On behalf of:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

of the Federal Republic of Germany

Strategic Mainstreaming of Ecosystem-based Adaptation (EbA) in Vietnam

PARTICIPATORY IDENTIFICATION OF EBA MEASURES FOR PILOTING IN HA TINH

Synthesis Report

Imprint

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Contents

Executive summary

As part of the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) and ISPONRE (Institute of Strategy and Policy on Natural Resources and Environment)-run project "Strategic Mainstreaming of Ecosystem-Based Adaptation (EbA) in Vietnam", a participatory identification of a site and EbA measures for piloting has been conducted by a professional team in Ha Tinh province. This identification study has been reviewed by the International Centre for Research in Agroforestry (ICRAF). The report at hand contains the synthesized results from both the original participatory identification reports and ICRAF's reviews. It is divided into three major sections, with the first one describing the Ha Tinh team's process of selecting a site and potential EbA measures for piloting, the second part focusing on the particular EbA suggestions provided and the recommendations given by ICRAF in regards to these, and the third part offering an overview over the implementation plans and status of the Ha Tinh team's and ICRAF's EbA recommendations.

As part of the participatory identification process, the Ha Tinh team identified **Village 1 in Sơn Thọ commune, Vu Quang district** as highly vulnerable, and thus selected it as the pilot site. Droughts were classified as constituting the most serious threat to the commune in focus. In order to respond to this threat, the overall measure of **natural forest protection and enrichment**, including a variety of activities, was chosen for piloting. ICRAF assessed that a sole focus on droughts was misleading, as recent droughts might not necessarily be related to actual climate change, but more to weather phenomena such as El Nino, and as other extreme events like floods should not be overlooked. The ICRAF team thus recommended to **consider climatic challenges more holistically and over a longer time span**, including **viewing droughts, flashfloods and flooding as part of the same problem and planning interventions at plot and landscape/catchment scales.** On a more specific activity level, ICRAF inter alia suggested to divide the slope chosen for pilot activities into four instead of originally intended three sections, and to critically re-evaluate the strong focus on the plantation of orange trees as a pilot measure, as planned in the original participatory identification reports.

Many of ICRAF's recommendations have been thoroughly considered by the Ha Tinh team, and certain adjustments to the original implementation plan have been made. Some suggestions were purposely not selected for piloting, and again others constitute inspiration for future implementation at the pilot site.

Abbreviations

CBD	Convention on Biological Diversity
CC	Climate Change
CCA	Climate Change Adaptation
DARD	Department of Agriculture and Rural Development
DFID	Department for International Development
DCC	Department of Climate Change
DONRE	Department of Natural Resources and Environment
DPI	Department of Planning and Investment
EbA	Ecosystem-based Adaptation
ENSO	El Nino Southern Oscillation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICEM	International Centre for Environmental Management
ICRAF	International Centre for Research in Agroforestry (World Agroforestry Centre)
IMHEN	Institute of Meteorology, Hydrology and Environment
IPCC	Intergovernmental Panel on Climate Change
ISPONRE	Institute of Strategy and Policy on Natural Resources and Environment
M&E	Monitoring and Evaluation
MONRE	Ministry of Natural Resources and Environment
NTFP	Non-Timber Forest Products
PaLA	Participatory Landscape Appraisal
PFES	Payments for Forest Environmental Services
RPE	Remuneration of positive externalities
SES	Socio-Ecological System
SRI	System or Rice Intensification
SWOT	Strengths, Weaknesses, Opportunities and Threats
TC-HĐ	Trung Chau village, Ho Do commune
TL-STa	Village Trung Luu, Son Tay commune
VA	Vulnerability Assessment
VASES	Vunerability Assessment for Socio-Ecological Systems
V1-ST	Village 1, Sơn Thọ commune
V2-HL	Village 2, Huong Lien commune
V4-CM	Village 4, Cam My commune

Glossary

The definitions in this glossary are based on definitions provided by the IPCC in its Fifth Assessment Report (2014), with the exception of the terms *Ecosystem-based Adaptation* and *Sensitivity*.

Adaptation:

This concept refers to "the process of adjustment [of both human and natural systems] to actual or expected climate and its effects". In human systems, *adaptation* seeks to moderate or avoid harm - in this report caused by climate change - or to exploit beneficial opportunities. In the context of natural systems adaptation, human interventions may help to adapt to expected changes in the climate and its effects. (IPCC 2014, p. 118).

Adaptive capacity:

"The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC 2014, p. 118).

Climate change:

Climate change is defined as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer." Causes can be directly or indirectly attributed to human activity or to natural internal processes, altering the composition of the global atmosphere (IPCC 2014, p. 120)

Drought:

"A period of abnormally dry weather long enough to cause serious hydrological imbalance. Drought is a relative term; therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion." A meteorological drought is a period with an abnormal precipitation deficit. A megadrought is a very lengthy and pervasive drought that lasts much longer than normal, usually a decade or more (IPCC 2014, p. 122).

Ecosystem:

An *ecosystem* is a functional unit that consists of "living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases they are relatively sharp, while in others they are diffuse" (IPCC 2014, p. 122).

Ecosystem-based adaptation:

Ecosystem-based adaptation (EbA) is the "use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change" (CBD

2009, p. 41). This approach includes the sustainable management, conservation and restoration of ecosystems to supply benefits and create a favorable environment to help people adapt to adverse changes, including climate change (CBD 2017).

EbA helps humans adapt to climate change by actively and strategically managing and using ecosystems and their services. EbA supplements or replaces hard solutions or other technical adaptation measures, at the same time bringing in co-benefits such as biodiversity and livelihood conservation and diversification.

Ecosystem services*:*

"Ecological processes or functions having monetary or non-monetary value to individuals or society at large." *Ecosystem services* are categorized into "(1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food, fiber or fish, (3) regulating services such as climate regulation or carbon sequestration and (4) cultural services such as tourism or spiritual and aesthetic appreciation" (IPCC 2014, p. 122).

Exposure:

Exposure refers to "the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings" that are subject to being adversely affected (by either climate change or other causes) (IPCC 2014, p. 123).

Hazard:

This term is usually defined as "the potential occurrence of a natural or human-induced physical event or trend, or physical impact that may cause loss of life, injury, or other health impacts." Damage to and loss of property, infrastructure, livelihoods, service provision, ecosystems and environmental resources could also occur. In this report, *hazard* refers to climate-related events or climate-related impacts (IPCC 2014, p. 124).

Impacts:

In this report, the term *impacts* is defined as effects on natural and human systems and is used primarily to refer to the effects of extreme weather and climate events and of climate change on both natural and human systems. Climate change could impact lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure. Physical impacts are a subset of impacts of climate change on geophysical systems, including flooding and droughts (IPCC 2014, p. 124).

Land use:

This term refers to “the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed” such as grazing, conservation, and agriculture (IPCC 2014, p. 125).

Sensitivity:

The degree to which a system is affected – either adversely or beneficially – by climate change or -variability is referred to as *sensitivity*. The effects can be both direct, such as a change in crop yield due to a change in the temperature’s mean, range or variability, or indirect, like damages caused by an increase in the frequency of coastal flooding due to sea-level rise (IPCC 2007, p. 881).

Vulnerability:

The IPCC (2014, p. 128) defines *vulnerability* as the propensity or predisposition to be adversely affected, with the term encompassing various concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (to climate change).

1. Background

The project “Strategic Mainstreaming of Ecosystem-Based Adaptation (EbA) in Vietnam”, a joint project between GIZ and ISPONRE (MONRE), aims to strategically integrate the EbA approach into climate change adaptation policy, land use and development planning, as well as to implement these on the ground. A central part of the project is to integrate EbA into the national climate change adaptation policy in a systematic way, as well as implementing the policy continuously. The project will be running from 2014 to 2018 in Ha Noi, and the pilot provinces Ha Tinh and Quang Binh.

2. The necessity of a participatory identification of EbA measures

As part of the project, a full Vulnerability Assessment for Socio-Ecological Systems (hereafter referred to as VA) in both Ha Tinh and Quang Binh has recently been concluded by GIZ and ISPONRE with the support of international and national consultants from the International Centre for Environmental Management (ICEM). The aim of the VA was to provide a more systematic analysis of climate-related issues for each province.

Simultaneously, a variety of experiences and proposals exist on the side of the provinces to identify potential EbA measures. Therefore, a participatory site- and EbA measure identification process was conducted simultaneously with the rather strategic VA mentioned above. This participatory identification from and with local authorities and communities serves the purpose of better understanding the climate change (CC) impacts that these communities are facing, and of identifying the communities’ urgent needs for CC adaptation options, with an emphasis on EbA measures, which can then be implemented in the form of pilot activities.

The participatory identification of EbA measures fits well into the second component of the EbA project, which is to develop the necessary basis for further implementation (scaling up) of EbA through evaluation of existing experiences and a pilot measure. Additionally, the reports from the participatory identification focus on terrestrial ecosystems, as demanded in indicator 5 of the EbA Project Document: "Based on experiences and pilot application, two other formulated proposals are available – with at least one of them being for a non-coastal zone - for EbA application" (MONRE 2014, p. 13). Hence, identifying and selecting an appropriate and potentially successful EbA measure for the terrestrial ecosystems in Ha Tinh province fits well into the aim of the EbA project and is necessary for its successful implementation on the ground.

The process and results of the participatory identification have been closely consulted and shared with the VA team: survey methods have been discussed, and findings presented as part of provincial consultation workshops in Ha Tinh. In addition, other organizations that have practical experiences in climate change adaptation (CCA) and/or EbA such as the Department of Climate Change (DCC) (Adaptation Division, which was consulted during the initial phase and particularly for the methodology of the participatory identification process), the International Centre for Research in

Agroforestry (ICRAF) and provincial organizations have been consulted as part of the participatory identification.

After two initial reports had been drafted by an expert team in Ha Tinh (hereafter the Ha Tinh team) based on afore mentioned participatory assessments, with one focusing on the results of the survey, and the other one on the implementation plan of the proposed measures, the International Centre for Research in Agroforestry (World Agroforestry Centre - ICRAF) reviewed the results and provided concrete suggestions and improvements of the analysis and the implementation plan. Based on these recommendations and further ideas from the Ha Tinh team, pilot activities are now being implemented on the ground.

The work at hand constitutes the synthesis of the initial reports and ICRAF's recommendations. It is divided into three major sections, with the first one describing the Ha Tinh team's process of selecting a site and potential EbA measures for piloting, the second part focusing on the particular EbA suggestions provided and the recommendations given by ICRAF in regards to these, and the third part offering an overview over the implementation plans and status of the Ha Tinh team's and ICRAF's EbA recommendations. Findings from the VA report relating to the Socio-Ecological System of the finally selected commune have also been integrated into this report.

3. Objectives

Overall, this report follows three main objectives:

1. To describe the site selection and EbA measure identification process as conducted by the Ha Tinh team for the implementation of EbA pilot activities.

2. To introduce an implementation plan by elaborating on the EbA measures identified by the Ha Tinh team, and putting these in relation to ICRAF's recommendations on suitable EbA measures.

3. To provide an overview over both the Ha Tinh team's and ICRAF's EbA recommendations and implementation status.

The named objectives demand that the Ha Tinh team's and ICRAF's works are put into logical relation to each other, providing the reader with concrete insights into EbA measures suggested and how these could potentially be and have been improved, made more sustainable or more effective. This way, the original value and information of each work remains visible and concrete learning steps can still be seen, followed and reproduced in other contexts.

An overview over the recommendations given and their status of implementation allows the reader to quickly view what has been suggested by whom and to which degree these suggestions have been realized, including explanations for implementation statuses and the non-integration of certain suggestions. Simultaneously, the overview constitutes a dynamic control tool for the GIZ and the implementation team in Ha Tinh to review and retain an audit of the implementation status of the

different measures selected. As mentioned above, certain recommendations can be purposely left out without being forgotten or overlooked, as they will continue to exist in the overview, and can potentially be integrated at a later stage of the project.

4. Methods

4.1 The participatory identification method

In order to be able to deliver inputs to the above named objectives, the Ha Tinh team developed a method consisting of clear steps that guided the identification study to desired results (USAID 2015). The method consists of six steps that have been followed throughout the study. At this point, the steps shall be introduced only briefly – they will be elaborated upon in more detail in **chapter 5**.

The first step of the study was to conduct a rapid screen survey that assessed already existing reports and documents on the various communes located in the province. Together with DONRE, vulnerable communes have been identified using a clear set of criteria (see **Annex 1 and 2** as well as **chapter 5.1.1**).

In step two, it was essential to perform a risk analysis on the selected vulnerable communes. The risk analysis was conducted through group discussions (involving questionnaires, see **Annex 3.1**) with commune staff and other representatives (see **Annex 3.2**). Based on the analysis, the most vulnerable village in each commune could be selected (see **chapter 5.1.2**).

Following step two, a risk analysis of the selected vulnerable villages was conducted in order to determine the risks faced by the village. This risk analysis was also performed as group discussions with the village heads, heads of mass organizations and with experienced farmers. Based on the results of the risk analysis, potential EbA measures were identified in this third step (see **chapter 5.1.3**).

The fourth stage consisted of comparing the selected villages regarding the impact the identified natural hazards would have on them, in order to identify the most vulnerable village. By calculating an average value, the most vulnerable village could be identified (see **chapter 5.1.4**).

Step five - thorough discussions between DONRE and the EbA staff in Ha Tinh - was to select promising EbA measures. Deciding which EbA measures would benefit the village most required developing and making use of a **scoring matrix** (see **chapter 5.1.5**).

