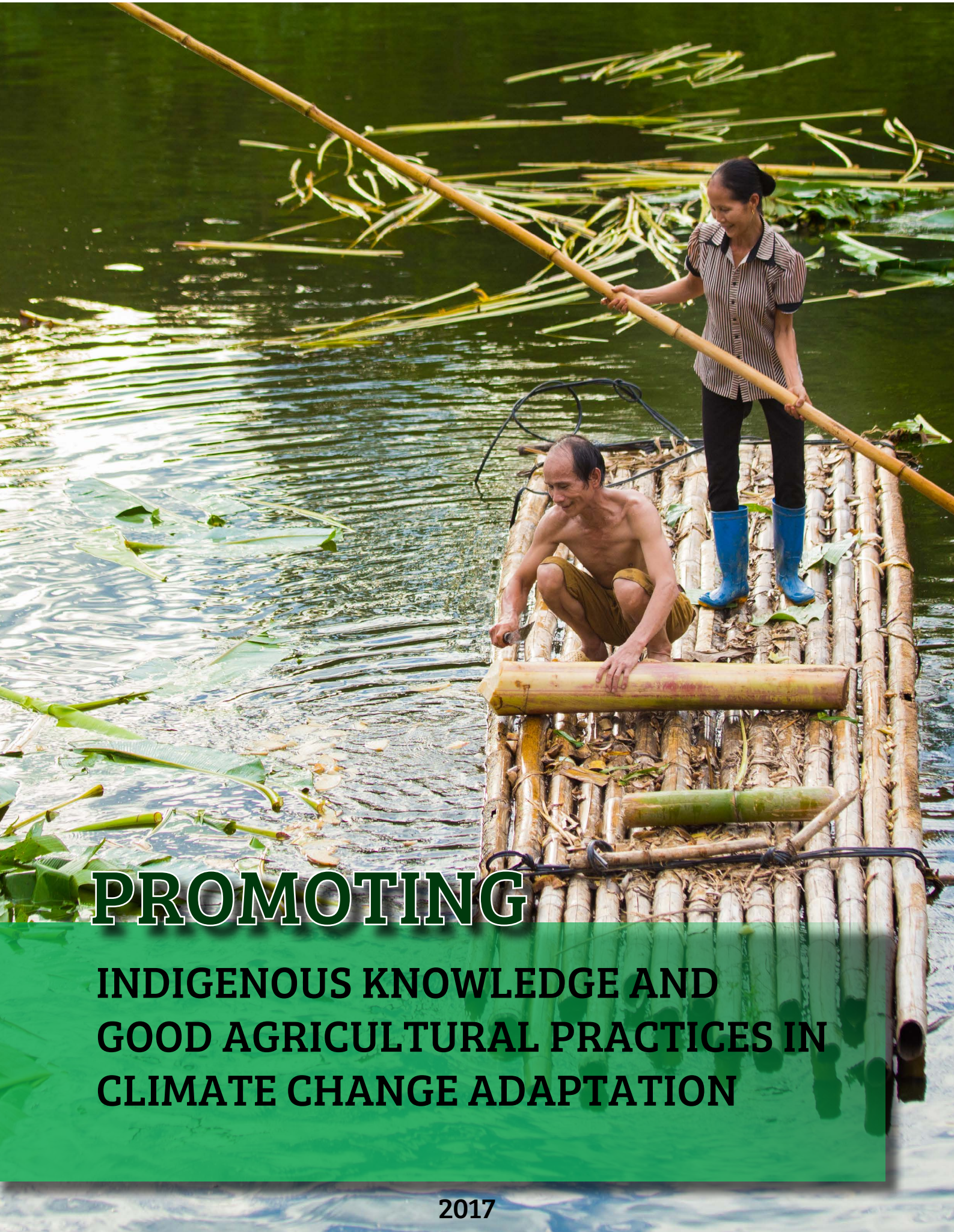

PROMOTING

INDIGENOUS KNOWLEDGE AND GOOD AGRICULTURAL PRACTICES IN CLIMATE CHANGE ADAPTATION

2017

CONTENTS

ACRONYMS

ADC	Agriculture and Forestry Research & Development Center for Mountainous Region
CARE	CARE International in Vietnam
CBA	Community based adaptation
CC	Climate Change
CCA	Climate change adaptation
CSCNDPC	Central Steering Committee for Natural Disaster Prevention and Control
CVCA	Climate vulnerablility and capacity analysis
EM	Ethnic Minorities
FAO	Food and Agriculture Organization of the United Nations
IK	Indigenous knowledge
IPCC	Intergovernmental Panel on Climate Change
WIPO	World Intellectual Property Organization

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KEY CONCEPTS

Climate change

The changes in the status of the climate system that can be perceived by the average change and the fluctuation of its properties, maintained for a long enough time, centuries or longer. Climate change can be caused by natural processes inside the climate system, or by external influences, or by frequent human actions that change the compositions of the atmosphere or in land-use processes. (IPCC, 2014).

Climate change mitigation

The intervention of human to reduce the sources or enhance the sinks of greenhouse gases (IPCC, 2014).

Climate change adaptation

The adjustment of the natural system or human to respond to actual or anticipated changes in circumstances or environment, or their impacts, aiming at reducing the vulnerability to the impacts of climate change and take advantages of the favorable opportunities that each change of climate brings (IPCC, 2014).

Indigenous knowledge (IK)

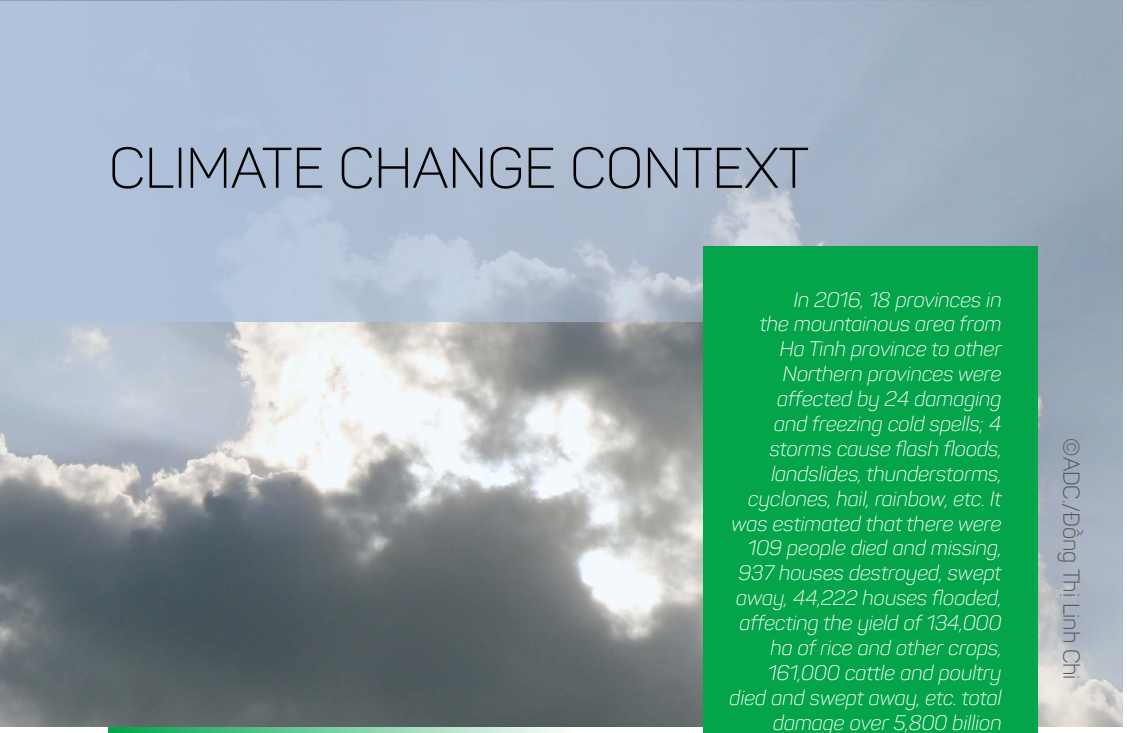
According to the World Intellectual Property Organization - WIPO (2012), indigenous knowledge, or traditional knowledge, is the knowledge that includes know-how, skills, innovation, reality, and learning that are created, preserved and transmitted from generation to generation in a traditional context within an indigenous or local community.

