were spread across the choices given including forest losses, GHGs, emissions from industrial factories, and others shown in the table above.

2.2.3 General understanding of participants on adaptation

Definitions of adaptation to climate change

Table 18: definition of adaptation to climate change

No.	Answers	Number of participants' answers before training	Number of participants' answers after training
1	Adaptation to Nature	1	0
2	Strange climatic conditions	1	0
3	Adaptation to climate change	1	0
4	Adjustment to climate change	1	0
5	Use of mature crop and livestock species resistant to pest and disease	1	1
6	Training of affected people	1	0
7	Safe-guarding and planned prevention	1	0
8	Push for reforestation	2	0
9	Training for suitable agricultural technique and reduction in chemicals	1	0
10	Cutdown on population growth	1	0
11	Adaptative strategy for climate change	0	1
12	Assisting human, animal and crop to tolerate climate change	0	5
13	Activities of human, animals and plants in adaptation to climate change and tis minimal damage	0	8

As shown in the table, four pre-training participants who could not define the meaning of climate change were able to give answers after receiving training. Prior to the training, the definition of climate change varied considerably and some were not right. The training has enabled eight participants to answer that adaptation to climate change refers to an activity in which human, animals and plants respond toward climatic patterns to reduce their impacts. Another five said that

adaptation techniques for climate change means that living things could tolerate the change. The performance has showed that the training provided all participants with an understanding of adaptation to climate change.

Agriculture technologies with adaptation potential

Table 19: Methods for adaptation

No.	Answers	No. of answers before training	No. of answers after training
1	Irrigation of rice paddies during dry periods	2	0
2	Technical livestock raising	2	0
3	Appropriate use of agricultural fertilizer	1	0
4	Proper rice storage	1	0
5	Changes in plant crops	5	0
6	Finding higher ground during flood	2	0
7	Use of rightly mature plant crops	2	0
8	Technical use of natural fertilizer	1	0
9	Use of model equipment for drought	1	0
10	Prevention of feed and disease	1	0
11	Transpanting rice during recession	1	0
12	Growing drought-resistant vegetables	1	0
13	Reduction in use of farming pesticide and fertilizer	1	0
14	Practices of rice intensification	1	5
15	Reduction in population growth	1	0
16	Composting	0	1
17	Construction of bio-digesters	0	1
18	Use of disease-tolerant animal breeds and high-yielding crops	0	15
19	Spreading pre-cautious information on climate change	0	2
20	Reforestation	0	1
21	Good water managment	0	5
22	Practices of integrated pest management	0	4
23	Provision of new techniques	0	3
24	Mixed farming	0	5
25	Use of location-specific plant crops	0	2
26	Construction of canals in dry season	0	1

Before receiving the training, six participants did not raise any questions, but after that they were able to answer them all. In the meantime, the answers provided before the training were dissimilar, but they were then similar after joining the training. The participants mostly thought that the effects of climate change on agriculture can be mitigated by rotating crops and raising animals in a proper method.

Farming activities for adaptation to climate change

Table 20: farming activities for adaptation to climate change

No.	Answers	No. of answers before training	No. of answers after training
1	Use of organic fertilizer for farming	1	1
2	Vegetable cultivation	1	0
3	Planting cover crops	1	0
4	Breeding Disease-tolerant rice crop	3	0
5	Technical animal raising	2	3
6	Practices of rice intensification	2	3
7	Extension service for upright seasonal farming	2	0
8	Use of short-duration plant crops	1	4
9	Supply of water, sufficient feed and animal health care	1	5
10	Use of short-duration rice as an alternative to long-duration rice	0	6
11	Forage cultivation	0	7
12	Construction of bio-digesters	0	2
13	Breeding new species of rice resistant to disease	0	5
14	Establishment of rice production committees	0	2
15	Good management of water and soil	0	3
16	Adequate irrigation systems	0	2
17	Construction of reserviors	0	1
18	Mixed farming	0	1

As pointed out on the table, it can be clearly seen that pre-training trainees that numbered up to 8 did not answers the question asked, while the answers were clearly given at the end of the training, meaning good results and efficiency of training. The trainees suggested many ways to adapt agricultural practices to the harsh condition in case of climate change. Thus, Drought-tolerant crops should be chosen as a good solution to producing food, and mixed crops are also considered because if one crop fails, others may survive.