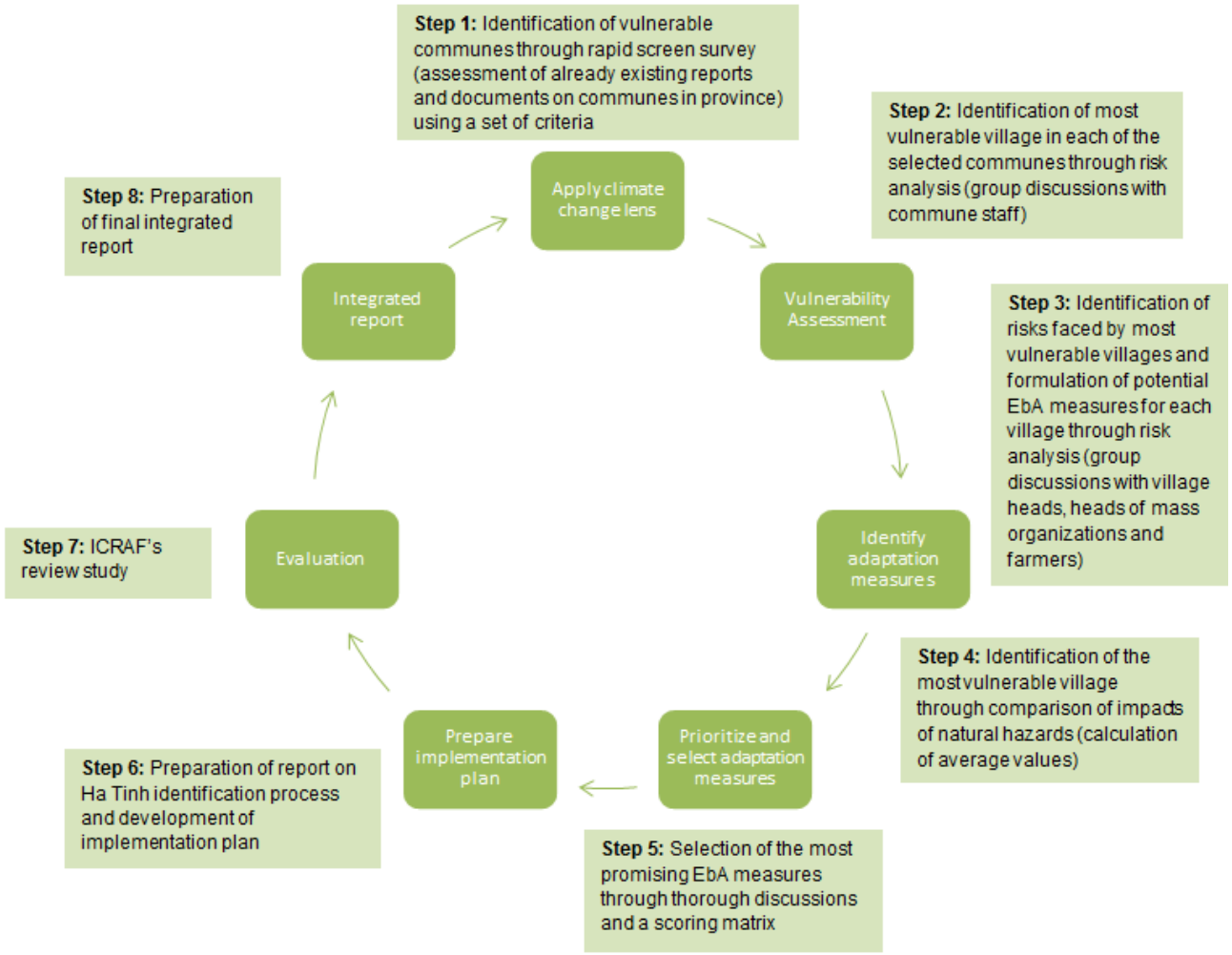
After selecting the EbA measures, a report on the identification process was prepared and an implementation plan prepared (step 6). These documents were developed in close collaboration between DONRE and commune staff, and were then reviewed by DARD staff for additional inputs. The implementation plan presents details on how the suggested EbA measures should be implemented, and what steps are needed for successful implementation. The inputs from the reports

have been integrated into the synthesis document at hand, yet the originals can be made available upon request.

A seventh and eighth step have been added to this methodology, consisting of ICRAF's review study and the production of a final integrated report, which is the report at hand. In the results-section of this report, step one to five as conducted by the Ha Tinh team will be elaborated upon in more detail, in order to thoroughly inform the reader about the site and EbA measure selection process. Since ICRAF's recommendations specifically relate to the findings from the Ha Tinh report, its methodological approach is only briefly described under **4.2**, and focus lies mainly on ICRAF's findings and recommendations rather than the process through which these have been identified. Also in this report's results-section, step six and seven have been integrated into one sub-chapter to provide a comparative overview over the most important findings and recommendations of the participatory identification reports and ICRAF's review study.

Figure 1 below shows a brief overview of the steps followed to achieve this final integrated report.

Figure 1: The underlying methodology for the integrated report



4.2 ICRAF's method

ICRAF conducted thorough preparations and fieldwork in June and July 2016. These included a systematic assessment on whether the EbA measures proposed in the participatory identification reports are suitable in terms of climatic, biophysical/ecosystem and socioeconomic contexts, policy support and scaling opportunities. Briefly, this included analysis of meteorological data, a literature review of policies and species suitability, as well as field work with transect walk, hazard mapping, tree-crop suitability ranking, and participatory Strengths, Weaknesses, Opportunities and Threats Analysis (SWOT) of land uses proposed for EbA interventions, including the market potential of interventions. Details of ICRAF's methods can be found in **Annex 4.** ICRAF's full review report can be made available upon request.

THE IDENTIFICATION PROCESS

5. Results

5.1 Site and EbA measure selection – the identification process (Objective 1)

5.1.1 Step 1: Rapid screen survey to identify the vulnerable areas in the province

The selection of vulnerable areas through the Ha Tinh team was based on multiple steps, which shall be further elaborated upon here:

1. In a first step, documents on climate change and its adverse impacts available at province level were assessed to get a general overview over natural hazards existing in the province (see inter alia **Table 1**), with a particular focus on their causes and impacts. The documents assessed (see **Annex 1**) were:
    - The Ha Tinh Assessment Report on Climate Change (ISPONRE 2009)
    - The Provincial Action Plan to Respond to Climate Change 2011-2015 (DONRE 2011)
    - The report from districts on climate change and its impacts (2015)

    The above named documents revealed which ecosystems were impacted by different types of hazards. As the "Strategic Mainstreaming of Ecosystem-Based Adaptation (EbA) in Vietnam" Project Document clearly demands that at least one pilot measure is being conducted for a non-coastal zone (MONRE 2014, p. 13), terrestrial ecosystems were prioritized for further study.

2. Staff from DONRE and DARD, which is well experienced with climate change and climate change adaptation issues in Ha Tinh, agreed in following discussions that a selection of five vulnerable communes should be paid further attention to. DONRE staff provided information on vulnerable areas which are severely affected by climate change every year, and DARD contributed information on the current situation of ecosystems and the services they provide. The five communes were selected based on criteria such as severe problems caused and exacerbated by extreme weather events (floods, landslides and droughts); abundance and availability of natural ecosystems and the availability of potential implementable and efficient EbA response mechanisms to hazards existing in the communes; degree of dependency of local people on natural resources for their livelihoods and accessibility for visitors (DONRE and DARD provided experience-based information on the last two criteria; see also **Annex 2**). The communes identified were located in five different districts, namely Cam Xuyen, Huong Khe, Huong Son, Vu Quang, and Thach Ha.

Table 1: Main risk periods for extreme weather events in the province in a) current climate and b) future scenarios for the 2030s in Ha Tinh

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
a)	Drought	Drought, hot spell, Tmax 41°C and dry winds						Drought		Cold and rain		
								Flood, flash flood, landslides				
b)	Drought	Increased average and maximum temp. Drought risks increase						More rains, storm intensity increases		Less frequent cold spells		

Chart legend:

Tmax: maximum temperature

a) Results from fieldwork

b) Downscaled CC scenarios for the 2030s in the province, adapted from ISPONRE (2009) and Ha Tinh DONRE (2011)

The table shows the weather conditions in Ha Tinh over a year. While the light blue is for events that are less extreme, the dark blue represents the events that are more extreme, in terms of intensity and frequency. The months are listed In order following the solar calendar.

Based on the above results of the rapid screen survey and further inputs from provincial staff members, DONRE and DARD together with the Ha Tinh team selected the following five communes: Hộ Độ commune, Lộc Hà district; Cẩm Mỹ, commune, Cẩm Xuyên district; Hương Liên commune, Hương Khê district; Sơn Thọ commune, Vũ Quang district; Sơn Tây commune, Hương Sơn district (see also **Figure 2**).

Figure 2: Selected communes for the survey (colored marks)

5.1.2 Step 2: Identification of most vulnerable villages

In a next step, focus group discussions with commune staff from the five communes (leader representatives, officer in charge of cadastral, agriculture, environment) (see **Annex 3.2**) were conducted, also using questionnaires (see **Annex 3.1**), to identify the most vulnerable village in each commune. This way, five villages could be identified and, in a next step, baseline data on these villages could be gathered (see **Table 2** below).

Table 2: Natural and socioeconomic conditions of the five villages[1]

No.	Sites/Features	Village 2, Huong Lien	Village 4, Cam My	Village Trung Chau, Ho Do	Village Trung Luu, Son Tay	Village 1, Sơn Thọ
A	**Total area (ha)**	**134**	**105**	**21.3**	**300**	**413**
1	Residential area	12	17	2.3	5	18
2	Natural secondary forest			10.45 (mangroves)	170	180
3	Plantation	105	60		80 (acacia and indigenous timber)	160
4	**Agriculture area (ha)**	**17**	**28**		**45**	**55**
4.1	Paddy rice	7	21		12	15
4.2	Crops	10	7 (peanut, cassava, green bean)		30 (green tea, peanut)	40 (peanut, cassava, sugar cane, etc.)
4.3	Others			8.5 (salt fields), 30% used	3 (grass)	
B	**Population**					
1	Number of households	128	167	114	103	114
2	Population (people)	514	639	450	417	435
3	Number of poor households	21	20	18	9	10

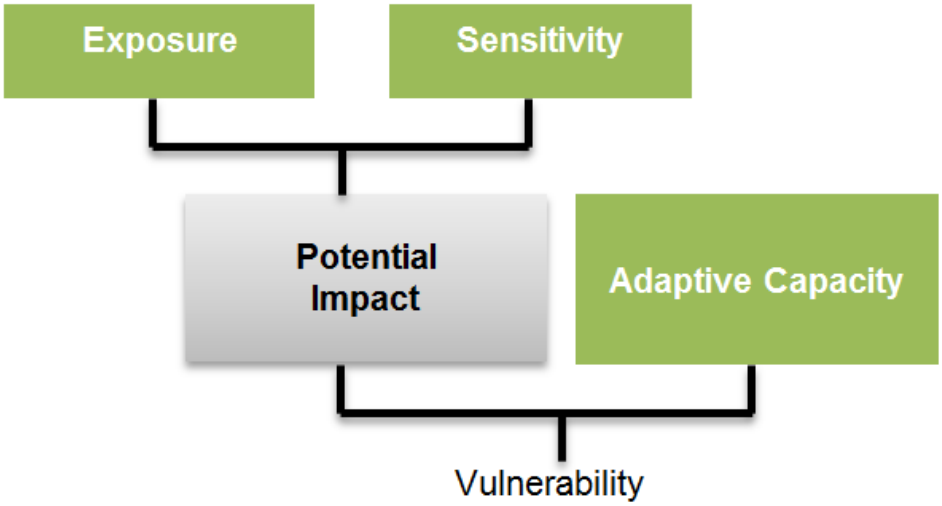
5.1.3 Step 3: Vulnerability assessment - risk analysis of the selected vulnerable villages to identify potential EbA measures

A focus group discussion (5-7 participants) was conducted at village level with village leaders, representatives of all mass organizations (women, farmers, youth, elderly, veterans), and farmers from each village for the vulnerability assessment. The results are displayed in **Table 3**. The table provides insights into values for the important constellation "Vulnerability: Exposure - Sensitivity - Adaptive capacity" from each site, based on the information provided by communities during the focus group discussions. **Vulnerability** is, as has been elaborated upon in the glossary, defined as the degree to which something (a species, an ecosystem, a group of people, a set of activities, built infrastructure, etc.) is susceptible to, or unable to cope with, the adverse effects of climate change, including climate variability and extremes. Vulnerability is further explained as a function of the

[1] Some of the villages mentioned in the table have numbers as names

character, magnitude, and rate of climate variation to which a system/species is exposed, the system/species' sensitivity, and the system/species' adaptive capacity (IPCC 2007, p. 21). **Figure 3** presents this relationship graphically.

Figure 3: The components of vulnerability (from Marshall et al. 2009; Preston and Stafford-Smith 2009.)



In this report, the levels of exposure and impact in percentages and areas were estimated based on farmers' perspectives on developments within the specified topical areas over the last ten years as presented during the focus group discussions. The farmers discussed among each other to clarify which plots were affected and how much their crops lost due to extreme weather events. Furthermore, they zoomed in on specific time frames when particularly extreme weather events occurred, and discussed these periods and their effects in more detail. Estimations in numbers, ha and percentages were provided by the expert farmers. Finally, as part of the group discussions, the farmers also identified potential EbA measures in response to those weather events the individual villages have been assessed as being highly vulnerable to (see **Table 3** and the **scoring matrix** further below).

Vulnerabilities in this report are considered as High if they are subject to high exposure and sensitivity, but low adaptive capacity.