Community-based Adaptation (CBA) to Climate change

An approach to adapt to climate change with the purpose is to include vulnerable groups in the design and implementation of adaptation measures.

Community-based adaptation to climate change is often based on two complementary forms of analysis. The first is a combination of participatory approaches to development to find out how people are exposed to climate risks and their vulnerabilities. Second is the interaction between developers and/or climate scientists to seek for ways to integrate local needs with future climate change projections. (Forsyth, 2017).

CLIMATE CHANGE CONTEXT



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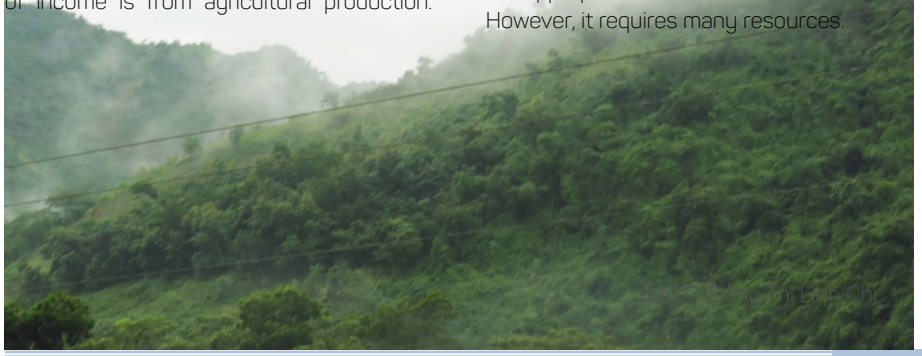
In 2016, 18 provinces in the mountainous area from Ha Tinh province to other Northern provinces were affected by 24 damaging and freezing cold spells; 4 storms cause flash floods, landslides, thunderstorms, cyclones, hail, rainbow, etc. It was estimated that there were 109 people died and missing, 937 houses destroyed, swept away, 44,222 houses flooded, affecting the yield of 134,000 ha of rice and other crops, 161,000 cattle and poultry died and swept away, etc. total damage over 5,800 billion dong due to these disasters. (CSCNDPC, 2017).

Global climate change is the reason for the frequently and stressful rate of natural disasters, causing tremendous impacts on many different areas such as economy, culture, society and environment. Vietnam is one of the countries will be most severely affected by impacts of climate change (Dasgupta et al., 2007). The erratic fluctuations of temperature and rainfall, and human's activities would lead to adverse impacts on human health as the increase in the occurrence of diseases, natural disasters, as well as on food production due to seasonal structure change (McSweeney et al., 2010). By 2020, according to three scenarios of climate change in Vietnam - low, medium and high, the annual average temperature for the northern climatic regions will increase by 0.5°C compared to the period 1980-1999, while the annual rainfall is predicted to increase from 1.4 to 1.8% for Northern climatic region and 0.3 to 0.7% for Southern climatic regions (FAO, 2011). Sea level rising will be the reason for the loss of a large lowland area - the wetland ecosystems of Vietnam's largest deltas - the dwellings of long-standing communities, the cradle of wet rice civilization, the region with the greatest agricultural production potential and the natural habitats for many native species, including national parks, nature reserves and biosphere reserves. Studies in Southeast Asia show that climate change can reduce the agricultural productivity of Vietnam by 2-15% in the 2080s (Zhai và Zhuang, 2009). Particularly the frequency and intensity of floods and droughts which can reduce biodiversity, including agriculture and forestry plants and the extinction of many native plants and animals, causing serious economic damage.

The physical factors of upland areas' environment in the northern mountainous region of Vietnam, such as climate, soil, water, terrain and the biological factors, the vegetation and animals, are being affected by unusual changes in increased or decreased in temperature, odd flood seasons, and high volume of abnormal rainfall. The total populations of the area - about 6.5 million people are living in a rapid changing environment, often harshly caused by the recent dramatic climate change (CARE international in Vietnam. 2010). Ethnic minorities living in the northern mountainous region of Vietnam have less opportunity to approach to social services and education system (CARE International in Vietnam, 2013). This has brought about the lack of many ethnic minority communities' awareness of climate change and is the cause of many major challenges requiring further efforts in building climate change adaptation capacity activities for those communities.

Climate change is one of the most important challenges to sustainable development in the Northern mountainous region of Vietnam. Climate change in the Northern mountainous region is different from that in the Central, Central Highlands and South West. The majority of people of the Northern mountainous communities are ethnic minority people. Their major source of income is from agricultural production. Moreover, the Northern mountainous region is considered to be the poorest area in the country. The poverty rates in the studied provinces in 2010 were high: Bac Kan, Phu Tho and Yen Bai respectively 32.1%; 19.2%; 26.5%. Therefore, the Northern mountainous region has higher rates of damage due to extreme weathers than other regions (CCWG, 2011). According to the report of the Central Steering Committee for Natural Disaster Prevention and Control, in 2016, 18 provinces in the mountainous area from Ha Tinh province to other Northern provinces were affected by 24 damaging and freezing cold spells; 4 storms cause flash floods, landslides, thunderstorms, cyclones, hail, rainbow, etc. Natural disasters occurred in 18 mountainous provinces that left 109 people dead and missing, 937 houses distroyed, swept away, 44,222 houses flooded, affecting the yield of 134,000 ha of rice and other crops, 161,000 cattle and poultry died and swept away, etc. total damage over 5,800 billion (CSCNDPC, 2017).

Curently, Vietnam has been implementing a number of measures to adapt to climate change with different approaching directions, in which the use of community-based adaptation to climate change as an approach aiming at the community, basing on priorities, demands, knowledge and abilities of communities to empower them in planning to respond to climate change impacts is an appropriate and sustainable direction. However, it requires many resources.



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THE ROLE OF INDIGENOUS KNOWLEDGE IN CLIMATE CHANGE ADAPTATION

Why we need to promote the use of indigenous knowledge in agricultural production adapting to climate change?

Vietnam has 54 different ethnic groups. These peoples have lived for many years and have their own cultural traditions, especially the indigenous knowledge on agricultural practices. However, many IKs have been lost through deaths of previous generations while some are still used and developed. IK is a knowledge system that includes knowledge of climate, soil, primitive varieties, farming techniques, irrigation and water management, plant protection, harvesting and preservation methods, etc.

Specifically, the diversity of plant and animal systems in the IK system contributes to the improvement and maintenance of ecosystem services, enhances the adaptability to climate change, and reduces vulnerability in the community. Indigenous plant/ domestic animal varieties tend to be more resistant to diseases, less susceptible to diseases than new varieties, and do not require high investment for intensive cultivation, suitable for many people, including the poor. Furthermore, the use of IK in agricultural production is one of the measures to reduce costs and to prevent the loss of plant genetic materials having high disease resistance. Although modern technology, to a certain extent, has solved the problem of food and fiber demand, however, it is very expensive in terms of cost of technology transfer. (Davis and Ebbe, 1993).

In addition, IK is the basic foundation for self-sufficiency and self-determination of the indigenous people, helping people less dependent on external factors to reduce the vulnerability of the community to impacts of climate change (drought, flood, etc.). Farmers are likely familiar with indigenous techniques, they can understand, adapt and maintain such techniques better than the newly introduced ones from outside, and as a result, experience and voice of the community can be promoted properly.