Trainees' awareness of GHGs

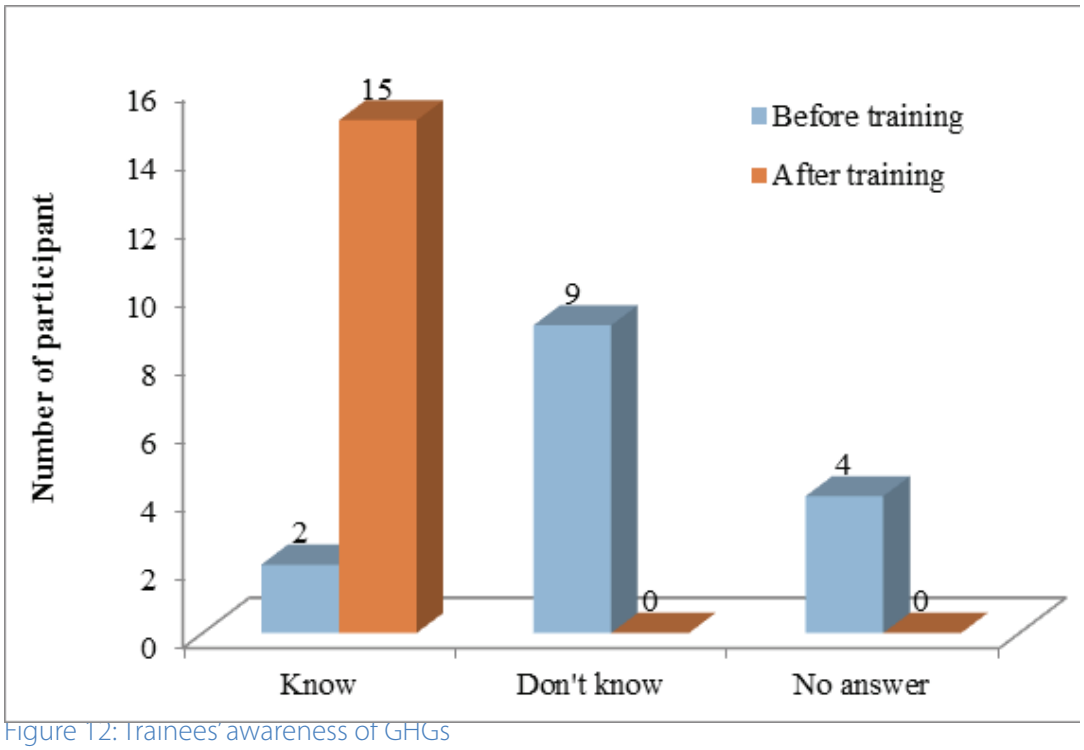


Figure 12: Trainees' awareness of GHGs

The graphic demonstrates only two trainees were awareness of GHGs and briefly described some of them even before the training. However, the training was vitally important for them to yield an insight into gas emission and outline all GHGs as shown graphically.

Types of GHGs

In this case, prior to participation, 13 trainees did not know what GHGs are.

Table 21: Types of GHGs known by trainees

No.	Types of GHGs	No. of participants' answers before training	No. of participants' answer after training
1	CH4, NO2	1	0
2	CO2, CH4	1	0
3	CH4, NO2, CO2, HFCs, PFCs,SF6, O3	0	1
4	CH4, NO2, CO2	0	14