Table 3: The main climate-related hazards, impacts and adaptation options

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
Cẩm Xuyên: Cẩm Mỹ commune - Village 4 (V4-CM)							
Flood (and flash floods) in 2010 and 2012	- Home garden: 10% of households had animals affected (5% pigs died, 20% cows got diseases); food got wet (20% of households) - Agricultural land (30% of second rice crop, 20% of maize and cassava affected) - Aug to Oct - Once a year and not happened every year - Not increased	- Cassava, rice and maize were not resistant to flooding - Animal shelters were in lower locations	- Maize and cassava died : 20% of the area; second rice crop was washed away: 30% → reduce yield - Rice and peanut products at home got wet, could not be used for humans: 20% of households - Animals died	- Lack of food after floods - Income reduction due to yield reduction	+** Local knowledge: Be prepared before the floods (put products into bags, move the animals to higher places, make an additional floor in the house, buy wooden boats) + Support from the commune (boats, information, new varieties - short term ones) -** Limited financial resources for buying food, varieties, making flood control work... - No other lands to cultivate crops in flooding time	Medium	N/A*
Cold in 2008 and 2012	- Home garden: 5 elderly got sick; 10 cows died (10 households); 10% of peanut seedlings died; 50% of fruit trees did not flower	- Rice and peanut seedlings were sensitive to cold spells - Animals couldn't bear cold	- 10% of rice and peanut seedlings died → replanting → low growth → yield reduced - Animals died (10 cows)	- Spend more money to buy seeds and animals - Income reduction due to yield reduction	+ Local knowledge (improved animal shelters, stored fodder for animals, re-germinating) + Support from the community and local government (adjusted the crop calendar)	Medium	N/A

* EbA measures were identified to cope with climate change phenomena with high risk/vulnerability only;
** Adaptive capacity contains positive aspects (+) and negative aspects (-)

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
	- Agricultural land: 10% of peanut and rice seedlings died - Animals grazing in the forests died and got diseases - Dec and Jan - Short period of time (3-4 weeks/year only) - Not increased	- Fruit trees and crops	- Fruit trees' growth is low (50% of fruit trees did not flower)		- Limited financial resources for making good shelters for cattle, preparing cold-resilient equipment for crops - Farmers were inactive in changing farming practice (transplant rice instead of direct seeding)		
Drought in 2013-2014-2015	- Home garden: 85% of households did not get water for use; 90% of the fruit tree areas were affected; 30% of livestock was sick - Agricultural land: 95% of the peanut and green bean area was affected; 40% of rice area was affected - Apr to Oct - Long period of time	- Peanut, green bean, maize were sensitive to drought - Animals (chicken, pigs, cows, buffalos) didn't grow well and got diseases under droughts - Ground water reduced	- 95% of crops and 90% of rice grew slowly -> Yield reduction - Animals grew slowly: 30% of livestock was sick - 95% of the peanut and green bean area was affected - Shortage of water for humans and crops: 90% of households did not	- Income reduction due to yield reduction - Lack of clean water for humans	+ Local knowledge: Took water from other families and rivers for human use + Support from commune: encouraged farmers to have drilled wells where possible - Limited financial resources to prepare irrigation work for crops and trees; to prepare water storage equipment for humans - No drought-resistant species	**High**	Rain water storage (tank) Home garden enrichment by intercropping with native timber species, fruit trees and short-term crops

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
	- Every year - Increased (longer by the time)		have water for three months				
Vũ Quang: Sơn Thọ commune, Village 1 (V1-ST)							
Flood and flash flood in 2010-2011-2013	- Home garden: Only 5% (5 households) had collapsed fence and walls - Agricultural lands: 9% (4ha) of crops were affected; animals were washed away due to the late gathering - Oct-Nov - Once a year and not happened every year - Not increased	- Rice, peanut, maize and fruit trees were unresistant to floods	- 9% of crop area died from floods → yield reduction	- Income reduction due to crop destruction - Had to spend money to buy animals	+ Support from district: Awareness raising on natural disaster control for the community + Provincial support: only one flood-resistant house - Limited financial resources to have good houses and buy animals - No better land for cultivation and settlement	Medium	N/A
	- Paddy rice and agricultural land:		- The second rice crop could not be		+ Local knowledge: Stored water from ponds for	**High**	Forest enrichment by native timber species, fruit

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
Drought in 2009, 2013-2015	Almost 100% dried up, 50% severely dried up - Forestry land: 60% of the area with slow tree growth - Home garden: 90% of households had no water for use, 95% of fruit tree area dried up, 40% of animals sick - Apr-Sept - Long period of time and increased - Every year	- Rice, peanut, bean and fruit trees dried up - Wells dried out - Natural and plantation forests caught fire	cultivated: 100% of the area - Fruit trees, crops did not grow well and died: 95% of the area - Shortage of water for human use: 90% of households - Agricultural land left fallow: 80% of the area - 40% of animals got sick	- Income reduction - Lands were left fallow	animals; prepared pumps to take water for daily use and garden crops + Support from district: Changed the second rice crop to maize or peanut or green bean (but the yield was very low) + Support from district and commune: Forest fire prevention - Limited financial resources to have irrigation work for rice and fruit trees - No better land for crop cultivation		trees and short term-medicinal plants Upgrade the natural ponds/lakes to store water by earth dykes with tree planting
Hương Khê: Hương Liên commune, Village 2 (V2-HL)							
Flood in 2010	- Paddy rice: 40% of the area was flooded - Agricultural land: 20% of maize and green bean area was flooded	- Second rice crop, maize and green bean are cultivated in low areas - Settlement in low locations	- Second rice crop, maize and green beans were washed away → yield reduction - Houses were flooded: 15%	- Income reduction	+ Local knowledge and support from commune: Humans and animals were evacuated - Limited financial resources for building more solid	Medium	

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
	- Home garden: 15% of households had houses flooded, 5% of livestock got disease - Once a year and not happened every year - Sep-Nov - Not increased	- Animals are not in solid shelters	- Animals got disease: 5%		houses or building houses in higher areas - No better land for cultivation		
Drought in 2010, 2013-2015	- Paddy rice: 90% of the rice area had no harvest - Maize and green bean: 60% of the area had no yield - Home garden: 30% of households had fruit trees affected - March-Sep - Every year - Increase (intensity and frequency)	- Second rice crop is in the high areas, where water is not available - Wells do not have water - Animals get sick due to hot temperatures	- Second rice crop could not be cultivated, if yes, only usable as fodder for animals: 90% of the area - Maize and green bean had no yield → fodder for animals only: 60% - Shortage of fodder for animals (35% of animals got sick) - Shortage of water for humans (10% of households had no	- Income reduction	+ Local knowledge: Used water from the river, without consideration of quality - Limited financial resources for irrigation work and water storage - No better land for cultivation	**High**	- Enrichment of home garden by planting fruit trees and medicinal plants (*Ardisia sylvestris* may not grow well in gardens) - Enrichment of natural forests by planting timber species and medicinal plant (hard to protect in natural forests)

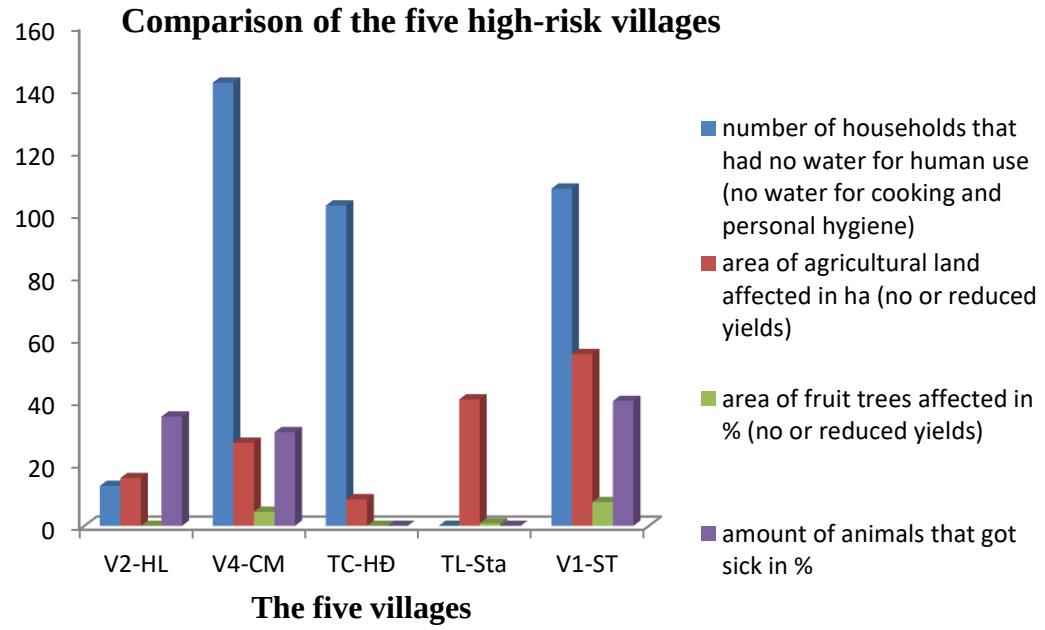
Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
			water for use) and crops				
Lộc Hà: Hộ Độ commune, Trung Châu village (TC-HĐ)							
Drought in 2014-2015	- Aquacultural area: one hh was affected - Agricultural area: 100% of peanut area dried up - Home garden: 90% of households had no water for use for 3-4 months - Apr-Sep	- Shrimp aren't resistant to drought - Peanut needs water for growing - Wells do not have enough water for human use	- Shrimps died (high salinity content): one hh - Peanuts provided a very low yield: 100% of the area - Shortage of water for humans (90% of households) - Land degradation: 100% of the area	- Income reduction - Labor migration to the city and other places	+ Local knowledge: Prepared tanks for rainwater storage (5m^3-tank); bought fresh water from other places - Limited financial resources for doing other business, and having water storage work - No better land for cultivation	**High**	
High rainfall (flood in 2010 esp. and rain every year)	- River: Siltation leads to fishery resources reduced - Salt field: 100% of the area was flooded - Home garden: 50% of households had garden with erosion - Sep-Nov	- Water flow changed and brought sand into the river - Salt fields are exposed to the rain - No trees or equipment for erosion control in home gardens	- Water flow unobstructed due to the siltation - Fishery resources reduced by the siltation - Salt yield reduced: 100% of the area	- Income reduction - Labor migration to the city and other places	+ Local knowledge (harvested salt and fishery earlier than normal)	Medium-**High**	Mangrove restoration (not bring the direct benefits to cope with CC impacts from its services, is only protecting earth dykes to prevent flooding) Community mangrove management

Hazard (What)	Exposure (Where, When, Frequency)	Sensitivity (Why)	Impact (How much/many)		Adaptive capacity	Vulnerability	EbA measures
			Bio-physic	Socioeconomic			
Hương Sơn: Sơn Tây commune, Trung Lưu village (TL-STa)							
Heavy rain in 2013-2014	- Agricultural lands (sand sedimentation): 50% of the area had increased sand content - Home gardens (clay sedimentation): 40% of the households had gardens with increased clay sedimentation content - Oct-Nov	- Peanuts and green beans are not resilient to heavy rain, their flowers will be easily washed away - Vegetables are destroyed by rain and fruit trees can't keep their flowers for fruits	- Loss of agricultural land: 50% of the area (sandy content) - Uncultivable home gardens (high clay content): 40% of the households - Crop yield reduction	- Income reduction due to yield reduction - Had to spend money to rehabilitate cultivation lands by buying fertile soils to cover sedimentation plots	+ Local knowledge (had fertile soil to cover clay layer for cultivation) + Local planning: changed crop (green tea instead of peanut and green bean where possible) - Limited financial resources to buy food and have good drainage work - No better land for crop cultivation - Did nothing, accepted the loss	Medium-**High**	Green tea plantation on the infertile land (after sandy sedimentation) where possible - low sand content
Drought in 2014-2015	Agricultural land (water shortage for the second rice crop, peanut and maize: 100% of households and 90% of the area - Mar-Sep - Every year and increased	- The second rice crop without water for growth - Peanut and maize are not resilient to drought	- No rice products at second crop: 100% of the area - Great reduction of peanut and maize yield on 90% of the area	- Income reduction - Lands left fallow	+ Local planning: changed crop (green tea instead of peanut and green bean where possible) - No better land for cultivation - Did nothing, accepted the loss	**High**	Fruit tree plantation and bee raising on forestry land Forest enrichment with native timber species, fruit trees and bee raising

5.1.4 Step 4: Selection of the most vulnerable village: Comparison among communities with high vulnerability to identify the most vulnerable village

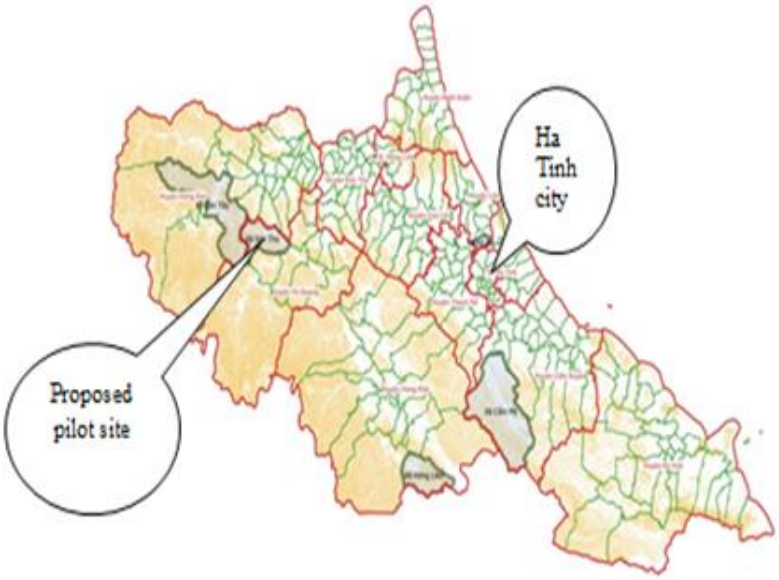
After all vulnerabilities had been assessed, the next step consisted in selecting all those vulnerabilities that had been identified as High for further analysis. **Figure 4** below illustrates the comparison of adverse impacts from the high risk categories in **Table 3** above for the five selected sites. The numbers provided are based on the focus group farmers' assessments (in ha, amounts and percentages) of adverse impacts of the extreme climatic events in focus on water quality and usability, agricultural land, fruit trees and livestock.

Figure 4: Comparison of the 'high risk'-category of all 5 sites (V2-HL: Village 2, Huong Lien commune; V4-CM: Village 4, Cam My commune; TC-HĐ: Trung Chau village, Ho Do commune; TL-STa: village Trung Luu, Son Tay commune; and V1-ST: Village 1, Sơn Thọ commune)



V4-CM and V1-ST had similar impacts that included all four aspects (number of households had no water for daily use in hot days; areas of agricultural land affected, fruit trees affected and number of animals that got sick during the severe droughts). While V4-CM has the highest number of households without water for daily use during droughts, the remaining three aspects add up to a higher value for V1-ST. Thus, **V1-ST is considered to be the most vulnerable site** (see **Figure 5** below).

Figure 5: Map of Ha Tinh province and the pilot site



5.1.5 Step 5: Identification of the EbA measures for implementation

In a next step, the final EbA measures were chosen for implementation by using a scoring scale. The results of this scoring exercise can be found in the **scoring matrix** below. The matrix shows eleven potential EbA activities which were identified during the focus group discussions (rain water storage; home garden intercropping (2x); forest protection and enrichment (3x); natural pond/lake upgrade; mangrove rehabilitation; community mangrove management; green tea plantation on degraded lands; fruit tree plantation and bee raising on forestry lands) for the five selected villages, and how these scored in relation to six different parameters (affected by climate change; cost effectiveness; upscaling potential; suitability for local conditions; capacity to benefit humans and usage of ecosystem services) on a scoring scale from one to five, with five constituting the best possible, and one the least favorable value.

The six different parameters were evaluated according to the following guidelines:

Parameter 1: Affected by climate change. This parameter assesses how severely affected the place in focus is by climate change. The scores were distributed based on the information provided on exposure and impact during the local focus group discussions as presented in **Table 3**. The more severely affected a commune and village, the higher a score was attributed to it. In cases of 90%-100% of households, agriculture lands, home gardens and animals affected, a score of five was allocated. Were 30%-40% affected, a score of three was given. In cases of 10% being affected, a score of one was allocated.

Parameter 2: Cost effectiveness. The second parameter was scored according to the estimated financial resources it would demand to implement a particular measure – the higher the estimated

costs were, the lower a score was given. Here, making use of and working with already existing resources and assets (such as already existing forest being enriched) was generally assessed as being more cost effective than introducing an entirely new and thus resource-intensive measure (such as establishing a new plantation).