IK and related activities are becoming more and more valuable as the community strives to build capacity to adapt to the potential future impacts of climate change. IK provides additional solutions, options in the process of adaptation to climate change. As a result, local people have more choices when offering solutions and models that are suitable for the community to adapt to climate change rather than depending on external factors (like new technologies) (ADC, 2013). As its evolving and relevant nature in the local context, IK contributes to building the capacity of households and communities to adapt to changing situations, including climate change and natural disasters, as well as the constructing of social capital that provides value in securing and enhancing livelihood opportunities. (Berkes, et al., 2000). At the same time, indigenous knowledge is an important part of global knowledge of development issues, providing problem-solving strategies for local communities, especially the poor (World Bank, 1998).

The most commonly used IK in agricultural production is the use of domesticated crops and livestock. Vu Van Liet, et al. (2011) had pointed out that the Thai community in the Northern mountainous region is using widely indigenous varieties including: 7 food crop varieties, 13 vegetable varieties, 7 poultry varieties and 9 cattle varieties. The ethnic minority (EM) communities in the Northern mountainous region is managing and using abundant and valued crop and livestock varieties for agricultural production due to their natural ability to tolerate adverse conditions. These indigenous varieties are contributing significantly to the mitigation of extreme weather and climate change impacts.

IK is also used in cultivation techniques in extreme climatic conditions. With cultivation conditions are mainly sloping land, many traditional techniques have been applied to limit soil erosion due to heavy rainfalls like building terraced fields, arranging stones to create contours, leaving natural grass on the contour line, intercropping to cover the ground. Particularly indigenous techniques of watering and retaining water in hilly terrain conditions have been very popular in many ethnic minority communities such as making reel, water-wheel and bamboo cylinder for water supplying, digging wells in paddies for water storing, etc., that help plants survive drought. IK has helped the agricultural production of EM communities to develop sustainably for generations.

IK is an untapped resource in the development process (World Bank, 1998). Consequently, scientists in the knowledge economy are exploring new ideas and renewing with the expectation that indigenous knowledge may contain important messages that can be used to overcome current shortcomings in agriculture and environment (Berkes et al., 2000).

Nature of indigenous knowledge (IK)

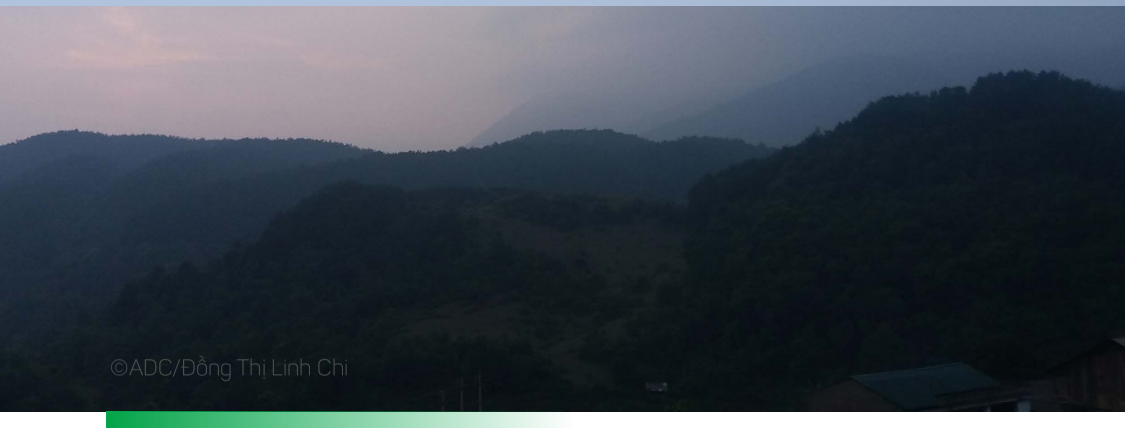
- It is based on experience formed in the course of life (experiencing and drawing lessons).
- It is constantly being reviewed over centuries: The process is never ending and is affected by different factors of life.
- It adapts to cultural and environmental identifications: suitable with the natural environment and social communities. It reflects the co-regulation, one of a common feature of the culture (which hypothesizes that communities living in similar natural conditions will share common cultural characteristics).
- It is dynamic and always changing: IK is not a permanent structure; integrations always go on after a self development process or the acculturation

(Mai Thanh Son, et al., 2007)

The benefits of using indigenous knowledge in agricultural production

- The cost of using IK is cheap and free in most cases
- IK creates cultural harmony and social cohesion
- Easy to understand the concepts and practices because knowledge can be orally transmitted in the local language
- Products used in IK are available, such as urine, ash, local varieties, etc.
- No harm to human health and no side effects
- Applying IK does not always require the professional attention of veterinarians or extension workers

THE METHODS AND TOOLS USED TO IDENTIFY IK APPLIED BY THE COMMUNITY-BASED ADAPTATION PRACTICES

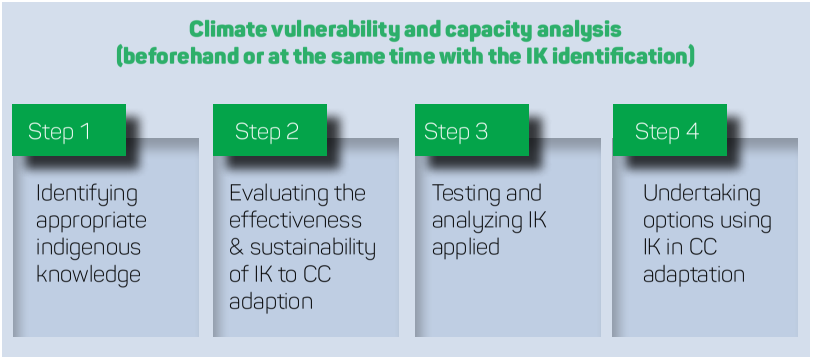


Process to identify indigenous knowledge based agriculture and forestry production models adapting to climate change

Determination of production options using indigenous knowledge to adapt to CC based on community participation, is in fact the process to identify the climate resilient livelihoods focusing on agriculture and use of indigenous knowledge. This usually goes along with the climate vulnerablility and capacity analysis (CVCA). The process can be flexibly implemented into 2 ways:

(1) Conduct the CVCA and after that to further study the identification and use of IK in the community based adaptation production options: following this, the study on IK can be extensive and focused, but it does require comprehensive human and financial resources.

(2) It is possible to combine the CVCA to make it in a single step by integrating the form of questions related to IK in the CVCA process. This method saves resources and brings results sooner, but it lengthens the identification process and the discussions are diverse so the method is in need for flexible coordination.



Step 1: Identifying appropriate indigenous knowledge of EM in climate change adaptation

- Identify information and experiences in the community/area by working directly with the community.
- Note down all the information and experiences relevant to the identified issues.
- Evaluate the collected information in terms of the relevance, applicability, efficiency and so on.
- Example: Indigenous varieties, farming techniques or pest control measures.

Step 2: Evaluating the effectiveness and sustainability of IK to CC adaptation

- IK is not always useful. Especially in terms of its adaptability and viability to CC. In some cases, IK based practices may harm the course of sustainable development. It is thus pivotal to choose the ones that are beneficial for CCA.
- Evaluate IK in CCA by seeking to understand the reasons why people rely on IK to adapt to CC impacts, and how the IK responds to CC impacts.

Step 3: Testing and analyzing IK applied

- The testing can be research, local trials, field research, etc.
- Experiencing to combine the IK in an efficient and flexible way with new scientific and technological knowledge to enhance the value of IK in CCA.
- If the IK is effective, but yet unable/no need to improve, then apply it in a proper way.