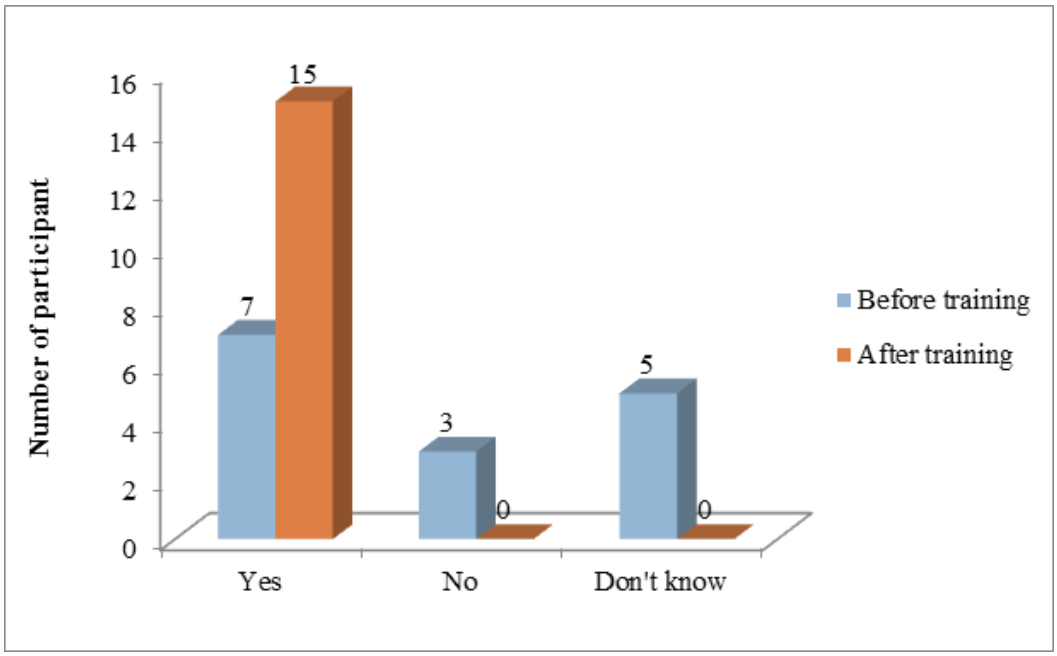


Figure 13: Contribution of agriculture to GHG emissions

It is very clear that seven pre-training participants thought that farming contributed to gas emission, three did not believe this, and five were not sure. Nevertheless, those receiving the training said that agriculture really make a huge contribution toward climate change. The result means that they have become familiar with GHG. For this reason, the participants provided the reasons why agriculture contributes to global warming as submerged rice produces CH_4.

Ability to reduce GHG emissions in agriculture

Similar to the previous graph, 4 pre-training participants maintained that the possibility of agriculture made less contribution to GHG and was beneficial for adaptation, 4 mentioned the impossibility of agriculture, and 7 said that they did not know. However, after training, they answered that agriculture potentially reduced gas emissions and was advantageous for adaptation when practiced appropriately. In this case, most of the participants mentioned keeping water in rice fields at a minimum level at which rice can survive, so the possibility of methane creation is low.