Parameter 3: Upscaling potential. The higher an upscaling potential for a specific EbA measure was expected to be, the higher a score was allocated to it. The upscaling potential was estimated by taking into account how easy or complex the (planting) techniques to be applied were, if and how many ecosystems were available, how much support and commitment was visible among local stakeholders during group discussions, and to which degree a measure was already in line with local policies. The just named criteria were debated and agreed upon in group discussions between DONRE, DARD and the village inhabitants. In order to define the scores, literature as well as local knowledge on the just named different criteria were consulted.

Parameter 4: Suitability for local conditions. This parameter evaluates how suitable a suggested measure is for the existing local conditions: The more suitable an activity is, the higher the score it received. Criteria for assessing the suitability were for instance to which degree native species could be used that suit local soil conditions, or how much experience the local stakeholders had with implementing the measure. The criteria were defined based on thorough discussions between DONRE, DARD, commune staff and villagers, and with a focus on applicability of measures for farmers.

Parameter 5: Capacity to benefit humans. This parameter assesses to which degree a measure provides direct benefits for people to cope with climate change impacts on the ground. The benefits each measure can bring about were agreed upon in collaborative processes involving DONRE and the local populations. The more benefits a measure can provide in addition to the 'natural' direct and indirect benefits an ecosystem is already providing, the higher its score.

Parameter 6: Usage of ecosystem services. The final parameter describes how many ecosystem services (provisioning services, regulating services, cultural services and supporting services) are made available for humans through the implementation of a measure. The more services made available, the higher the allocated score. The content and amount of ecosystem services made available were defined and assessed through discussions with local stakeholders and with the help of a questionnaire which can be made available upon request.

After all measures had been scored according to the five-scale system, the measures with the highest scores were identified as the ones focus for implementation should lie on. Since the degree of vulnerability of a commune and village has been incorporated into the scoring matrix, no additional considerations needed to be made as to whether to choose the most vulnerable place or the EbA measure that scored the highest.

Scoring matrix

The EbA options suggested in this scoring matrix are based on the principle of using existing ecosystem services to support farmers in addressing the severe of extreme weather events in each site. Numbers have been allocated by applying the guidelines for the six different scoring parameters described above.

No.	EbA measures identified	Description	Location	Criteria						
				Vulnerability of place to CC	Cost effectiveness	Scaling up possibility	Suitable to local conditions	Support people	Ecosystem service usage	Total
1	Rain water storage	Use tanks to store the rain water in hot days	Cẩm Mỹ	4	3	3	4	4	0	18
2	Home garden intercropping	Native timber species, fruit trees, green tea	Cẩm Mỹ	4	3	4	4	4	3	22
3	Home garden intercropping	Fruit trees and medicinal plant	Hương Liên	3	3	4	4	4	2	20
4	Forest protection and enrichment	Native timber species and medicinal plant	Hương Liên	3	4	3	4	4	3	21
5	**Forest protection and enrichment**	**Native timber species, fruit trees, bee raising, short-term crops**	**Sơn Thọ**	**4**	**4**	**4**	**5**	**5**	**5**	**27**
6	Natural pond/lake upgrade	Earth dykes with tree planting on the dyke banks	Sơn Thọ	4	2	2	2	4	3	17
7	Mangrove rehabilitation	Plant mangrove to prevent flooding	Hộ Độ	4	3	2	3	3	3	18
8	Community mangrove management	Support local people in the protection of mangroves	Hộ Độ	4	4	3	3	3	3	20
9	Green tea plantation on degraded lands	Plant green tea in the degraded agriculture land	Sơn Tây	3	3	3	3	3	2	17
10	Fruit tree plantation and bee raising on forestry lands	Plant fruit trees on the barren lands	Sơn Tây	3	3	2	3	3	2	16
11	**Forest protection and enrichment**	**Native timber species, fruit trees, bee raising**	**Sơn Tây**	**3**	**4**	**4**	**5**	**5**	**5**	**26**

Together with DONRE and DARD Ha Tinh and commune staff, and based on the scoring matrix above, the Ha Tinh team therefore selected the measure of ***natural forest protection and enrichment*** **in Village 1, Sơn Thọ commune, Vu Quang district**, as the most promising one for piloting.

The report will now move on to describe the by the Ha Tinh team recommended EbA measures for Village 1 in Sơn Thọ commune in more depth, thus zooming in on a very limited scale for the implementation of EbA measures. It will furthermore provide ICRAF's recommendations as supplementing or new/additional ideas for implementation. The recommendations generated from the original participatory identification reports and those provided by ICRAF have been kept separate and identifiable as coming from different sources, but have been placed together based on similar content.

EBA MEASURE RECOMMENDATIONS

5.2. Step 6 and 7: The Ha Tinh team's implementation plan of EbA measures for Village 1 in Sơn Thọ commune and ICRAF's review report (Objective 2)

5.2.1 The socio-ecological system around Sơn Thọ commune

Sơn Thọ is a mountainous commune of Vu Quang district, about 70 km from the provincial center. Its natural area is approximately 4.591 ha, in which agricultural land takes up about 668 ha (14.5%), forestry land is about 3.465 ha (75.5%), and non-agricultural land constitutes 290 ha (6.3%). Roughly 2.715 residents live in 756 households, distributed over 10 villages.

Ecosystems in the commune are abundant, including native forests, acacia monoculture plantation; paddy rice; mixed farming - cassava - sugar cane - maize, perennial tree crops - orange; and home gardens.

The main income source comes from agricultural production - acacia plantation, orange and livestock – and only a very small amount is generated through the service sector.

The commune experiences different weather conditions over the year. Extreme droughts, hot spells and dry winds occur from April to September, with temperatures up to 41°**C**. Heavy rains often reach the area in October and November, causing floods, flash floods, landslides, and storms. Cold and rainy periods dominate during December and January.

Village 1 is located in the northernmost part of the commune, along the Ho Chi Minh trail. It has 413 ha of natural area, with native secondary forest and acacia mono plantation accounting for the highest proportion, namely 180 ha and 160 ha respectively.

There are 114 households in the village, out of which 10 households are ranked as poor.

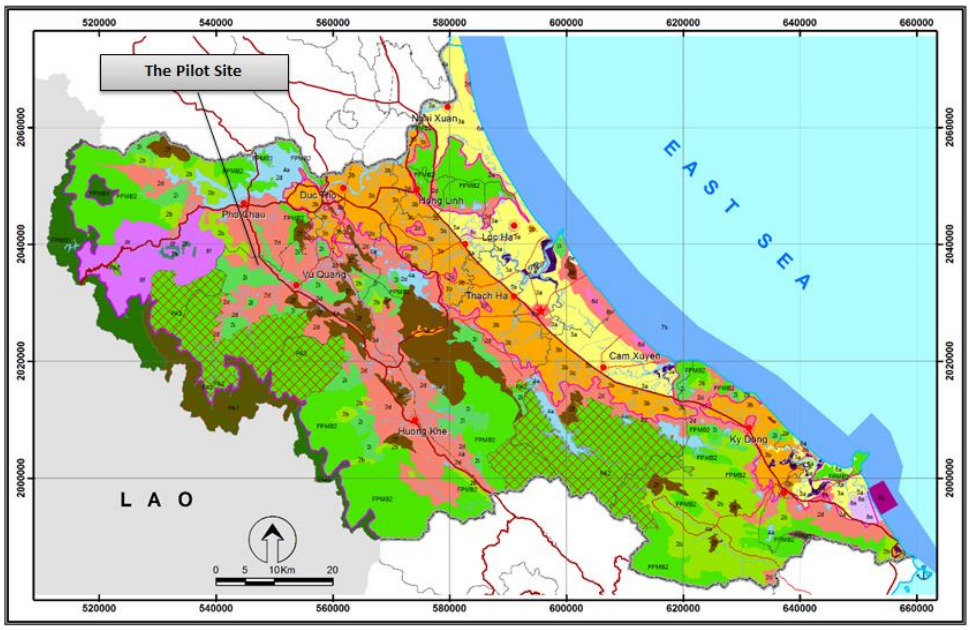
Village 1 experiences similar climate conditions as the rest of the commune, yet people here witness more severe impacts caused by droughts, as the natural water resources are more limited than in other villages. In agricultural production, while a small part of low and flat land is utilized for paddy rice and annual crops, orange - the crop bringing highest income - is located in hilly slopes, which causes a variety of difficulties for growers.

At this point, the socio-ecological system around Sơn Thọ commune as identified in the Vulnerability Assessment (VA) report shall be introduced briefly. This is done, since information on the socio-ecological system around Sơn Thọ commune will be utilized at a later point in this report. In the VA, the area around Sơn Thọ commune is defined as mainly ***moist tropical forest, mainly utilized through Kinh smallholder inland valley paddy rice cultivation and tree crops (acacia, citrus, rubber, tea)*** (ISPONRE, GIZ, and ICEM 2016, p. 94; see **Figure 6** below). This type of socio-ecological system is identified as being among the top 10 most important socio-ecological systems in Ha Tinh province[2], which were then subject to provincial level VAs (more precisely, the

[2] "The ranking was based on 12 criteria, encompassing ecological, social, economic, climatic and environmental

system has been ranked number nine out of ten priority socio-ecological systems) (ISPONRE, GIZ, and ICEM 2016, p. 95; see **Table 4** below).

Figure 6: Socio-ecological systems of Ha Tinh and the pilot site



Legend

- Province capital
- District capital
- District border
- National road
- Provincial road
- Rail way

Elevation

- 100m
- 700m

1. SUBTROPICAL FOREST >700m

- PA1. State PA Management (Vu Quang)
- FPMB1. FPMB on upland forest

2. MOIST TROPICAL FOREST < 700m and >10m

- PA2. State PA Management (Vu Quang, Ke Go)
- FPMB2. FPMB on lowland forest
- 2b. Kinh/Ethnic minority smallholder field + tree crops + forestry
- 2d. Kinh smallholder inland valley paddy cultivation + tree crops (acacia, citrus, rubber, tea)
- 2f. Kinh commercial rubber production
- 2f. Kinh commercial tea production
- 2i. Community forest management

Legend

- Province capital
- District capital
- District border
- National road
- Provincial road
- Rail way

Elevation

- 100m
- 700m

1. SUBTROPICAL FOREST >700m

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- FPMB2. FPMB on lowland forest
- 2b. Kinh/Ethnic minority smallholder field + tree crops + forestry
- 2d. Kinh smallholder inland valley paddy cultivation + tree crops (acacia, citrus, rubber, tea
- 2f. Kinh commercial rubber production
- 2f. Kinh commercial tea production
- 2i. Community forest management

factors identified in the profiles developed in the first phase of the project and the professional judgement of the consultant team" (ISPONRE, GIZ, and ICEM 2016, p. 93).

Top 10 priority socio-ecological systems in Ha Tinh

This table lists the ten priority socio-ecological systems as identified in the VA (ISPONRE, GIZ, and ICEM 2016, p. 95). **The socio-ecological system Sơn Thọ commune is located in has been marked green in this table**. It is ranked number nine out of ten priority socio-ecological systems in Ha Tinh.

Table 4: The top 10 priority socio-ecological systems in Ha Tinh

Rank	SES Code	Name of SES	% area
1	8a	Commercial and state water management infrastructure (dams, weirs, saline intrusion barrages, irrigation canals)	n/a
2	8h	Urban and rural settlement, industry, services	1.2
3	PA1+2	State SUF (National Park, Nature Reserve) Management (Vu Quang, Ke Go)	13.5
4	3a	Kinh smallholder lowland floodplain irrigated paddy rice cultivation	7.25
5	3b	Kinh smallholder floodplain-hills transition, paddy rice + mixed farming and tree crops	9.78
6	FPMB 1+2	Forest Protection Management boards on subtropical forest > 700m and moist tropical < 700 m	17.18
7	8e	State-managed Special Economic and Industrial Areas (coastal)	0.31
8	2b	Kinh and ethnic minority smallholder field and tree crops	6.51
9	2d	Kinh smallholder inland valley paddy rice cultivation + tree crops	15.29
10	6d	Kinh commercial shrimp aquaculture on sand	0.13
TOTAL AREA			**71.15**

5.2.2 The phenomenon in focus

Participatory identification report: Drought

According to the fieldwork conducted by the Ha Tinh team, the commune authority and villagers experience several climate change phenomena in their entire area, but Village 1 is considered as the most vulnerable spot. The phenomena include floods, flash floods, cold spells, droughts, and landslides. **One of those, namely severe and increased droughts,** brings numerous adverse impacts to people and ecosystems, which are: i) The second rice crop in the lower part of the location could not be cultivated due to water shortage; ii) Fruit trees and annual crops in the

middle part of the location (peanut, maize, green bean, cassava, etc.) did not grow well and many died; iii) Shortage of water for human use (people often directly use ground water from wells and surface water from streams in the forest); iv) Many lands are left fallow during droughts.

ICRAF's report: A more holistic perspective

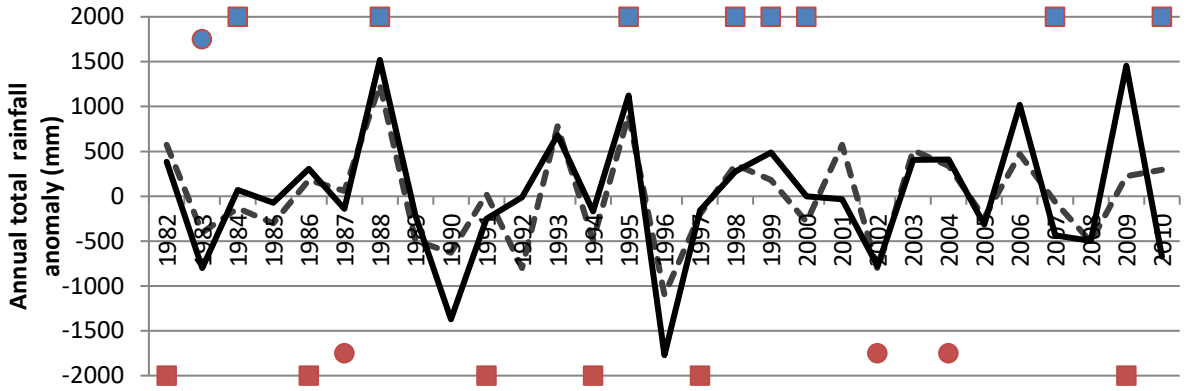
In the participatory identification reports, the proposed EbA-interventions target drought. However, as becomes clear from **Table 3**, and as has furthermore been evaluated by ICRAF, farmers identified several natural hazards or risks affecting agriculture production (such as floods and flashfloods; more hazards were identified during ICRAFs fieldwork, see **Annex 5.1** and **5.2**): In ICRAF's report, it is assessed that flash flood, drought, heavy rain, whirlwind and storm were **all** important natural hazards used in rankings for women and leader's groups, while men added cold spells but excluded heavy rain and storms (see **Table 21** in the Annex). Whirlwinds (tornadoes), heavy rain causing flash floods, and landslides occurred almost annually in the recent five to seven years, and can as such not be neglected. The fact that farmers focus on droughts can be expected during an El Nino-period (see information on El Nino-phenomenon below). The recent floodings in the province in October 2016 just show that frequency, intensity and impact of natural hazards need to be taken account of in **longer time scales** for designing interventions.