Step 4: Undertaking IK based options to adapt to CC

- After collecting and identifying their value in CC adaptation, IK will be applied in the local practices.
- By adopting IK in CCA practices, local people will find it easier to apply and replicate the options on their own.
- Experience of the community will be promoted, which enhances the community's autonomy in CCA.

SELECTION CRITERIA AND PROCESS OF MODEL IMPLEMENTATION

Selection criteria for climate change adaptation models

The effectiveness of climate change adaptation and mitigation

- The contribution to reduce the risk of being affected by climate change impacts of the community, thereby enhancing the adaptive capacity of the community to the CC impacts.
- In addition to climate change adaptation, good practice models and experiences need to show other socio-economic and environmental benefits/ positive impacts that create livelihood diversification, improving the local environment, maintaining the traditional culture, or other socio-economic benefits for instance. In addition to the cost effectiveness, the number of new jobs created and other social effectivenesses (contributing to cost reduction for consumers, creating benefits for vulnerable groups).
- Considering the uncertainty and impacts of climate change and/or the application of preventive principles.

Involvement of local communities

- Being built based on the needs, priorities, knowledge and capabilities of the local community.
- Using participatory approaches to enhance awareness and capacity of the community on climate change and the climate change impacts.
- The active participation of local communities, especially vulnerable groups such as ethnic minorities, the poor, women and the elderly, etc., throughout the whole process of the project, from designing to implementing and monitoring.
- The close coordination between local communities, scientists/experts and project staff, among them the local community plays the leading role.

Sustainability

- Models/practices often focus on solving the immediate needs of the community, but in that there is a need for consideration of medium and long term priorities.
- Identifying and understanding all causes of vulnerability of the community.
- Applying solutions flexibly, not necessarily confined to responding to climate change, to reduce the vulnerability of the community.
- Measures to harmonize conflicts of interest (available and potential) that may arise during the implementation of the model/practice.
- Measures to implement the model meet the actual needs of the community, learn from local experiences and in line with local socio-economic and cultural values.
- The good models/practices should consider the effects and trends of national and international response activities that may involve local response activities and vice versa.

Originality/ creativity

- Having unique/creative approaches, especially the flexible and creative application of the knowledge/solutions already in the implementation of the model and producing specific results.
- The combination of indigenous knowledge and scientific knowledge in a reasonable way.
- Showing outstanding advantages compared to previous local practices (if any).

Replicability

- Good models/practices will be representatitive, accepted and supported by the community. The results of the good model/practice has a positive impact on the community.
- Issues addressed through model implementation are representative of many regions and many communities.
- The activities implemented and guidelines developed within the implementation framework of good models/practices should be simple, easy to understand, easy to accept and apply at the community level, especially for technical activities and instructions.
- Good models and practices, in addition to meeting the needs of the community and helping the community respond to climate change, should be aligned with local, regional and national policies, strategies and priorities and with the support of the authorities at all levels.
- There are effective mechanisms for collecting and sharing experiences/ knowledge related to climate change and responding to climate change.

Process of implementation

Implementing research on indigenous knowledge and climate change to be the basis for modeling

- Identifying and understanding the impacts of climate change/ extreme weather and community vulnerability.
- Identifying and understanding good indigenous knowledge/ experiences of the community that has been used to adapt to climate change.
- Discussing with local authorities at all levels and people to assess needs, identify, select and build adaptive agricultural crop models based on community criteria.

Developing implementation plan

- Project, commune and district officers and representatives of local people discuss to:

- Identify/select households to implement the model
- Identify the implementation time of the model
- Identify the area/ scale of the model
- Identify the support of the project and the contribution of the people

Implementation

- Local people, authorities, commune departments, and unions, district professional officers and project officers. should be involved in the implementation activities.
- Arranging village meetings to discuss and select households, locations to implement the model: selecting enthusiastic, willing-to-participate households, giving priority to poor and near-poor households, and increasing the participation of women; Surveying, assessing and collecting basic information on the production status of households..
- Identifing the current situation, difficulties and experiences of the households in cultivating crop models in extreme climatic conditions, thus identifying the technical solutions and climate change adaptation factors of the model.
- Assigning tasks to households, project staff, and commune officers who are responsible for every step of implementing, managing, and monitoring the model.
- Guiding people to compost micro-organic fertilizer
- Organizing training along with production stages of the model.
- Guidance for model implementation
- During the implementation process of models, applying some indigenous knowledge/ experience of the people.
- Monitoring and supervising the implementation of the model with the participation of district staff, commune staff, project staff, village heads, village women's unions and households for timely support to help ensure the model is well deployed and have good results.
- Organizing field workshops to assess the implementation and the replication potential of the models.
- Evaluating results of the models according to criteria such as economic, social and environmental efficiency, the model's adaptability to climate change.
- Scaling up the model by coordinating with the Commune People's Committee to evaluate the effectiveness of the models and scale up by including them in the commune socio-economic development plan.

The use of micro-organic compost fertilizer, on the one hand, has helped to reduce the cost of fertilizer for crops by using local fertilizer, on the other hand, create a renewed and environmentally friendly way for production, and rminimizing environmental pollution caused by the use of chemicals, chemical fertilizers. And this is one of the priority objectives of the project.

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AGRICULTURAL PRODUCTION MODELS APPLYING IK FOR CLIMATE CHANGE ADAPTATION OF EM PEOPLE IN THE NORTHERN VIETNAM

Curently, there are many agricultural activities practiced by communities proved to be effective. This document introduces four practices on indigenous varieties and techniques in CCA, especially appropriate with the northern mountainous area, including Medicinal plants intercropped with banana in sloping land, peanut intercropped with corn, squash intercropped with Tiêu Hồng banana, and drought-tolerant green mung bean model.

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MEDICINAL PLANTS INTERCROPPED WITH BANANA ON SLOPING LAND MODEL

Implementation Unit: Agriculture and Forestry Research & Development Center for Mountainous Region (ADC)
Ethnic group: Tay, Dao
Location: Thanh Van and Mai Lap commune, Cho Moi district, Bac Kan province
Scale: 50000m²
Season: March - November

MODEL'SEFFICIENCYEVALUATION

Economic aspect

- Low transportation costs due to locally consumed products, at the time period when babana price is high the collectors even directly collect at the banana fields.
- Besides, the use of banana trunks and leaves to make micro-organic compost or feed for pigs, chickens, buffaloes, cow, and fish also contribute to household savings. At the same time, villagers can easily apply IKs through training or through learning directly at the model area/ through group meetings to build models for their own families. As a result, investments in seedlings and technologies

The economic efficiency of medicinal plants intercropped with banana in sloping land model			
Input material cost/1000m²/year			
Items	Quantity	Unit price (VND)	Total (VND)
Banana seedlings	200 trees	7,000	1,400,000
Ginger seedlings	100kg	15,000	1,500,000
Khôi tía seedlings	350 trees	15,000	5,250,000
NPK fertilizer	100kg	5,000	500,000
Total cost			8,650,000
Revenue /1000m²/year			
Items	Quantity	Unit price (VND)	Total (VND)
Banana seedlings	200 trees	7,000	1,400,000
Banana fruit	1000kg	6,000	6,000,000
Ginger	500kg	8,000	4,000,000
Khôi tía	80kg	200,000	16,000,000
Total revenue			27,400,000
Profit			18,750,000

decrease significantly.