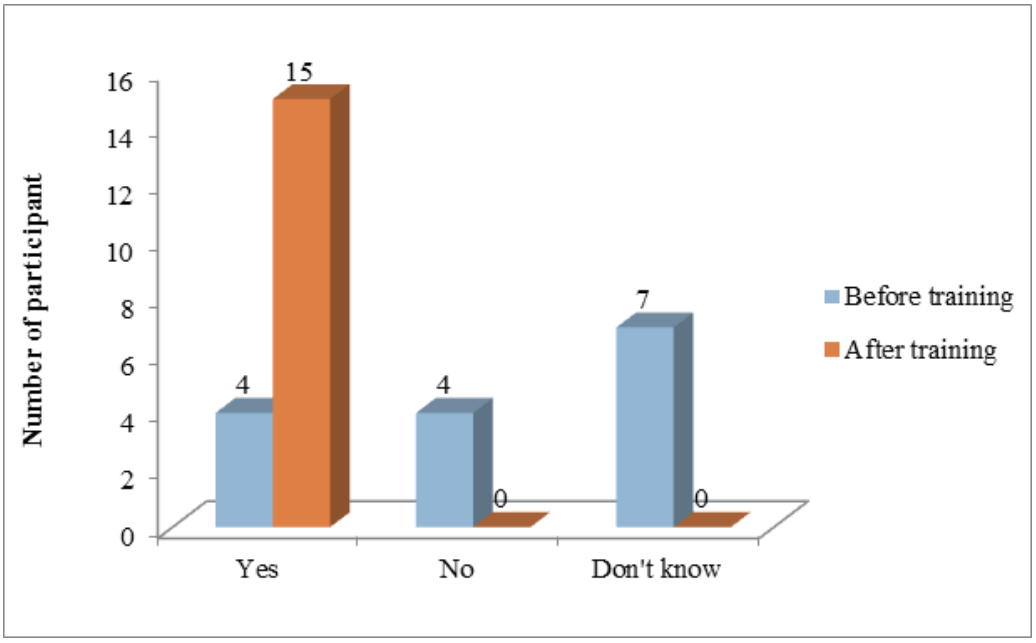


Figure 14: Participants' vision of agricultural abilities to reduce GHG

Agricultural practices with less GHG emissions and high adaptation potential

Before the training, 13 participants did not answer the question. After the training, they showed a broad knowledge of the issue and were able to answer all the questions. Detailed answers are given in the Table 22.

Table 22: Agricultural practices with GHG mitigation and adaptation potential

No.	Answers	No. of answer before get training	No. of answer after get training
1	Use of rice varieties resistant to drought and flooding	1	0
2	Emissions of methane	1	0
3	Pumping driven by air power	1	0
4	Reduction in use of chemical pesticide and fertilizer in agriculture field	1	1
5	Use of crops for climate change adaptation	0	2
6	Promotion of natural fertilizer (compost)	0	6
7	Construction of bio-digesters	0	3
8	Technical animal raising	0	2
9	Power generated by solid and liquid water from animal farms, from husks and renewable energy	0	6
10	Reforestation	0	2
11	Forage cultivation	0	1
12	Practices of rice intensification	0	1
13	Practices of crop diversification	0	1
14	Reduction in fuel use	0	1

Planning tools to facilitate adaptation to climate change

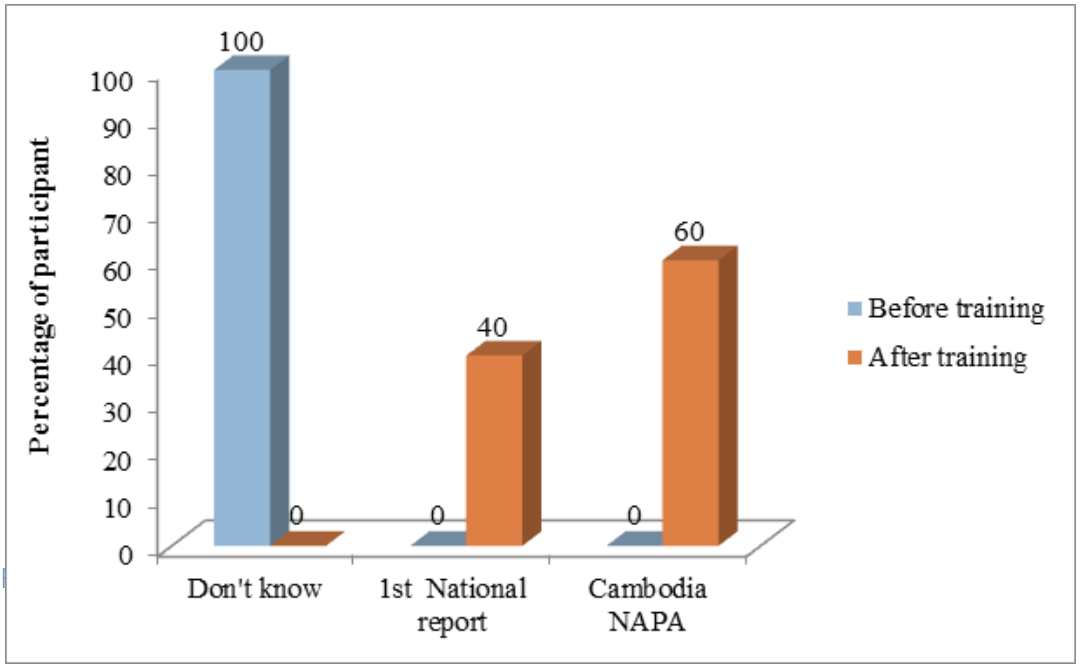
Before receiving the training, 11 participants did not answer the question and 15 participants were able to answer after the training (Table 23). This shows that the training made the participants to have awareness of how to make the subordinates capable of doing activities related to climate change. Although the answers varied from person to person, the results have shown that the trainees are starting to have a high awareness about possible tools. Most of the tools were strongly related to training on new crop varieties which are considered helpful in adapting to climate change.