Weather phenomena and long-term climate change

Furthermore, many of the points provided in **Table 3** appear to be based on local experiences and on relatively recent weather phenomena. Again, when working with climate change, it is highly important to include long-term climate data and future projections, in order to avoid defining natural climate and weather variability as long-term climate change. Humans clearly also need to adapt to the former. However, regularly occurring weather phenomena need to be understood differently from climate change, as they occur with a certain regularity and predictability, only last for a limited period of time and do not necessarily worsen in their intensity. Frequency, intensity and impact of natural hazards thus need to be assessed **over a long period** of time to identify whether or not they are actually related to climate change. As part of its assessment report, ICRAF provided the following scientific data on weather phenomena and climate change in the focused-upon region:

Natural variations in rainfall - The natural variation in annual rainfall in the district is high and can vary up to 1500 mm between two years (see **Figure 7**); it is hence very difficult to identify trends and to forecast. ICRAF's analysis of meteorological data finds indications of less winter rainfall (which makes 5% of the total annual rainfall), which could mean that soil moisture levels remain lower and add to delayed spring season in drier years. Rainfall anomalies in many years are associated with ENSO (El Nino Southern Oscillation, referring to more rain during La Nina, less rain during El Nino phase). Both droughts and humid conditions lead to crop pests and yield reductions. According to ICRAFs fieldwork observations, farmers' perceptions about drought trends and whirlwinds are influenced by the recent El Nino-related drought conditions.

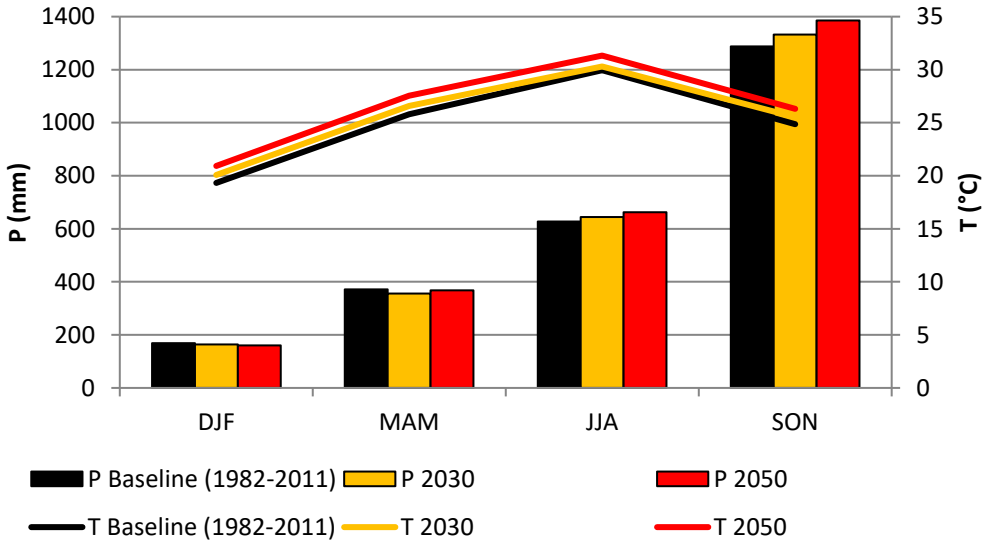
Figure 7: Rainfall anomalies showing interannual variability of annual total rainfall in Huong Son (dashed line) and Huong Khe (thick line) for the period 1982-2011. Blue (red) colors indicate La Nina (El Nino) phase, squares indicate long phases and circles a short (autumn) phase



Temperature - There was a non-significant increase in annual average temperature during 1982-2011. The highest observed temperatures were 42.6°C (Huong Khe) and 40.5°C (Huong Son). The number of days with temperatures above 40°C (Huong Son) was particularly associated with El Nino-periods, and increased from 1 day in the 1980s, peaked at 16 days in the 1990s, 12 days in 2000s and 2 days in 2010-2011 (**Annex 5.1**). Crop fertility will be particularly affected during hot years, which can be anticipated, as air temperatures increase. Crop selection should consider this.

Climate change scenarios (**Figure 8**) suggest that by the 2030s, springs (March-May) will be warmer and drier, and summers and autumns warmer and rainier. This means that **while spring crops need further adaptation, adapting to *only* droughts would be maladaptation.**

Figure 8: Climate change scenario based on high emission scenario for Huong Khe for 2030s and 2050s compared to baseline period (1982-2011). Scenario from IMHEN (Nguyen Van Thang and Hoang Duc Cuong)[3].



[3] For more information, go to http://vnclimate.vn/en/about/imhen/

Inputs from the VA report

Also the VA report assesses major climatic threats for the socio-ecological system around Sơn Thọ commune. It identifies multiple climate change threats as existing in regards to the socio-ecological system *Kinh smallholder inland valley paddy rice cultivation and tree crops*: Whilst it emphasizes that droughts constitute a major vulnerability factor (ISPONRE, GIZ, and ICEM 2016: 121), it also mentions a variety of other risks:

"In recent years, drought and heat have become more serious. Maximum temperatures in summer now reach 43°C, and last longer. Rice is killed, and farmers forced to plant again. Fruit trees grow slowly and productivity declines. There are shortages of drinking water. Cold snaps have also become more serious, with temperatures as low as 5°C. The cold can also kill rice; cold delays the flowering of citrus; in March, trees usually have small fruits, but this year [2016] they are just flowering. Flash floods have become more frequent and powerful, damaging rice and peanut crops, and causing loss of agricultural land from erosion" (ISPONRE, GIZ, and ICEM 2016, p. 119). The following table provides an overview over the focused-upon socio-ecological system's exposure and sensitivity as assessed in the VA report (ISPONRE, GIZ, and ICEM 2016, p. 120):

Table 5: Exposure[4] and sensitivity[5] of the inland valley socio-ecological systems to predicted climate change

Climate change variables and phenomena	Degree exposure	Nature of sensitivity (describe)	Degree sensitivity
TEMPERATURE			
Hot season is hotter and longer	HIGH		
By 2-3 deg C in 2050			
# Hot days >35C increasing	HIGH		
# Cold days/nights <5C increasing		Paddy rice can be killed; citrus flowering delayed	
Shift in timing of seasons			
Temperature rises more rapidly earlier in spring			
PRECIPITATION			
Wet season is getting wetter		Landslides, erosion increase(?), sedimentation in small reservoirs;	
5% more rain in summer by 2050		Ngan Sau valley is prone to flooding	
Dry season is getting drier			
5% less rain in spring by 2050			
More frequent drought	HIGH	Main crops require some irrigation	MOD
WIND AND STORMS			
Wind speeds higher	MOD	Citrus vulnerable to wind damage	
Storms frequency less predictable			
Storm season coming later			

[4] Exposure: Duration (length of time): Frequency; Location (area); Magnitude (size, volume); Intensity (power/energy involved; Aspect (topography)

[5] Sensitivity: Infrastructure: design, materials, siting, maintenance; Crops: tolerance (to duration, magnitude, intensity etc.)

From the above table, it becomes clear that the VA report particularly considers issues of drought, but also those related to storms and flooding as serious threats for the socio-ecological system Sơn Thọ commune is located in. It might thus be correct to pay particular attention to droughts, but **not sufficient to only focus** on these. This also becomes visible when looking at the recommendations provided for this particular socio-ecological system in the VA report:

*"***Storms, high rainfall > Flash floods**: Increasingly intense high rainfall events will add to the already frequent flash floods experienced along watercourses of narrow inland valleys, particularly where there are bottle-necks.

Hot Lao winds, drought > crop decline or failure: Paddy fields are typically irrigated by small reservoirs, vulnerable to running out of water. Field crops in unirrigated upland areas are killed by drought, which is often intensified by the hot Lao winds that will become more intense with climate change. Citrus is also sensitive to drought, suffering reductions in quality and production.

Hot Lao wind, drought > Fire: Fire hazards particularly occur where monocultures of timber crops are planted acacia or the more flammable eucalypts and pines but also occur.

Potential EbA Interventions

- Employ SRI [System or Rice Intensification] paddy cultivation systems where appropriate.
- Where irrigation water is in very short supply, switch crops from paddy rice, to less water demanding crops such as cassava and maize.
- Apply soil and water conservation practices to the cultivation of upland crops and citrus trees, especially on steep slopes, using contour planting, alley cropping, mulching, etc. to reduce erosion and encourage infiltration of rain water.
- Promote the use of nitrogen fixing (soil) cover crops to protect soils and enhance their fertility.
- Diversify the tree crops within plantation landscapes to increase the structural (and economic) complexity of the stands, and enhance their resilience to climate stress.
- When preparing land for plantation, or harvesting tree crops, leave strips of trees along the edges of rivers and streams (this will improve the water supply and water quality services).
- Change crop varieties, cropping pattern and adapt cropping calendar to suit changing conditions.
- Increase the rotation length for acacia, eucalyptus and pine, to protect the upland soils and control erosion, particularly around small reservoirs and other areas vulnerable to erosion.
- Protect all remaining watershed forests from unsustainable use and conversion to other uses, through revision of land use plans and their strict enforcement.
- Sustainable harvesting of timber and NTFPs [Non-Timber Forest Products]" (ISPONRE, GIZ and ICEM 2016, p. 202f.).

5.2.3 Specific EbA recommendations

ICRAF's overall recommendation

Even though droughts thus appear to constitute a major threat to Sơn Thọ commune and Village 1, it is important to **consider climatic challenges more holistically and over a longer time span**. More concretely, this entails:

Adopting a landscape perspective for EbA-projects to make spatial and temporal links visible. This means

- **viewing droughts, flashfloods and flooding as part of the same problem - and solution**
- **interventions at plot and landscape/catchment scales are framed with realistic short, intermediate, and long-term visible results per section**
- **maintaining the long-term build-up of ecosystem functions through customer-tailored packages of long-term planting schemes, capacity building and awareness raising activities (monitoring, farmer-extension field schools).**

Recommendations from the participatory identification reports

In the reports prepared by the Ha Tinh team, the following recommendations are given: A group of about ten households which have forest allocations nearby (around 3-5 hectare each) can join the pilot. Native timber species (for example, *Erythrophloem fordii, Calophyllum soulattri, Michelia mediocris, Castanea sativa)* are planted to enrich the upper part of the spot where a range of native species still exists, but the quality and composition of these are poor. Fruit trees are planted in the middle part of the hill, annual crops are planted in the lower part of the hill. People can put bee hives in their forests for earning some income, and for better pollination of their trees (as added values). A forest area of about 30-40 hectare managed and enriched can provide the following services: i) **Provisioning services** (surface water from streams for daily use, firewood, food for humans and animals from annual crops, income from fruit trees, annual crops and honey, etc.); ii) **Regulating services** (ground water and surface water increase and continuous availability, so people can use the middle and lower parts of the hill effectively, micro climate condition improvement, soil quality improvements); iii) **Supporting services** (habitat for native species, pollination for crops). These services will substantially **support people to cope with aforementioned droughts** by providing products and income.

ICRAF's specific recommendations

Four slope sections

In the participatory identification reports, the slope (transect) with proposed EbA interventions in Vu Quang consists of three sections divided by altitude (upper, middle, lower). However, during ICRAF's transect walk, it was found that the middle section of the intervention slope transect has irregular topography and varied land uses that require different types of interventions. Furthermore, as drying paddy fields in the lowlands are a problem, they should be part of the solution. ICRAF thus suggests to **sub-divide the sloping field into four sections**: upper, upper-middle (steep slopes), lower-middle (undulating terrain) and lowland. This will allow for better

targeted interventions due to the need for permanent tree cover on steep slopes and potential for agroforestry on undulating slopes.

Measures on the ground

In its report, ICRAF also provides suggestions for very concrete measures on the ground. These account for a more **long-term** (including both past and future climate projections) as well as more **holistic and landscape-level** approach to climate-change related issues in Sơn Thọ commune and, more specifically, Village 1:

Table 6: Proposed interventions with indicators for short-term monitoring and exit towards intermediate to long-term benefits.