Cultural-social aspect

- Local people participate in the deployment of the model (men, women, poor households, etc), local authorities and professional agencies, whereby enhancing the communication process between the local authorities and people.
- Strengthening technical capacity for local residents and local staff in agricultural production through training courses to help them take initiatives in production.
- There is synchronization between IK and technical science, thereby facilitating the replication and sustainability. For example, crosscutting the banana trunks before planting, and calculating the time for the tree to shoot and to develop fruits around April - May (when there is surge in banana prices).
- Stable income from the model helps poor households escape from poverty, and improve the living conditions, i.e. children can have their breakfast before going to school, higher spending for daily consumption, mobile phones for women.
- Enhancing the roles of women in the livelihood related decision-making, they can make decision on how to use the incomes from the model.
- Medicinal plants such as ginger, Khôi tía (*Ardisia silvestris Pitard*), Jiaogulan (*Gynostemma pentaphyllum*) are valuable medicine sources and widely used in traditional remedies. For example, decocting *Ardisia silvestris Pitard* with Eugenia leaves, sophora leaves decanting the take bath water for children having impetigo. The Dao chops into small pieces, dries and soak the roots of *Ardisia silvestris Pitard* in alcohol for a certain aperiod of time and drink it as medicine which is good for blood, also these root can be decocted and then use to treat dysentery, sore pharynx, and sore muscle.

Climate change and environmental aspect

- Intercropping of banana and medicinal plants helps better adapt to the increasing drought condition in Bac Kan province in the CC context. By discussing with the people, it is speculated that the increasing trend of temperature does not affect the model since the trees grow stronger and the fruits ripen quickly under scorching sun and high temperature.
- Shorter and warmer winter make it more favorable for banana trees to

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grow, reducing the ripening time, and produce better banana fruit quality.

- Banana trees are less affected by unseasonable rains or changes in seasonal precipitation.
- Shifting the crop pattern to adapt to the changes of climate is essential to the local socio-economic development.
- Compared to the maize monoculture farming, the model helped incease the coverage, reduce runoff erosion, maintain moisture for the soil and improve the underground water sources for production, since the plants in the modal are all year round without vacant period, with 3-5 year business cycle.
- Combining multiple plants in the same area helps limit weeds, thereby reducing the need for pesticides.
- Agricultural and livestock residues and the wastes from the model are made use to make micro-organic compost and provide humus for the model, restrain the burning of byproducts causing smoke and dust, leading to environmental pollution.

THE APPLICATION OF IK

- The medicinal plants ginger, *Ardisia silvestris Pitard,* Jiaogulan (gynostemma pentaphyllum) and banana are the indigenous crops of the local community.
- The adjustment and adaptation to droughts by cutting 1/3 the banana suckers/plants help to adapt to dry condition in the sloping land and reduce the mortality of the suckers/plants.
- Preserving ginger from the previous season in the sand, under the floor of house on stilts, avoiding the light. Ginger splits into small buds, and should be planted in rich soil.
- The medicinal plants ginger, Khôi tía (*Adisia silvestris Pitard*), and Jiaogulan (*Gynostemma Pentaphyllum*) are collected and domesticated from the forest following to folk experience.
- Intercropping of medicinal plants like ginger (growing well in shade) with banana is a suitable combination and effective cultivation. Using micro-organic compost and green manure to help improve soil quality, and prevent erosion.
- Planting in the early rainy season to take advantage of water.
- Intecropping with short-term plants. The intercropping time of ginger or medicinal plants from April of year 1 or year 2 to reduce weeds or erosion is a technique - indigenous knowledge applied by many people.

CHALLENGES AND LESSONS LEARNED

Challenges

- The transportation of seedlings, fertilizers and products is one of the most difficulties due to the sloping terrain.
- In order to replicate the models accessing to the sources of funds is needed. However, the access is limited. Therefore, incentives should be in place to use and mobilize funds from relevant development projects and programs (some of them are Program 135, program 30A, provincial socio-economic development program).
- The banana markets are unstable. The target buyers of banana products are mainly is China's traders. The domestic markets have just been connected, so that the future stability is not guaranteed due to a lack of a clear perspective on market needs.

Lessons learned

- To approach to people in the community there are needs to base on indigenous knowledge and consultation with the people. Modeling with the criteria: applying as much as posible appropriate indigenous knowledge making it easier for modeling; providing people with the proactivity and flexibility to adapt to the adverse conditions of the environment, natural disasters and climate change.
- The "learning by doing" approach for the people, having supervision and adjustment is an appropriate approach.
- Criteria for selection of participating households and locations should be clear and agreed upon by the people to achieve the project objectives, especially for projects targeting the poor, women.
- Households implementing the model have to record fully information into a tracking book to facilitate the monitoring of the growth and pest control of the model, share their experiences and account the economic efficiency.
- It is necessary to monitor the model regularly to detect mistakes of the households and timely address.
- Assigning specific tasks to members implementing the model to have regular cross-checking to help the model is carried out according to plan.
- Requiring households to commit to implement the model in order to increase the responsibility of the households in the implementation process.

PEANUT INTERCROPPED WITH MAIZE MODEL

Implementation Unit: Agriculture and Forestry Research & Development Center for Mountainous Region (ADC) in cooperation with CMD
Ethnic group: Tay
Location: Tam Son town, Quan Ba district, Ha Giang province
Scale: 10000m² with the participation of 30 households
Season: August – December

MODEL'S EFFICIENCY EVALUATION

Economic aspect

As a result of the model, the average income of the intecroping model of peanut with maize is about 6 million VND/1000m², the income from secondary crop (peanut) can cover the initial investment cost for the model.

Although the beginning of the growing season encountered unusual weather conditions compared to many years ago (prolonged drought), it affected the growth and yield of the crop in the model. However, comparing to the meize outside the model, the maize in the model gives corn with evenly spaced and thick kernel, and rat tail.

The model results showed the effectiveness of intercropping of legumes with main crop (maize), which is the basis for the formation of a stable crop structure, by taking advantage of legumes. Diversifying crops on an area, limiting the impact of pests, reducing the risk of climate change impacts. Comparing to the past, when people did not cultivate in the spring season, the economic efficiency increased by 100%.

The economic efficiency of maize-peanut intercropping model tolerant drought in 1 crop land			
Input material cost/1000m²/year			
Items	Quantity (kg)	Unit price (VND/kg)	Total (VND)
Corn seeds	2	100,000	200,000
Peanut	12	60,000	720,000
Fertilizer (N:P:K)	70	12,500	875,000
Total cost			1,795,000
Revenue /1000m²/year			
Items	Quantity (kg)	Unit price (VND/kg)	Total (VND)
Corn	700	6,000	4,200,000
Peanut	120	30,000	3,600,000
Total revenue			7,800,000
Profit			6,005,000