Table 23: planning tools to facilitate work of subordinates in adaptation to climate change

No.	Total	No. of answers before training	No. of answers after training
1	Training preparation	4	10
2	Extension service for climate change	2	8
3	Introduction of new crop varieties	2	0
4	Integration of climate change planning into planning institutions	0	3
5	Field trip preparation	0	4
6	Experimentation on climate change impacts	0	1

Action plans in response to climate change

There was a significant change in the responses before and after the training. The graphic below shows that none of the participants knew about the government's documents on actions in response to climate change before the training. After the training, six participants could identify the first national report to the United Nations Convention on Climate Change and the rest were aware of the documents and activity plans on adaptation to climate change. The limited knowledge was due to non-availability of these documents at the district level. It will be more useful if these documents are made available at local level so the staff is aware about how to use them.



Trainees' awareness of key words relevant to climate change

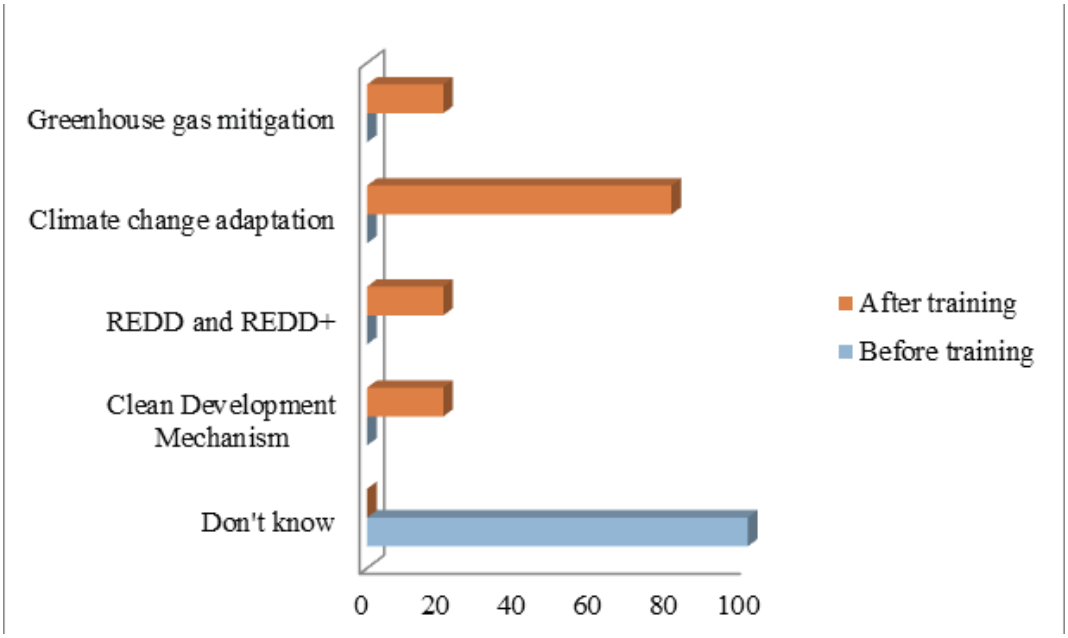


Figure 16: Identification of key words relevant to climate change

According to the above graphic, none of the participants knew the climate change keywords before training. After the training, participants were able to identify different keywords including clean developmental mechanism, reduction in GHG, decrease in gas emission caused by deforestation, and forest degradation in developing countries that have contributed toward climate change mitigation, through forest preservation, sustainable forest management and carbon sequestration.

2.2.4 Basis of capacity building

Past attendance in climate change related training

80% of the participants have ever received any training on climate change and the reason being that they were not assigned to training at provincial level by the directors of agricultural provincial departments. Others have added that training programs on climate change are rarely organized at provincial levels as this is a new issue in Cambodia and not many government officers know about it.

Experience from previous training

Among those who had previous training on climate change, participants described the knowledge they obtained from the training which included use of agricultural pesticide and fertilizer, definitions of climate change, impacts of climate change on agriculture sector and public health, and farming techniques for climate change adaptation.