Slope section	Sloping land practices and components Recommendations for Village 1, Vu Quang		**Indicators for anticipated benefits short-term (year 1-2) – intermediate (year 3-8) – long-term (year 8+)**
	Intervention "technology"	**Component**	Short-, intermediate, and long-term
Upper section	Forest enrichment in natural forest Multistory forest with different native tree species (different heights and ages) and under-vegetation that builds up and stabilizes soil	Native tree species should be considered for planting: dẻ (*Castanea sativa*), cồng trắng (*Calophyllum soulattri)*, giổi xanh (*Michelia mediocris)*, lim xanh (*Erythrophloem fordii)*, vàng tâm (*Manglietia conifera)* NTFPs and undervegetation (allowed in allocated natural forests): rattan, bamboo, orchids, medicinal plants such as ba kích (*Morinda officinalis*), cover grass - lạc dại (*Arachis pintoi*)	Short-term: • Seedling and tree survival rates Intermediate: • some income from NTFPs in allocated natural forests • reduced soil erosion • carbon sequestration Long-term: • Reduce soil erosion, prevent flash floods and flooding • Reduce impacts of storms – wind breaks • Micro climate regulation **Risks:** reduced income from timber trees for initial period demotivates farmers to maintain the model, acacia and fruit trees not allowed in natural forests
Upper middle section	Permanent plantation with selective cutting, stands with mixed age/species	Maintain planted acacia in allocated natural forest; For plots that have just been harvested or are going to be harvested: identify alternative	Short-term: • Income from NTFPs - bamboo shoots, honey, medicinal plants • Reduced soil erosion Intermediate: • reduced storm damage, • carbon sequestration, • pollination

	Undervegetation to bind soils Windbreaker trees to prevent damage on seedlings NTFPs	timber trees with different root structures , medicinal plants, e.g. *Morinda officinalis;* *Arachis pintoi* to bind soils Bee hives	Long-term: • reduced landslides, in-situ soil moisture recharge **Risks:** reduced income from timber trees for initial period demotivates farmers to main the model
Lower middle section	Agroforestry with hedgerows along contour lines soil erosion control, for fodder and green manure Water pond + drip irrigation system (if possible)) Biological pest control methods	Fruit trees* + annual crops + mulato or guinea grass/pine apple/shade tolerant ba kich (*Morinda officinalis*)/tea hedgerow, arachis pintoi as ground cover *) Mixed fruit trees e.g. orange, lime, jackfruit Bee hives Multipurpose hedgerow e.g. keo dậu - *Leucaenia lecophala (* as fodder mix <20% dry matter (for bovine) to avoid mimosin toxin)	Short-term: • fodder grass, honey , molasses? • prevent soil loss Intermediate: • Increase income sources from fruits and nursery • Pollination, biological pest control • Reduced soil degradation Long-term: • Microclimate regulation; reduced water stress **Risk:** uncontrolled pest and disease in fruit trees, poor germplasm; Leucaenia is good for soil improvement but should not be planted near free grazing animals
Plains (lowland)	Seasonal and weather forecast for adjusting the timing of planting/harvest and crop selection Intercrop annual crops Soil improvement with compost, biochar, biological pest control to build up top soil high in organic matter, that easily absorbs rain rather than creating hardpans (surface flow) Wind breaker and river stabilization	Keep 2 crop of rice where water allows; Short-duration crops that can be rotated with maize, peanut, beans Cassava with legumes for poor soils Sugarcane Bamboo, grasses	Short-term: • Avoid exposing plants during sensitive stage with the period of extreme weather events Intermediate: • Yield/income increase or stabilization (unclear which is farmers main priority)? • Improved soil carbon and nutrient status • Reduced emissions from inorganic fertilizer Long-term: • stabilized water regulation **Risk:** all exposure to natural hazards cannot be prevented; groundwater recharge depends on catchment land use and withdrawal

As becomes apparent from the above table, having **clear, measurable indicators** that focus on **key services** (limited in number) for a **relatively long time span** is greatly important when working with climate change adaptation. To make its suggestions even more concrete and to provide a template for future reference, ICRAF additionally provided a **step-wise indicator plan over a ten-year scale**, which should be used for the case at hand:

Figure 9: Step-wise indicator plan over a ten-year scale

				• Canopy cover cause: (1) increased soil moisture through litter; (2) build-up of top soil layer • Increased canopy cover in orange and natural forests • Fruits start to generate income						• Increased natural forest cover
			• Orange harvests generate income • *Year 3-4: Nursery provides stable supply of indigenous tree seedlings*							• Increase soil moisture • *Stream water regulated* • Improve ground-water recharge downstream
		• First grass harvest • Income from pine apple • Reduced soil erosion in orange-fodder grass plots; • Fertilizer plants improve soil nutrient status in orange fields • Improved technical skills through training and guidance								
• Harvest annual crops – gradually stabilizing yields • Income from honey										
Year 1*	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10+**

*) Assuming Year 0 is the layout of the slope, contours and planting schedule, first planting initiated.

The role of citrus trees

For the middle part of the slope, the plantation of fruit trees, with a particular focus on citrus trees, in barren or sparsely planted areas has been suggested by the Ha Tinh team. The VA report also acknowledges the great potential of citrus fruit trees: "Over the last 10 years, through New Rural Development and other government programs, villagers have been encouraged to replace the pine and plant up any bare areas with higher earning citrus, and now 80% of households grow them. Citrus species are particularly suitable here, as they are tolerant of poor soils and drought – although they do need some irrigation to supplement rainfall. Trees yield up to 125 kg/yr. when mature, and fruits sell at 40-100,000 VND/kg. They are estimated to earn up to 1 billion VND/ha/yr. – 10-20 times more than other crops" (ISPONRE, GIZ, and ICEM 2016, p. 117). According to provincial land use plans, the province's orange area is planned to further increase by 1.100 ha by 2020. Vu Quang district currently has 2.000 ha citrus, in which 1.900 ha is orange and planned to reach 2.900 ha by 2020 (these figures need further confirmation as the increase corresponds to the total increase in the province over the same period). By the end of 2015, Sơn Thọ commune had 228 ha orange plantations, aiming to expand another 100 ha in 2016.

As part of ICRAF's research, however, multiple issues have been identified with regards to such a strong focus on fruit trees:

1. orange, lime and annual crops had failed due to storms, drought, pest and disease
2. if the orange harvest takes place too early and supply exceeds demand, the revenue for farmers remain limited and not all fruits can be sold
3. *Government support* for orange plantation exists but "depends". According to district leaders, the district supports VND15.000/seedling if farmer plants 2 ha of orange. However, the commune leaders said the commune supports 20% and district 80% of orange seedlings, if farmers meet the criteria of orange plantation by commune and district norms. From a socioeconomic perspective the policy seem to favor larger-sized farms

ICRAF therefore suggests the following solutions:

1. before proposing oranges, find out what the **pests** are, why fruits drop or get diseases, check soil nutrient status and sourcing seedling quality to avoid greening disease
2. **adapt timing of flowering/fruiting** to avoid fruiting during high-risk periods > consider **delaying orange harvest** to December-February (closer to Tet), which would lead to higher return, but would demand more irrigation
3. a **market value analysis of orange plantation** might be needed**:** Despite plans for expansion, the point of market saturation in the near future should be identified. There are lessons to be learnt from previous rubber expansion and declining rubber prices
4. **diversification with other tolerant fruit trees** will be needed (jackfruit, mango, litchi)
5. explore if **links with fruit processing factories** can be established for drying, freezing and juicing to extend the sustainability and usability of the fruit
6. EbA-intervention could actively seek to **reduce inequalities in government support** for orange plantation by supporting the difference to smaller farms
7. Marketing. In 2015, Vu Quang district initiated an association to establish an orange trademark. The association includes members from DARD, the Farmers' Union and some other district branches as well as chairmans of communes and towns, and targets supermarkets in Ha Tinh Town. Seedlings are procured from Phuc Trach in Huong Khe district (Ha Tinh province) and Quy Hop in Nghe An province. The EbA project could actively aim for an inclusion of **Sơn Thọ farms and farmers in such a certification system**
8. Demonstration models. There are two **VietGap (Good Agriculture Practice) models of orange plantation** with drip irrigation system in Sơn Thọ commune that can be used as demonstration sites
9. **Farmer-managed community innovation funds** could be established for initial investments

Recommendations for upscaling and sustainability

Upscaling

In order to upscale the project, ICRAF recommends to **partner with organizations and local governments** that can conduct participatory landscape and farming system appraisals. **Joint teams of DARD and DONRE** seem to be beneficial to maximize the necessary expertise and the potential of enabling landscape planning interventions.

Finally, **liaisons with organizations and donors in Ha Tinh** that are advanced in terms of climate action, e.g. mass organizations, non-governmental research and/or development organizations such as the Farmers' Union, CGIAR, Belgian Technical Cooperation (BTC), Centre for Environment and Community Assets Development (CECAD), Scottish Rural Development Programme (SRDP) or the International Fund for Agricultural Development (IFAD) would create great advantages in terms of upscaling potential.

Sustainability

In terms of extending the sustainability of the project, ICRAF recommends to make use of the concept of **Remuneration of positive externalities (RPE)** in order to establish more sustainable catchment ecosystems and raise awareness as well as motivation among farmers.

Furthermore, **capacity building for inhabitants of Sơn Thọ commune** (particularly from Village 1) is suggested. For this, a thorough **Training Needs Assessment** needs to be conducted. Certain suggestions can however already be made:

1. learn more about **tree management technologies**, for instance from Ha Tinh Farmers' Union's model farms, Smart-Tree Invest project site (Huong Khe) and My Loi climate-smart village
2. training on the improved/increased use of **compost** in the lowland areas
3. **water-harvesting methods** could be explored further in fields and in/near home gardens, e.g. by visiting existing models for drip irrigation in the commune, rain-water collection from roof or in ponds
4. learn from **climate adaptation projects**/programs already implemented in Vu Quang district
5. establish **Farmer Field Schools** with learning landscapes based on farmers' own observations (**Annex 5.2**) where farmers are able to see impacts of technologies (rather than species), e.g. multistorey forests (for reduced climatic impacts), acacia plantations (extracting soil moisture), intercropping and mulching (conserving soil moisture)
6. strengthen **farmers' negotiation skills** on markets, access to and interpretation of weather and market information
7. establish **farmer groups** as implementing landscape **co-managers**. Outline the design of interventions at a landscape scale: make plans for planting, shortlist EbA-indicators for monitoring that are relevant for farmers and officers
8. prepare a **communication plan** and **awareness raising activities** for different target audiences
9. identify women and men farmers who can get some extra training, to promote and facilitate EbA in **farmer-to-farmer household exchange** in the village and commune

6. Overview over recommendations and implementation status (Objective 3)

Overall, ICRAF emphasized in its report that a more holistic perspective, including other types of extreme climatic events and more long-term assessments, would be needed to refine the participatory identification reports. This suggestion was made both in relation to the research conducted and the EbA measures suggested. Droughts, so the point of argumentation, do constitute a very serious threat, but need to be dealt with in an integrative manner, as part of which other phenomena such as floods and flashfloods get considered equally. Furthermore, ICRAF recommends that changes in intensity, frequency etc. of droughts should be assessed to see if **droughts actually are affected by climate change**; long-term climate change predictions and assessments of scientific data on temperature and precipitation do indicate more heat, but also more rain in the future, and furthermore hint at the fact that droughts of past years are related to the **El Nino phenomenon**.

As it was not possible to conduct further time- and resource intensive research as part of the fast track vulnerability assessment, and as pilot measures needed to be initiated relatively promptly, no additional studies have been performed in Sơn Thọ commune. ICRAF's recommendations on how to adjust EbA measures in accordance with such a more holistic, long-term perspective, however, have been included where this was possible and considered useful.

An overview over the originally suggested EbA measures, ICRAF's most important recommendations, the implementation plans and status as well as remarks on why certain measures are adopted and others are left out is provided below.

In summer 2017, based on the success of the current activites, it was furthermore decided to expand the ongoing measures. Additional forest enrichment including training and material provisioning are planned for fall 2017. The project also aims to have enlargened the training and material provisioning activities for bee keeping by the end of 2017. These measures have also been included at the end of the overview table.

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
Divide the slope into three sections**: upper, middle and lower section**	Divide the slope into **four sections**, including the low land: upper, upper-middle (steep slopes), lower-middle (undulating terrain) and lowland			The slope has been divided into four slope sections, however, pilot activities will mainly focus on the upper slope section, the lower middle slope section and the lowlands
Upper slope: **Native timber species** (for example, Erythrophloem fordii, Calophyllum soulattri, Michelia mediocris, Castanea sativa) are planted	**Upper slope:** **Native tree species** should be considered for planting: dẻ (Castanea sativa), cồng trắng (Calophyllum soulattri), giổi xanh (Michelia mediocris), lim xanh (Erythrophloem fordii), vàng tâm (Manglietia conifera) **NTFPs and undervegetation** (allowed in allocated natural forests): rattan,	- households in the upper slope section which had at least 1 ha of natural forests allocated as their property and held land use certificates for this land as well as which want to keep and enrich that area rather than having it clear cut for acacia plantation were selected for these measures - site check for the technical design	- 26 households have been selected as part of a meeting of the entire village	Native tree species are being planted, but no mention of undervegetation During site checks, some NTFP species were found under the forest canopy, such as *Dianella ensifolia* - material plant,

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	bamboo, orchids, medicinal plants such as ba kích (Morinda officinalis), cover grass - lạc dại (Arachis pintoi)	- technical training on planting and taking care of trees, as well as managing the existing forests - site checks before and after the planting of trees - training on monitoring the plantation processes	- technical training is being provided - number of trees planted: 3.788 *Manglietia glauca* seedlings*, 3.788 Erythrofloeum fordii* seedlings*, and 5.043 Cinnamomum iner* seedlings - two technical checks (before strip clearance and hole digging; and after plantation of trees) completed - survival rate is about 90%, and trees are growing well - farmers keep tending trees	Rattan, *Ardisia silvestris* - medicinal plant. No plan for utilization of these findings has been established so far, as a comprehensive survey and further support are needed for a market analysis and the eventual introduction of any related interventions
	Upper middle slope: Maintain planted acacia in allocated natural forest; For plots that have just been harvested or are			For acacia: the planting density can be adjusted, as the current density is quite high Farmers could use another species of acacia (*Acacia auriculiformis* instead of hybrid acacia), which however needs a

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	going to be harvested: identify **alternative timber trees** with different root structures, medicinal plants, e.g. *Morinda officinalis; Arachis pintoi* to bind soils			long time span (more than 10 years, instead of 4-5 year rotation now) until it is able to provide services such as soil improvement, minimization of run off and erosion, etc. *Morinda officinalis:* there exists a strong need to analyze the soil conditions to ensure this species fits with soil conditions before introducing it to farmers, yet this could be considered for future implementation *Arachis pintoi* is not suitable to plant under acacia, as acacia closes its canopy early, around 1.5 years after planting, and acacia is first harvested 2.5 year after its canopy closed
Fruit trees planted in **middle part of the hill**	**Lower middle slope**: **Fruit trees** (Mixed fruit	- households in the lower middle slope which plant native timber species on	- 27 households have been selected as part of a meeting of the entire village	Focus remains on oranges rather than mixed fruit trees; this is because there exists a

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	trees e.g. orange, lime, jackfruit)	their entire site were selected for these measures - technical training on planting and taking care of trees - site check before and after the planting trees - training on monitoring the plantation processes	- technical training provided - trees planted: 2.145 seedlings - two technical checks (before strip clearance and hole digging; and after plantation of trees) completed - survival rate is about 95%, and trees are growing well - farmers keep tending trees	bigger market for oranges than for limes or other citrus fruits; Farmers have limited to no interest in growing jackfruit, as this species doesn't provide good income, and it requires an extremely long time to grow until it produces fruit
	Annual crops + mulato or guinea grass/pine apple/shade tolerant ba kich (Morinda officinalis)/tea hedgerow, arachis pintoi as **ground cover**		Pineapples have been included in middle part of the slope as contour line. Pineapples are growing well, technical instructions on stimulating flowers and fruits was provided. *Arachis pintoi* is planted under orange trees for soil binding, to store moisture	*Morinda officinalis*: see lower middle slope

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
			and eliminate grass for the orange trees Annual crops (cassava, peanut) planted in this slope section where possible, self-funded by farmers	
	Multipurpose hedgerow e.g. keo dậu - Leucaenia lecophala (as fodder mix <20% dry matter (for bovine) to avoid mimosin toxin)			*Leucaenia lecophala*: not introduced any more, as it requires complicated treatment techniques before it can be used, which are too complex for the local framers to apply them Thorough consideration on the design of the middle part slope intervention has been undertaken
	1. Before proposing oranges, find out what the **pests** are, why fruits drop or get diseases, check soil nutrient status and sourcing seedling quality to			1. Pest and disease matters were addressed during the technical training and site check