Cultural-social aspect

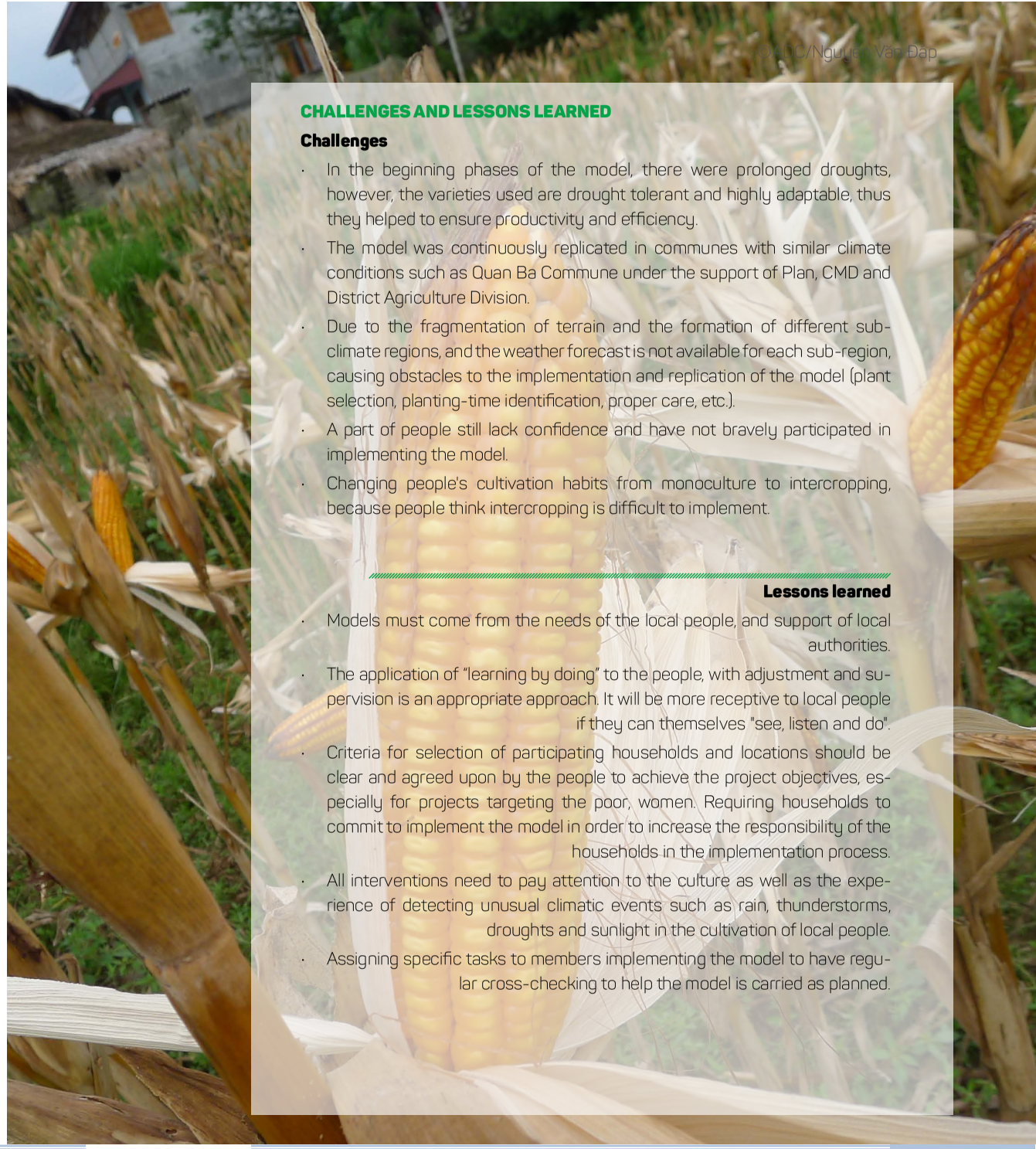
- Mobilizing the participation of local people and authorities, specialized agencies to have the better implementation of information exchange mechanism between local authorities and people.
- The technical capacity in production of local people and officials (30 villagers and commune officials) were enhanced through training courses that help people take the initiative in production.
- The peanut harvested from the model is a food source that contributes to the maintenance of the traditional culture of the Tay because they use the local red peanuts to make traditional cuisines in holidays, Lunar New Year's days.

Climate change and environmental aspect

- This is an environmentally-friendly model because of the common use of organic fertilizers and the balanced use of inorganic fertilizers, which will reduce the risk of soil degradation.
- Increasing land cover, reducing soil erosion, maintaining soil moisture, improving soil quality, making soil porous by using peanut leaves and stems as on-site green fertilizers.
- The appropriate cultivation techniques, crops identification, use of good tolerance varieties helping reduce pest should use less pesticides. Therefore, there is no pesticide residue left in the soil, in the product and does not affect the environment and the quality of the agricultural products.
- The selection of seedlings capable of supporting one another promotes the nitrogen fixation of peanut in the soil, which increases the nutrient content, helping the maize grow better and are suitable for local ecological conditions like short growing time, timely releasing land for winter rice and the intercropped plants quickly cover the cultivating area, have good drought-resistant and resistance to pests and diseases.
- The poor soil needs to be improved with the increased use of organic fertilizer to improve humus content in the soil.
- The intercropping, arranging density of maize and peanut plants techniques keep the soil moist (for maize density: wide row spacing is 1.1-1.2m, narrow row spacing is 0.5m, tree is 0.25m, plant-to-plant distance is 0.25m; planting 3 rows of peanut in the middle of a wide row of maize, row spacing is 0.35 m, plant to plant spacing is 0.12- 0.15 m). On the other hand, intercropping two species of plants help to increase land cover, moisturizing ability as well as limiting the impact of local drought.
- Pest and disease control, harvesting and preservation techniques were trained and guided so that the households could easily apply them to obtain the highest productivity and quality.
- The "learning by doing" approach in the field combining with the visual materials help households participating in the model easy to apply trained techniques.

THE APPLICATION OF IK

- Using the local peanut variety with high resistance to diseases and pests.
- During the implementation of the model, only cut the above-ground parts of the weeds in areas severely dried. This help to maintain soil moisture.
- When harvesting corn, if the corn ripe in the long rains, remove corn silk, bend corn ears downward to the ground so that rain water does not penetrate inside to rot grain, and then harvest when the rain is over.
- Farmers usually dry and store peanut seeds in dry places.
- Corn seeds can be preserved by mixing dry leaves of Neem and Coi (*Pterocarya tonkinensis*) into dry corn. Then pour into the jar and cover the surface with a dry ash layer and close the lid.
- Using mixture of urine with the crushed leaves of Neem and peach to limit pests.



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CHALLENGES AND LESSONS LEARNED

Challenges

- In the beginning phases of the model, there were prolonged droughts, however, the varieties used are drought tolerant and highly adaptable, thus they helped to ensure productivity and efficiency.
- The model was continuously replicated in communes with similar climate conditions such as Quan Ba Commune under the support of Plan, CMD and District Agriculture Division.
- Due to the fragmentation of terrain and the formation of different sub-climate regions, and the weather forecast is not available for each sub-region, causing obstacles to the implementation and replication of the model (plant selection, planting-time identification, proper care, etc.).
- A part of people still lack confidence and have not bravely participated in implementing the model.
- Changing people's cultivation habits from monoculture to intercropping, because people think intercropping is difficult to implement.

Lessons learned

- Models must come from the needs of the local people, and support of local authorities.
- The application of "learning by doing" to the people, with adjustment and supervision is an appropriate approach. It will be more receptive to local people if they can themselves "see, listen and do".
- Criteria for selection of participating households and locations should be clear and agreed upon by the people to achieve the project objectives, especially for projects targeting the poor, women. Requiring households to commit to implement the model in order to increase the responsibility of the households in the implementation process.
- All interventions need to pay attention to the culture as well as the experience of detecting unusual climatic events such as rain, thunderstorms, droughts and sunlight in the cultivation of local people.
- Assigning specific tasks to members implementing the model to have regular cross-checking to help the model is carried as planned.

MODEL'S EFFICIENCY EVALUATION

Economic aspect

- For the communes having undeveloped industry and services to attract agricultural labor, the agricultural development towards product diversification and quality improvement of agricultural products is an important solution for job creation, increasing household income.
- Creating a source of quality seedlings in the community helping the community take initiative in seed sources and do not have to depend on external seed sources to reduce investment costs and improve production efficiency.