Dissemination of knowledge to local community

Three of the four who had prior training on climate change have disseminated their knowledge to farmers and one did not disseminate the information to local community though most of them did not have any financial support from the government. They disseminated the information by holding trainings, direct talks or farmer field schools.

Need for future training on climate change

All the participants said that they were highly interested in joining training on climate change that would be held at a later date. Table 24 presents the proposed topics to be added to the future training programs.

Table 24: Training topic need for future by participant

No.	Kinds of training	Numbers of participants
1	Climate change impacts on agriculture	10
2	Impacts of climate change on Cambodia	8
3	Selection of plant varieties and suitable farming technique for adaptation to climate change	7
4	Preventive technique and response to climate change	6
4	Adaptation measure on climate change	6
6	Technique for constructing bio-digesters to reduce GHG	5
7	Technique for using renewable energy	5
8	Importance and use of meteorological information	4
9	Preventive methods for flooding and drought	4
10	Extension of plant species selection	4
11	Educational method on infectious disease and its prevention	3
12	Water management technique	3
13	Strategy for water management and irrigation systems	2

2.2.5 Conclusion

In conclusion, the training program held was successful with the highly skilled trainers in facilitating training. According to detailed evaluation conducted before and after the training, it can be clearly seen that 80% of the trainees did not have any understanding of climate change and hence were not able to provide good answers to questions asked in the evaluation. However, after the training program, most could answer the questions though were not 100% correct. All the trainees suggested having additional training on climate change at provincial and district levels as they aim to disseminate the knowledge to farmers and other stakeholders engaged in agriculture.

3.0 FINAL TRAINING MODULES

3.1 Modifications made after the evaluation

I. Module one

According to the detailed report and evaluation of the training module on adaptation to climate change in agriculture sector for extension officers at provincial level, some adjustment have been made in the content and pedagogical methods.

1. Teaching methods in the content, Introduction to Climate Change and Global Warming, has been slightly changed by showing two video clips. The original methodology was "lecture and question-answer sessions" which was changed to a combination of lecture, VCD (Documentary on climate change and UNEP Climate change) and question and answers.

2. Part of the content titled "Adaptation options in water resources management and adaptation options in soil conservation and management" was primarily separated. After the training, it was observed that these cannot be separated since the soil conservation and management is closely related to that of water resources management. Hence, these two sub-contents were suggested to be combined into "Adaptation options in water resources management and soil conservation and management."

3. The case study on climate change vulnerability, impact assessment and adaptation was not prepared and hence it was suggested to be excluded from the standard module. However, it was suggested that the module should be brought back when a suitable case study is prepared for training purposes.

4. Because of the limited budget, the field visits and on-site studies to test demonstration plots in the module of "Adaptation options in soil conservation and management and in crop production" were not implemented but kept for another training program in case of sufficient funds are made available.

II. Module two

Similar to the previous training module, minor adjustments were made in the content and methodology of the second module.

1. Teaching methods in the session on 'Introduction to Climate Change and Global Warming' has been changed by showing two video clips. The original methodology included lecture and question-answer sessions. The modified delivery method included lecture in combination with showing VCDs (Documentary on climate change and UNEP Climate change) followed by question and answers.

2. The case study on "Adaptation technology for agriculture" was not included in the training since no useful case studies were found in Cambodia and case studies from other counties were not found to be suitable for the context of Cambodia. Thus, the trainers had to demonstrate adaptation options in crop production and animal production which unnecessarily overlapped with the previous module.

The content and methodology in this module was kept for later use in the event of particular research into adaptation technology in agriculture is made available which will be useful for all levels of extension officers.

3. Due to the limited budget, field visits "Impacts of climate change on agriculture (crop, animal, and fish production) and integrate farming systems adapted to climate change" were not implemented. However, these sessions should be implemented if sufficient funds are available.

In short, these two trainings were extremely important to build the capacities of extension officers at commune, district, and provincial levels, in order to make them understand climate change, its impacts on agriculture sector and build the capacity to adapt. This experience can be disseminated to other officers in order to implement government's policies in reaching a targeted rice export of one million tons by 2015.