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	avoid greening disease 2. Adapt **timing of flowering/fruiting** to avoid fruiting during high-risk periods > consider delaying orange harvest to December-February (closer to Tet), which would lead to higher return, but would demand more irrigation 3. A **market value analysis** of orange plantation might be needed: Despite plans for expansion, the point of market saturation in the near future should be identified. There are lessons to be learnt from previous rubber expansion			2. Farmers knew how to keep oranges for Tet, and many farmers are applying this technique 3. The district has developed a proposal on expanding orange plantation areas which a market analysis is a part of

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	and declining rubber prices 4. **Diversification** with other tolerant fruit trees 5. Explore if links with **fruit processing factories** can be established for drying, freezing and juicing to extend the sustainability and usability of the fruit 6. EbA-intervention could actively seek to **reduce inequalities** in			4. Jackfruit, mango and litchi were experimented with at the site; however, oranges produce the highest return, and are not complicated for farmers. In addition, the district has developed a proposal on expanding the orange plantation areas which will create more benefits for the farmers (an incentive support program would be established, farmers can join trade fairs, etc.) 5. This step requires a long-term analysis with the involvement of many different stakeholders > constitutes a potential future option, yet also one which demands extensive resource

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	government support for orange plantation by supporting the difference to smaller farms 7. **Marketing**. In 2015, Vu Quang district initiated an association to establish an orange trademark. The association includes members from DARD, Famer Union and some other district branches and chairman of communes and towns, and targets supermarkets in Ha Tinh Town. Seedlings are procured from Phuc Trach in Huong Khe district (Ha Tinh province) and Quy Hop in Nghe An province. The EbA project could actively aim for an			6. The district (the Extension Centre on behalf of the district) works closely together with the EbA team to generate more equality in support for orange growers (famers with EbA interventions are not eligible to receive support from the orange expanding proposal) 7. The province (the Extension Centre on behalf of the province) is planning to organize an orange trade fair where orange growers from the province are invited to bring their products to the fair. This is an important chance for them to introduce their products

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	inclusion of Sơn Thọ farms and farmers in such a certification system			
	8. **Demonstration models**. There are two VietGap (Good Agriculture Practice) models of orange plantation with drip irrigation system in Sơn Thọ commune that can be used as demonstration sites	- district staff, commune staff and villagers will join the trip to these good practice examples (planned for 20 people)	8. DONRE Ha Tinh will organize the trips for farmers to visit these models in the fourth quarter of 2017	
	9. **Farmer-managed community innovation funds** could be established for initial investments			9. Not introduced yet > point for potential later inclusion
	Bee hives in lower middle slope	- 27 households which plant native timber and orange trees on their land	Bee hives are being set up and training on how to hold bees as well as M&E mechanisms established	Bee hives are better placed in the lowland areas, where people live, as they can frequently check up on the

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
		have been selected for this measure - 10 bee hives/ household - technical trainings for raising bees and monitoring them	About 1.6 tons of honey were extracted in the period from April to August 2017. The next honey season will start in March 2018	hives; they have therefore mainly been set up in the lowlands The up to 185kph fast typhoon in September 2017 affected beehives and swarms (around 20 out of 270 beehives were damaged due to strong winds, which led to a decrease in the bee population)
Fish ponds	**Lowlands:** Keep 2 crops of rice where water allows; **short-duration crops** that can be rotated with maize, peanut, beans; cassava with legumes for poor soils; sugarcane ; bamboo, grasses	-a small number of ponds for raising fish using water from the forests	A small number of ponds for raising fish using water from the forests are being set up	Farmers already planted different species in the lowlands, such as paddy field, cassava, sugar cane, maize, peanut, grass

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
Bee hives		- 27 households which plant native timber and orange trees on their land have been selected for this measure - 10 bee hives/ household - technical trainings for raising bees and monitoring them	Bee hives are being set up and training on how to hold bees as well as M&E mechanisms established	
	M&E mechanisms: interventions at plot and landscape/catchment scales are framed with **realistic short, intermediate, and long-term visible results** per section (see overview suggestions and step-wise indicator plan ICRAF)	M&E mechanisms for all activities	M&E mechanisms have been included in all interventions, particular attention is being paid to the planting of seedlings; training on M&E is provided	Except for planting of seedlings and middle slope intervention, no long-term perspectives and indicators have been included yet (ICRAF's step-wise indicator plan (**Figure 9**) should be taken into consideration here

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	Upscaling: 1. **Partner with organizations** and local governments that can conduct participatory landscape and farming system appraisals. Joint teams of DARD and DONRE			1. Close cooperation with both DARD and DONRE, DONRE is doing the capacity development component - including study trips to good practice examples, organizing a workshop for sharing lesson and trainings to farmers, but no replication/upscaling conducted through these institutions yet > point for potential later inclusion
	2. **Liaisons with organizations** and donors in Ha Tinh that are advanced in terms of climate action			2. Close cooperation with Vu Quang National Park for ecosystem restoration and management, with the district Extension center for the orange planning activities, with the provincial Extension center for introducing oranges, and for

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
				soil improvement through contour planting techniques
	Sustainability: 1. Remuneration of positive externalities (**RPE**)			1. Not introduced yet > point for potential later inclusion
	2. **Training Needs Assessment (TNA)**	- TNA for at least three relevant topics - trainings on the identified topics for commune staff and farmers	2. 100 farmers and commune staff participated in three trainings (water resource management, CC, and CCA/EbA)	
	3. Learn more about **tree management technologies**, for instance from Ha Tinh Farmer Union's model farms, Smart-Tree	- district staff, commune staff and villagers will join a trip to these good practice examples (planned for 20 people)	3. One trip for 12 villagers and commune staff was organized to visit professional nurseries in Ha Tinh, where farmers learned how to select good seedlings, and how to maintain these for future use	

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
			One trip was organized for 10 villagers and commune staff to visit forest enrichment projects in the neighboring province Nghe An	
	4. Training on the improved/increased use of **compost** in the lowland areas	- about 10 households will join this activity	4. Training on production and usage of compost (particularly in the lowlands) arranged by the district Extension center: In September 2017, 20 farmers from 10 families took part in this activity. 6 tons of compost each will be available for tending orange and sugar cane plants in November.	
	5. **Water-harvesting methods** could be explored further in fields and in/near home gardens, e.g. by visiting existing models for drip	- about 5 households will join this activity	5. A field survey was conducted to check sites, technically design and propose necessary equipment in August. 03 households were identified	

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	irrigation in the commune, rain-water collection from roof or in ponds 6. Learn from **climate adaptation projects/programs** already implemented in Vu Quang district 7. Establish **Farmer Field Schools** with learning landscapes based on farmers' own observations where farmers are able to see impacts of technologies (rather than species), e.g. multistorey forests (for reduced climatic impacts), acacia plantations (extracting soil moisture),	- district staff, commune staff and villagers will join the trip to these good practice examples (planned for 10)	as suitable for this activity. The set up will be done in November 2017	7. Not introduced yet, can be suggested to the local government (Farmer Union) so they can integrate this recommendation into their plans

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	intercropping and mulching (conserving soil moisture)			
	8. Strengthen **farmers' negotiation skills** on markets, access to and interpretation of weather and market information			8. Not introduced yet, can be suggested to the local government so they can integrate this recommendation into their plans
	9. Establish **farmer groups** as implementing landscape co-managers			9. Not introduced yet, can be suggested to the local government (Farmer Union) so they can integrate this recommendation into their plans
	10. Prepare a **communication plan** and **awareness raising** activities for different target audiences	A workshop to present the results and share lessons with other stakeholders will be organized in the district	10. Planned for December 2017	10. Awareness raising activities planned, yet no communications plan established

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
	11. Identify women and men farmers who can get some extra training, to promote and facilitate EbA in **farmer-to-farmer household exchange** in the village and commune			11. Not introduced yet, can be suggested to the local government (Women Union for example) so they can integrate this recommendation into their plans
		Additional forest enrichment with native timber species: Since initial good results could be reached through forest enrichment activities for the first 27 households in Village 1, additional forest enrichment activities are planned.	An additional 30 households from neighboring villages with similar ecosystems and livelohoods were selected during three village meetings. These 30 households will take part in forest enrichment activities on an average area of 1ha per household. Technical training is planned for the second week of October 2017. Planting will be initiated after the trainings have been conducted.	

Recommendations Participatory Identification	Recommendations ICRAF	Implementation Plan	Implementation Status	Remarks
		Additional bee keeping: Since initial good results could be reached through bee keeping activities in Village 1, additional training and material for bee keeping shall be provided.	Around 30 households will receive 5 beehives per household that contribute to rapid livelihood intervention and to supporting ecosystem services via pollination. Technical training and the provisioning of beehives are planned for the third week of October.	

7. Challenges in participatory identification

A major challenge that became visible as part of the participatory identification process is that EbA constitutes a concept which remains relatively unknown among local people; its basic functions and principles as well as potentials are not well established in a Vietnamese local context. That means that before on the ground EbA-related assessments could take place, thorough elaborations on EbA as an adaptation approach were key. Further in-depth clarification will be needed before and during the implementation of (particularly participatory) EbA measures. The fact that EbA does not yet constitute a well-known approach on the ground makes clear once again that more work on knowledge- and experience sharing as well as concrete EbA implementation is urgently needed.

Related to this point is the issue of other climate change adaptation options such as Climate Smart Agriculture or Climate Smart Villages being implemented in the province. The lack of a clear understanding on what EbA entails leads to confusion among local people and authorities as to what can be defined as EbA, and how it relates to other concepts and approaches as named above. Again, further knowledge sharing and explanation of linkages as well as differentiations between different adaptation options will be needed here in the future.

Other challenges experienced by the Ha Tinh team were related to a lack of scientific data on climate change in the vulnerable areas, which partly hindered the establishment of long-term and scientifically based assessments, a point also elaborated upon by ICRAF (see for instance **Annex 5.1**). Furthermore, it sometimes occurred that farmers had problems identifying qualitative losses and impacts which are difficult to quantify, which means that certain qualitative impacts might not have been registered as part of the participatory assessment.

Also, it became clear that the increasing trend of clearing natural forests for the planting of commercially more valuable species will constitute a challenge for future climate change adaptation measures in the province. Introducing principles such as the Remuneration of Positive Externalities might constitute a way to establish alternative and more sustainable perspectives on value in nature.

Finally, the implementation planning for the suggested measures is time consuming and might affect local cultivation calendars. Sufficient resources in terms of time and manpower need to be set aside for this step, and the benefits of adjusting or interfering with local cultivation calendars made clear.

MONITORING AND EVALUATION

8. Monitoring and evaluation in Ha Tinh province

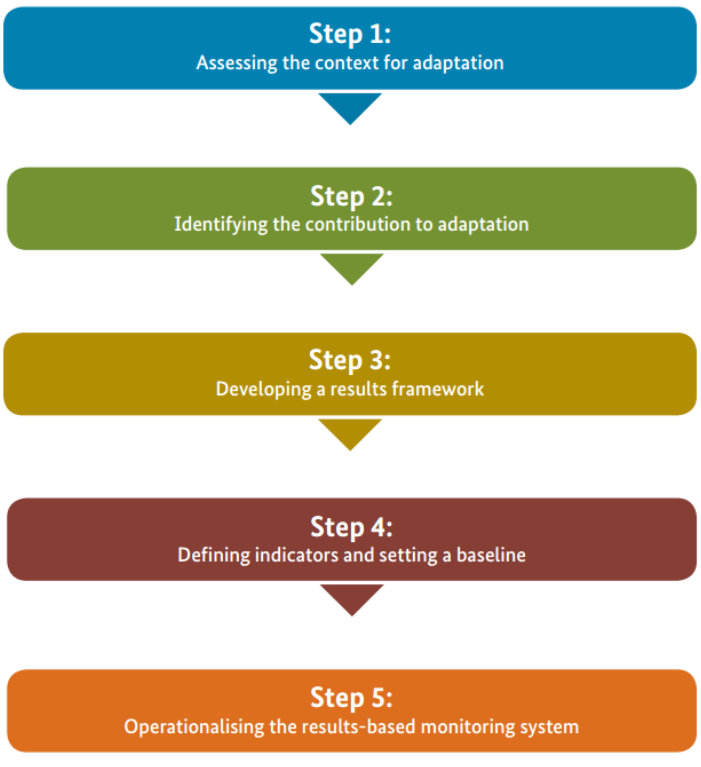
Effective monitoring and evaluation (M&E) of ecosystem-based adaptation activities is critical for building a strong, global evidence base around the approach and for assessing the wide, diverse range of interventions being implemented under the umbrella of EbA. At the global level, monitoring and evaluation is a tool for identifying and documenting successful projects and approaches and tracking progress toward common indicators. At the project level, the purpose is to track implementation and outputs systematically, and to measure the effectiveness of projects, while strengthening understanding around the many multi-layered factors underlying EbA. By doing so, M&E can also prevent future implementation problems in EbA such as mal-adaptation (GIZ 2016, p. 1).

In order to systematically understand and control the developments of the pilot activities in Ha Tinh as identified and described above, the EbA project team developed a monitoring and evaluation approach for these specific EbA measures. Its methodology and specific implications shall be elaborated upon in this chapter.

8.1 Methodology

The M&E methodology developed for the pilot activities of the project 'Strategic Mainstreaming of Ecosystem-based Adaptation in Viet Nam' rests in its main features on recommendations given in a 2016 concept note on monitoring and evaluation for EbA that was prepared as part of the project (GIZ 2016). These recommendations were then further developed and tailored into a context-specific system of indicators (see **8.1.4**). The afore mentioned concept note builds on a comprehensive, GIZ-developed framework of M&E for climate change adaptation whose core documents are training slides with the title 'Integrating climate change adaptation into development planning - Additional Modules on Monitoring and Evaluation' (2013a), and the guidebook 'Adaptation made to measure - A guidebook to the design and results-based monitoring of climate change adaptation projects' (2013b). In 'Adaptation made to measure', GIZ suggests a five-step approach to monitoring and evaluating adaptation activities (see **Figure 10**). This step-by-step guide has been developed to support practitioners in the strategic buildup of a framework to monitor and

Figure 10: Five step model of GIZ's 'Adaptation made to measure' framework (GIZ, 2013b)



evaluate the implementation of their adaptation activities (GIZ 2016, p. 2). To be able to effectively measure the outputs, outcomes and impact of adaptation actions, the guide furthermore provides support for the development of SMART (Specific, Measurable, Attainable, Relevant and Time bound) indicators (GIZ 2013a; 2013b). When applying this five-step methodology to an EbA context, where an underlying understanding is that economy, society and ecosystems are intrinsically linked in their functioning, the environmental, economic and social impact of climate change needs to be taken into account each step of the model (GIZ 2016, p. 2).