The economic efficiency of the squash intercropped with Tiêu Hồng banana model			
Input material cost/1000m²/year			
Items	Quantity	Unit price (VND)	Total (VND)
Banana seedlings	300 trees	12,500	1,250,000
Squash seeds	2 packs	55,000	110,000
Urea	135kg	10,000	135,000
Potassium	150kg	12,500	1,875,000
Phosphate	150kg	3,000	450,000
Total			3,675,000
Revenue /1000m²/year			
Items	Quantity	Unit price (VND)	Total (VND)
Banana seedlings	300 trees	5,000	1,500,000
Banana fruit	6300 kg	5,000	31,500,000
Squash	1200 kg	4,500	5,400,000
Total			38,400,000
Profit			34,725,000

Cultural-social aspect

- The results of the model have brought many positive effects in the community. Previously, the local government and people suspected the success of the model especially the banana and squash market. Until the end of the model, it has attracted a lot of attention of people (people in the hamlet and commune bought seedlings from the households that have been implementing the model), initially establishing a relationship with two buyers in Thai Nguyen in the following years.
- The model not only brought economic efficiency, but also enhanced the technical knowledge of the people to cultivate the Tiêu Hồng banana and squash adapting to banana unpredicted changes of weather conditions in recent years.
- Tiêu Hồng banana is an indispensable fruit in five fruits tray in New Year days as well as the full moon days. This is one of the traditional cultural values of the Vietnamese people.

Climate change and environmental aspect

- When participating in the project model, people were instructed to make composted micro-organic fertilizer from

SQUASH INTERCROPPED WITH TIÊU HỒNG BANANA MODEL

Implementation Unit: Agriculture and Forestry Research & Development Center for Mountainous Region (ADC)

Ethnic group: Tay, Nung

Location: 2 hamlets of Na Mao commune, Dai Tu district and 1 hamlet of Bao Linh commune, Dinh Hoa district, Thai Nguyen province.

Scale: 14000m² with the participation of 37 households

Season: March

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"In the past, my family has planted Tiêu Hồng banana without the application of techniques, so we could not harvest banana in the Lunar New Year. Thus, it's difficult to sell banana in the other time periods of the year. Sometimes, banana fruits ripen in the trees and then people use them to feed pigs. In the years 2013-2014, with the support of the project, my family implemented the squash- Tiêu Hồng banana intercropping model in our garden and planted 50 banana trees. By early 2015, my family earned nearly 5 million VND by selling bananas. I never thought this garden area is economically efficient for the family. Next year, I will maintain and expand the area by using available seedlings"

Mr. Nam, Bao Linh commune, Dinh Hoa district.

agricultural residues to fertilize crops, improve soil and maintain soil moisture, and minimize the impact of local droughts. This has contributed to the increase of awareness of people in the efficient use and exploitation of agricultural waste, reducing environmental pollution.

THE APPLICATION OF IK

- Squash intercropped with Tiêu Hồng banana increases land use efficiency, reduce soil erosion and diversify the obtained products.
- Planting in the early of rainy season to take initiatives of water.
- After planting for about 30-35 days, when squash flowers begin to blossom, support the polination process by cutting off the petals, male flower cups and then sweep them on the female stamen.
- To store the squash for a long time, use a knife cut the squash with stem and apply lime into the cut and keep at cool the place.
- Treating banana planting holes by burning rice husk to reduce the density of harmful microorganisms and weed, increase some nutrients, especially phosphorus and potassium, and improves soil physical condition.
- Keeping banana near the scent/ smoke of incense for banana to ripen faster.


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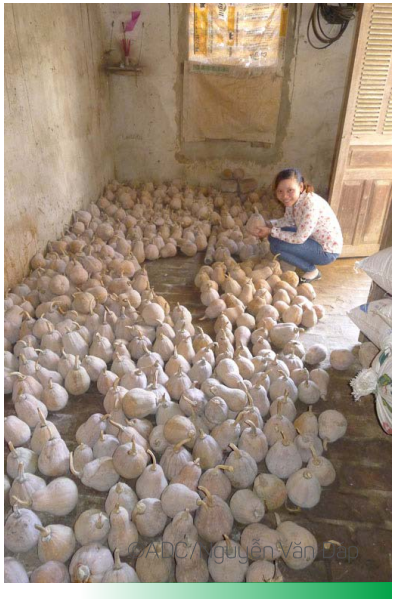
CHALLENGES AND LESSONS LEARNED

Challenges

- The thinking of exploiting the available resources is engraved on local people's mind.
- In recent years, the weather has unusual changes (heavy rain), affecting the growth of plants in the model, especially on squash trees such as flower losing, many young squashes, leaves and stems.
- Local people and local authorities lack information about market, material-service system for production.
- Output markets for agricultural products are still unstable.
- The technical capacity of the people is limited, so the technical requirements of the model were not fully met.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Lessons learned

- The application of "learning by doing" to the people, with adjustment and supervision is an appropriate approach.
- Criteria for selection of participating households, locations for model implementation must be clear and get the consensus of the people.
- Applying participatory approach, mobilizing core officers of the district, commune, village and key farmers to involve in the model implementation
- The implementation of model has to focus on improving the capacity of the people
- Households implementing the model have to record fully information into a tracking book. It is necessary to monitor the model regularly. Assigning specific tasks to members implementing the model and requiring households to commit to implement the model.
- Composting micro-organic fertilizer to fertilizing crops during the caring process of the model.

DROUGHT-TOLERANT GREEN MUNG BEAN MODEL

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Implementation Unit: Agriculture and Forestry Research & Development Center for Mountainous Region (ADC)
Ethnic group: Tay, Dao
Location: 13 Hamlets of Thanh Vận and Mai Lap commune, Cho Moi district, Bac Kan province.
Scale: 120000m² with the participation of 248 households
Season: Spring season

"In the spring of 2012, my family planted 200m² of green beans and 1500m² of spring rice. However, due to the long distance from our family's fields to the stream, it's difficult to water our rice during the prolonged heat waves. Thus, nearly half of the area was too dry and did not have flowers, the other half had very low productivity. Fortunately, I planted 200m² of green bean as instructed by ADC project team. I used microorganic compost when growing, reduced the amount of nitrogen, and made low furrows, so the plants can survive the drought. After harvesting I obtained 32kg of green bean, I left a part to eat, the rest to sell to earn money to buy rice seeds and fertilizer for the summer-autumn crop. Currently, I planted more green beans in the spring season, and in a part of rice growing area often faced droughts."

Mrs. Luong Thi Sinh - Quan Lang 2 hamlet, Thanh Van commune

MODEL'S EFFICIENCY EVALUATION

Economic aspect

- The area of fallow land or inefficient used land in the spring season in two communes is very large (about 25-30 ha) caused waste of resources. The use of fallow land in the spring season and the conversion of part of the inefficient used land to grow green bean, with a short growing period (harvesting after 70-75 days), helped increase incomes of ethnic minority farmers, about 4.5 - 4.8 million VND/1000m². This is a not really low income, especially in the hot and dry conditions causing productivity loss and crop failure in some spring rice cropping areas due to water scarcity like in spring 2012 in 2 communes in the project area.
- In addition, stems and leaves of dull-seeded green mung bean (đậu xanh mốc) also provide a significant amount of protein for the winter season, thereby reducing the cost of fertilizers. In addition to its economic contributes to social stability through the creation of on-the-job employment to reduce the burden on women's shoulders.

©ADC/Hà Trang

The economic efficiency of drought-tolerant green mung bean model

Input material cost/1000m²/year			
Items	Quantity (kg)	Unit price (VND)/kg	Total (VND)
Seeds	2.5	55,000	137,500
Urea	10	12,000	120,000
Potassium	9	14,000	126,000
Phosphate	45	5,000	225,000
Total cost			608,500
Revenue /1000m²/year			
Items	Quantity (kg)	Unit price (VND/kg)	Total (VND)
Grean bean	120	45,000	5,400,000
Total revenue			5,400,000
Profit			4,791,500

Cultural-social aspect

- Creating jobs for agricultural leisure and surplus labors in agricultural production is a matter of great concern. In the area of 2 communes, industry and services have not developed to attract agricultural labor, the agricultural development in the direction of diversifying products and improving the quality of agricultural products is an important solution to create jobs, increase income for farmers and increase material wealth for society.
- It is a fact that, in order to have income to cover their living, studying of children, some men and a few women work as hired laborers in urban areas. This is very easy to push them into the particular social evils in today's complex social context.
- Green bean is used in the traditional foods in holidays, festivals, Lunar New Year's days of the Tay and Nung, thus the implementation of the model helps maintain the ethnic cultural characteristics.