3.2 In-service Training Module on ClimateChange Adaptation for PDA's Extension Staffs at District and Commune Level

INTRODUCTION

Most Cambodian households are engaged in agriculture. The main agriculture commodity in Cambodia is rice. Research has clearly indicated that the frequency and intensity of droughts and floods may increase with changing climate and can cause severe damage to rice production. Successive droughts and floods have resulted in a significant number of fatalities and considerable economic losses. Floods have accounted for 70% of rice production losses between 1998 and 2002, while drought accounted for 20% of losses. In 2010, Cambodia was affected by a severe drought that has severely impacted the agriculture production and human wellbeing. Therefore, the staff who works in agricultural sector, especially those who work directly with farmers, need to have the knowledge and understanding on the impact of climate change on agriculture and adaptation to climate change in agriculture sector in order to be able to help the farmer to mitigate the adverse impacts of climate change.

TARGET GROUP

PDA's Extension Staffs at District and Commune Level

ENTRY BEHAVIOUR

The age of participants/trainees is not limited. The participants are not based on the education background; everyone who works on agriculture or related sector can attends this training course.

The trainers should hold the educational background from university degrees related to climate change and have experience in agriculture practices.

GOAL AND LEARNING OBJECTIVES

To improve additive capacity and knowledge of district and commune officers to climate change in agriculture sector.

IMPLEMENTATION MODALITIES

The number of trainees should be 30 and there should be at least 2 trainers per course. Duration of training is 20 hours. For conducting the training module the conducting institute should collaborate with other training institutions such as Royal University of Agriculture, Department of Agriculture Extension and Provincial Agricultural Department. The training facilities required are LCD, Laptop, Multi-media, Study site, mean of transportation, Poster/leaflet, Flipchart, marker and sticker for recording.

EXPECTED OUTCOMES

The trainees will obtain knowledge on climate change adaptation and mitigation in agriculture and be able to help farmers to mitigate the impacts in agriculture.

EVALUATION

The trainer will conduct the pre- and post-training evaluation by using simple questions on climate change adaptation and mitigation. During the session the trainers should ask questions and conduct short oral exam.

TRAINING MODULE

Title of the module	Improving capacity of district and commune officer on Climate Change adaptation in agriculture sector in particular on rice production
Target trainees / participants	District and commune officers
Responsibility of the participants after training (they are expected to do what)	-Responsibility of the participants: -Working closely with farmers -Provide training and conduct practical work with farmers
Duration of the module	20 hours

SN.	Enabling objectives	Contents	Methods / Activities	Duration (min./hr.)	Resources used	Methods of learning evaluation	Note by module designer
	To enhance the knowledge of district and commune officer on climate change adaptation	Introduction to climate change and global warming	-Lecture -VCD on documentary on climate change -VCD-UNEP Climate change -Question and answer	2h	Multi-media, reading documents, LCD, Computer	Ask questions	
		Introduce climate change adaptation and mitigation	-Case study -Group discussion -Question and answer	2h	Flipchart, marker and sticker for recording	Testing by using short questionnaire	
		Impact of climate change on agriculture (crop production, animal production, fish production etc.)	-Lecture -Field visit -Question and answer	6h	Reading documents, mean of transportation	Exercise	
		Adaptation technology in agriculture	-Lecture -Case study -Question and answer	2h	Reading documents, LCD, Computer	Ask questions	The trainer should present the example technology from deference countries

SN.	Enabling objectives	Contents	Methods / Activities	Duration (min./hr.)	Resources used	Methods of learning evaluation	Note by module designer
	The participants will be able to select the crop varieties tolerant to flood and drought areas and adaptation technique on rice production	Introduce crop varieties (rice crop varieties, other crops, vegetable varieties)	-Mini-lecture -Group discussion -Question and answer	2h	-Poster/leaflet, reading documents	Exercise	The trainer have to focus more on 10 varieties of rice, mung bean and tomato produce by CARDI
		Integrate farming system adapted to climate change	-Field visit to farmer's plot -Group discussion -Question and answer	4h	Study site, means of transportation	Ask questions	
		Rice production, management and adaptation technique /options	-Lecture -Case study -Question and answer	2h	Multimedia, reading documentation, LCD, Computer	Exercise	