Climate change and environmental aspect

- Climate change is expected to increase in the coming time. Extreme climatic events considered as the consequence of climate change, such as freezing and damaging cold spells, drought, etc. are continuously happening and increasing. This means that agricultural production is falling into difficult situations. The dependence on natural weather conditions makes agricultural production become more insecure than ever.
- The model of the project mainly brought effectiveness in enhancing adaptive capacity of people in agricultural production and minimizing damage caused by negative impacts of climate change such as: enhancing pest and disease resistance of crops by determining appropriate cropping time, balancing fertilizer (increasing potassium, reducing nitrogen), not raising the furrows too high, only making furrow-drain around the field to reduce drought, using local varieties to increase pest and disease resistance; improving soild quality through the use of microoragnic fertilizer and micro-organism in green bean roots with the self-synthesize nitrogen ability; using stems and leaves green bean as source of on-site fertilizer; timely releasing land for next crop.
- People's incomes are increased. People became more active in production for spring crop, contributing to the increase of their ability to adapt to drought and reducing their vulnerability to the risks of climate change.

THE APPLICATION OF IK

- The variety is dull-seeded green mung bean. The crop is pest resistant and can adapt to external adverse conditions
- People grow green mung been in late of March when neem flowers bloom (the soil is moist and the weather is getting warmer). This is done in order to avoid multiple resowing and crops developing vigorously
- Using ash to limit the cost of pest and disease control (sprinkling the ashes on the leaves when there are bugs). If there is Mylabris cichorii that bites flowers and beans, catch them string them into chance and put it in the middle of the field to drive away the other.
- Preserve seeds by using straw ash or dried neem leaves: After drying seeds, put them into pot/ jar, then sprinkle a layer of straw ash or put a hendful of neem leaves and tie it tight. This helps the seeds for next crops will not be mouldy and have high germination rate. There are adjustments to fit and develop in the corresponding local conditions.
- The smell from neem leaves can repel insects.

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CHALLENGES AND LESSONS LEARNED

Challenges

- The thinking of looking for resources available from the forest earning higher benifits and having less dificulties than developing agricultural production has been embedded in the minds of some people in this area.
- The grassroots extension system is not available at the commune level, so updating information to local people about cultivation and husbandry is limited. Agro-forestry staff are often responsible for both the forestry and agriculture of the commune. However, the agro-forestry staff are limited in terms of expertise as well as access to information.
- At the local level, there is a lack of information systems on market, varieties and fertilizers, so the agricultural production of people is limited. Therefore, products made by the people themselves are either purchased by traders at low prices or only used in their households because people do not actively seek markets for products, leading to small-scale production, serving only the needs of the family.

Lessons learned

- To approach to people in the community there are needs to base on indigenous knowledge and consultation with the people. Modeling with the criteria: applying as much as posible appropriate indigenous knowledge making it easier for modeling; providing people with the proactivity and flexibility to adapt to the adverse conditions of the environment, natural disasters and climate change.
- The "learning by doing" approach for the people, having supervision and adjustment is an appropriate approach.
- Criteria for selection of participating households and locations should be clear and agreed upon by the people to achieve the project objectives, especially for projects targeting the poor, women. Projects need to be human-centered rather than focused only on agricultural engineering models.
- Applying participatory approach, mobilizing core officers of the district, commune, village and key farmers to involve in the model from training, model visiting, to summary workshop phase. This helps increase the replicability of the model when the project is finished because key staff are well equipped with knowledge and experience in model implementation.
- Households implementing the model have to record fully information into a tracking book to facilitate the monitoring of the growth and pest control of the model, share their experiences and account the economic efficiency.
- It is necessary to monitor the model regularly to detect mistakes of the households and timely address.
- Requiring households to commit to implement the model in order to increase the responsibility of the households in the implementation process.

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CONCLUSIONS AND RECOMMENDATIONS

Good agricultural practices using indigenous knowledge have demonstrated the role of the indigenous knowledge in community-based adaptation to climate change. The combination of indigenous knowledge and new knowledge of science and technology will be more effective in adaptive activities. In order for these practices to be more sustainable and sustainable, it is necessary to have specific supportive policies, financial resources for practice, research, documentation, storage and replication under appropriate conditions. Local socio-economic development programs as well as poverty reduction and development programs (Program 135, new rural program, loan program of Vietnam Bank for Social Policies, vocational training program) should have specific support for community-based adaptation initiatives using IKs. The community has a role to play in implementing, maintaining and developing the IK source and interconnecting to share and support one another in adapting effectively to climate change.

GOVERNMENT

1. Currently there are a number of policies on CCA refer to community-based adaptation. However, these are general, and therefore not able to encorage and support the local application. Therefore, in the national programs and policies, there should be specific viewpoints and guidance to support the initiatives of community-based adaptation to climate change using IK and good agricultural practices.
2. The policies should encourage the use of indigenous varieties and techniques along with the advanced science and technology to generate sustainable development and conservation of genetic resources and knowledge to use for modern scientific studies
3. There are no clear financial mechanisms in place to support the development of IK based livelihoods adapaed to CC. Therefore, the national policies need to allocate financial resources to support such initiatives. One of the possible solutions is incorperating IK ideas and initiatives in the national socio-economic development programs. It is required to have policies/research programs in place to learn about the conservation and use of IK in the community and regard it as the adaptation measures of EM.

LOCAL AUTHORITIES

1. Need to raise awareness about CC and community-based adaptation using IK and good agricultural practices to the related staff.
2. Integrate ideas and initiatives using local knowledge in the socio-economic development program of the locality. Other development and poverty reduction policies in the area should also be coordinated to support the deployment and replication of the livelihood models adapting to CC using IK and scientific knowledge.
3. Need to invest in systematic and scientific studies on IK, adaptation and mitigation of CC in the local context. Encourage the selection and use of indigenous varieties and seedlings that produce high yielding and high market demand, suitable with the land conditions, farming techniques of local people and adapting to CC.
4. Encourage the use of local varieties and techniques along with advanced science and technology to generate sustainable development and conservation of genetic resources, knowledge to serve for modern scientific studies.
5. Have incentives and mechanisms in place to suport the production development adapting to CC using IK (especially credits from Social Policy Bank or poverty reduction program).
6. Document, invest in development and support the replication of feasible initiatives on CCA and mitigation for the local people.

CIVIL SOCIETY ORGANIZATIONS

1. Increase support to the government, community, especially EM community in adapting to CC using IK in agro-forestry production.
2. Organize activities to share, learn good agricultural experiences, and practices in climate change adaptation using IK.
3. Organize training on raising awareness of CC and the role of IK as well as good agricultural practices for staff of the organization, especially young staff.
4. Provide human resources with appropriate expertise to support the government and the community.
5. Conduct further research and analysis on climate change adaptation.

COMMUNITIES

1. It is needed to maintain and promote IK in the communities, especially the one with important roles in socio-economic development while adapting to CC such as crops and domestic animals of indigenous origins, traditional farming methods or experience in forecasting weather and crop seasons, etc.
2. Encourage the establishment of groups and teams to mutually support in production activities adapted CC using IK and effectively use of credit in community-based CCA activities.

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PROMOTING INDIGENOUS KNOWLEDGE AND GOOD AGRICULTURAL PRACTICES IN CLIMATE CHANGE ADAPTATION

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