3.3 In-service Training Module on Climate Change Adaptation for Province Level Agriculture Officers

INTRODUCTION

As a least developed agrarian country, Cambodia is highly vulnerable to climate change and has low adaptive capacity. Mitigating the impacts of natural hazards is an extremely important objective that can improve the livelihoods of poor farmers living in drought and flood prone areas. Delayed rainfall and severe floods have caused damage to crops in the past. Training provincial agricultural officers to be able to train the district agricultural staff who work directly with farmers is urgently needed. The provision of food during disasters can be improved by promoting short cycle crops, cultivation of drought and flood resistant crop varieties, and cropping techniques that mitigate negative impacts of droughts and floods. In Cambodia, one of the roles of the provincial agricultural department (PDA) staff is to train the district agricultural staff to work with farmers in improving agriculture production. These officers have basic knowledge in agricultural techniques. However, in the context of climate change, based on training needs assessment, we found they need to improve their knowledge and skills in climate change adaptation.

TARGET GROUP

PDA's Extension Staffs at provincial level

ENTRY BEHAVIOUR

The age of participants/trainees and the educational background of the trainees are not limited. The trainers should hold university degrees in sciences related to climate change and have experience in agriculture sector.

GOAL AND LEARNING OBJECTIVES

To enhance knowledge on climate change adaption and be able to develop possible adaptation options for agriculture sector.

IMPLEMENTATION MODALITIES

The number of trainees should be 30 and there should be at least 2 trainers per course. The duration of training is 20 hours. For conducting the training module, the conducting institute should collaborate with other training institutions such as Royal University of Agriculture, Department of Agriculture Extension, Provincial Agricultural Department and Climate Change Department of the Ministry of Environment. The training facilities required are LCD, Laptop, Multi-media, Study site, mean of transportation, Poster/leaflet, Flipchart, marker and sticker for recording, paper etc.

EXPECTED OUTCOMES

The trainees will get knowledge on climate change adaptation and mitigation in agriculture and be able to help farmer to mitigate the impacts in agriculture.

EVALUATION

The trainer will conduct the pre- and post-training evaluation by using simple questions on climate change adaptation and mitigation. During the session, the trainers will ask questions and conduct short oral exam.TRAINING MODULE

Title of the module	Climate change adaptation in agriculture sector
Target trainees / participants	Agriculture extension staffs at provincial level
Responsibility of the participants after training (they are expected to do what) -	The responsibility of the participants: -Provide training to district level staffs and to farmers -Conduct practical work with farmers
Duration of the module	20 hours

SN.	Enabling objectives	Contents	Methods / Activities	Duration (min./hr.)	Resources used	Methods of learning evaluation	Note by module designer
	The agricultural extension officers will understand the concept, knowledge of climate change and climate change strategy in Cambodia	Introduction to climate change and global warming	-Lecture -VCD on documentary on climate change -VCD-UNEP Climate change -Question and answer	2h	Multi-media, reading documents, LCD, Computer	Testing by using short questionnaire	
		Human response to climate change/climate change policies (UNFCCC, Kyoto Protocol etc.)	-Presentation -Panel discussion and reflection	1h30min	Leaflets, reading documents, LCD, Computer	Testing by using short questionnaire	
		Cambodia NAPA	-Mini-lecture	30min.	Reading documents, LCD, Computer	Ask questions	The trainer should be highline the NAPA activities related to agriculture and water sector
		Climate change mitigation	-Case study -Group discussion	2h	Flipchart, marker and sticker for recording	Pre-test Post-test	
		Climate change vulnerability impact assessment and adaptation	-Lecture -Question and answer	2h	Multi-media, LCD, Computer, Flipchart, marker	Exercise	

SN.	Enabling objectives	Contents	Methods / Activities	Duration (min./hr.)	Resources used	Methods of learning evaluation	Note by module designer
	This session will enable the participants to develop possible adaptation options in agriculture sector						
		Adaptation options in Soil Conservation and water resources Management	-Lecture -Group discussion -Field visit	6h	Reading documents, LCD, Computer, Mean of transportation	Ask questions	The trainer have to focus more on water use in agriculture
		Adaptation options in crop Production	-On site study to see demonstration plot	4h	Mean of transportation	Ask questions	
		Adaptation options in animal Production	-Mini-lecture -Small group discussion	2h	Flipchart, marker and sticker for recording	Pre-test Post-test	

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