8.1.1 Step 1: Assessing the context for adaptation

The standard procedure for assessing context in EbA is a vulnerability assessment. This tool is used to measure the vulnerability and resilience of a specific ecosystem (and its services), as well as the vulnerability, resilience and adaptive capacity of human communities. It forms the basis for outlining options and barriers to EbA measures (GIZ 2016, p. 3).

In the identification process of the pilot sites and activities in Ha Tinh as described above, steps 1-4 (see **chapter 4.1**) depict a vulnerability assessment process that, due to its holistic approach, took ecological, economic and social factors equally into account. This participatory assessment and the resulting activities were then furthermore streamlined with the extensive vulnerability assessment for socio-ecological systems (VASES) that was conducted as part of the EbA project in Ha Tinh and Quang Binh province (see **chapter 2**). Here, coherent systems were identified based on social, economic and ecological factors. Thereby, the above described understanding of society, ecology and economy being strongly interlinked was acknowledged. Vulnerabilities to climate change on all three levels were considered; based on these, a ranking of both the most important and the most vulnerable socio-ecological systems in the provinces as well as response mechanisms could be identified.

8.1.2 Step 2: Identifying the contribution to adaptation

To identify the contribution of a measure to adaptation, 'Adaptation made to measure' suggests working with the three dimensions *Building adaptive capacity; Measure for reducing identified risks/vulnerabilities* and *Successful development despite climate change (sustained development)*, and determining an adaptation contribution for each of these. For Ha Tinh province, the following table was developed:

Table 7: Contribution to adaptation

Dimension	EbA pilot measure	Activities	Contribution to adaptation
1. Building adaptive capacity[6]	Providing capacity development activities within the EbA pilot measure - **dealing with droughts**	• Provide technical knowledge to farmers through **on-site trainings** on how to use the upper section of the slope by protecting and enriching native forests to cope with the shortage of water resources (regulating service) • Provide technical knowledge to farmers through **on-site trainings** on how to use the middle section of the slope by planting oranges, pineapple and pinto peanut as contour techniques to improve soil conditions (control erosion, generate moisture content) • Provide technical knowledge to farmers on how to initiate and maintain short-term income generating activities (more specifically, bee keeping) through **on-site trainings** • Provide knowledge to farmers on defining ecosystem services which they benefit from through the pilot, and raise awareness on maintaining those benefits, through **group discussions** • Provide positive examples and lessons learned from farming practices that gain multiple benefits from a certain area of land through **study visits** to good practices nearby • Provide adequate information on climate change, its negative impacts, adaptation measures ("grey" and "green" ones); raise awareness among farmers and local (commune) decision makers on using/managing nature in environmentally friendly manners, through **awareness raising activities** • Provide opportunities for sharing lessons learnt from the pilot with decision makers and farmers in other places in the province where similar conditions exist to create interest in	• Understanding of farmers and local (commune) authorities on climate change and its negative impacts • Development of local community's adaptive capacity to deal with negative climate change impacts, in particular with droughts in this area • Behavioural change among farmers towards more sound farming practices over time • Shift in orientation and attitudes of local decision towards integrating "green" adaptation measures together with "grey" options

[6] Adapted from IPCC. 2014. "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." Geneva, Switzerland: Intergovernmental Panel on Climate Change.

Dimension	EbA pilot measure	Activities	Contribution to adaptation
		upscaling possibilities through a **workshop**	
	Enhancing the natural ability of terrestrial ecosystems to adjust to water scarcity	• **Planting timber trees** to create habitats for other plant species • **Planting fruit trees** and -plants (orange and pineapple) with contour techniques to control run-off and erosion • **Planting pinto peanut** to bind soils and keep moisture • **Keeping bees** for pollination of other crops	• Increase the vegetation layers which later on maintain underground water storage capacity • Bind soils to reduce erosion and run off, then improve soil fertility • Good forest quality and increased pollination create good conditions for other plant species to grow and substantially increase the underground water provisioning and storage capacity
2. Measure for reducing identified risks - water shortage	Developing healthy ecosystems that are resilient to changing climatic conditions (different slope sections of the terrestrial ecosystems are more resilient to droughts)	• **Protecting and planting native timber species** to get provisioning services (firewood, shoots, honey, animal fodder, water), regulating services (micro climate, underground water provisioning and storage capacity, erosion control, pest and insect control, moisture content), cultural services (recreational values) • **Planting fruit species** (orange and pineapple) in contour for provisioning services (fruits, seedlings), regulating services (micro climate, erosion control, pest and insect control, moisture content), cultural services (recreational values) • **Planting pinto peanut** to get provisioning services (materials for manure, animal fodder), regulating services (erosion control, moisture content), cultural services (recreational values) • **Keeping bees** for provisioning services (honey, wax, new hives), supporting services (pollination function), cultural services (recreational value through more pollination, thus more abundance and diversity)	Key ecosystem services such as water storage capacity of soils, erosion control and micro climate regulation that are central to dealing with changing climatic conditions in the area, particularly droughts, are enhanced.

Dimension	EbA pilot measure	Activities	Contribution to adaptation
3. Successful development despite climate change (sustained development)	The pilot is aligned with the local government's orientation on proper land use (maintaining natural forests instead of monoculture acacia), and farmers' commitment is enhanced (farmers are interested in protecting their natural forests as they understand the values provided by the pilot)	• **Effectively communicating and sharing experiences** with local governments and farmers • **Maintaining the existing pilot** by constant upkeeping of the activities • **Providing further support** through technical monitoring • **Expanding to other places** where possible • Bringing people from other places **to visit the pilot** for knowledge and experience sharing	• Effective communication and knowledge sharing of activities with farmers and local decision makers on climate change and its impacts on nature and human lives to create a consensual basis for climate change adaptation • Affirmation and support that climate change and climate change adaptation are taken up during public events for the development of local adaptation plans • Farmers and local decision makers understand the causes and impacts of climate change and see a need to adapt to them to maintain sustainable development for the area; they therefore change their behaviour in nature management (from exploiting natural resources without care to protecting them for longer benefits)

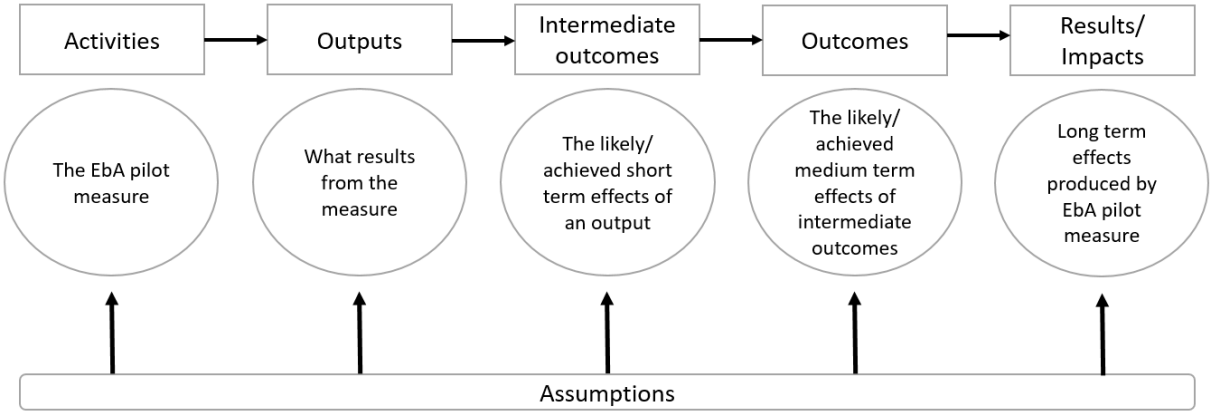
As established in the afore described participatory assessment processes (see **chapter 5**), the above table reveals that contribution to adaptation is particularly sought through EbA measures addressing drought- and water scarcity-related issues. The actual contributions identified then range from skill- and knowledge capacity development over increases in regulating and provisioning services to more awareness and focus on climate change and climate change adaptation among both local communities and decision makers. Having defined these categories of contribution to adaptation is highly useful for the development of a results framework in a next step, where strategic groupings of activities are needed, and where outputs, outcomes and impacts towards successful contribution to adaptation are identified.

8.1.3 Step 3: Developing a results framework

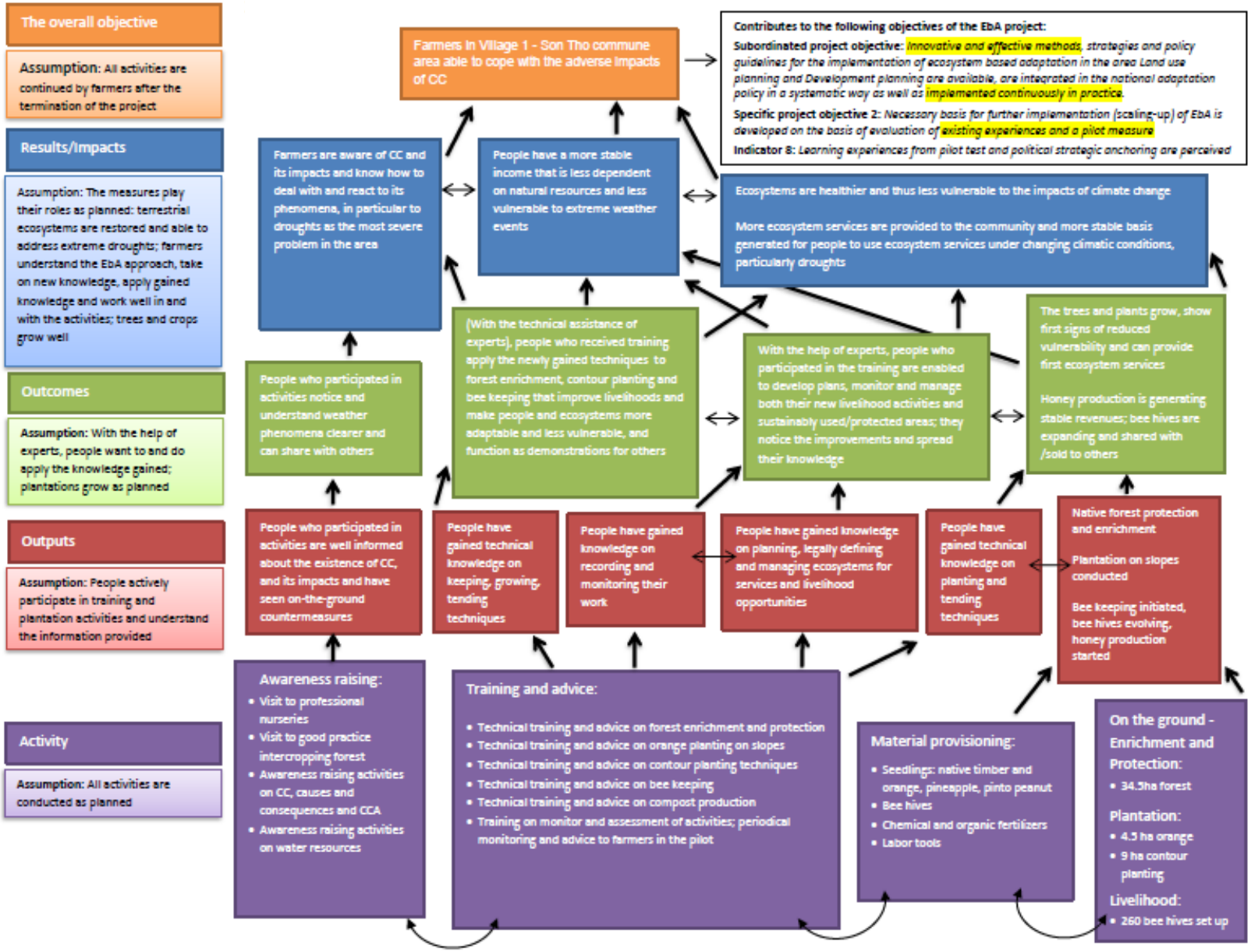
To monitor the successful contribution to adaptation, a results framework, also known as a 'logframe' with outputs, outcomes and impacts as well as underlying assumptions needs to be

defined. For this process, the 2016 concept note suggested a structure as shown below (GIZ 2016, p. 4).

Figure 11: Suggested results framework



However, EbA with its integrated and holistic approach requires an iterative, flexible and adaptive process to prevent mal-adaptation (GIZ 2016, p. 4). Due to the complexity and dynamic character of EbA measures, it was decided to take the results framework further and work with a Theory of Change methodology to develop outputs, outcomes and impacts. This model allows for more intermediate re-evaluation based on monitoring, which is key for every adaptation project, as conditions and circumstances, and thus results and activities may change along the way. For the pilot activities in Ha Tinh province, the following results framework based on a Theory of Change was developed:


The overall objective
Assumption: All activities are continued by farmers after the termination of the project
Results/Impacts
Assumption: The measures play their roles as planned: terrestrial ecosystems are restored and able to address extreme droughts; farmers understand the EbA approach, take on new knowledge, apply gained knowledge and work well in and with the activities; trees and crops grow well
Outcomes
Assumption: With the help of experts, people want to and do apply the knowledge gained; plantations grow as planned
Outputs
Assumption: People actively participate in training and plantation activities and understand the information provided
Activity
Assumption: All activities are conducted as planned
Farmers in Village 1 - Son Tho commune area able to cope with the adverse impacts of CC
Contributes to the following objectives of the EbA project:
Subordinated project objective: Innovative and effective methods, strategies and policy guidelines for the implementation of ecosystem based adaptation in the area Land use planning and Development planning are available, are integrated in the national adaptation policy in a systematic way as well as implemented continuously in practice.
Specific project objective 2: Necessary basis for further implementation (scaling-up) of EbA is developed on the basis of evaluation of existing experiences and a pilot measure
Indicator 8: Learning experiences from pilot test and political strategic anchoring are perceived
Farmers are aware of CC and its impacts and know how to deal with and react to its phenomena, in particular to droughts as the most severe problem in the area
People have a more stable income that is less dependent on natural resources and less vulnerable to extreme weather events
Ecosystems are healthier and thus less vulnerable to the impacts of climate change
More ecosystem services are provided to the community and more stable basis generated for people to use ecosystem services under changing climatic conditions, particularly droughts
People who participated in activities notice and understand weather phenomena clearer and can share with others
(With the technical assistance of experts), people who received training apply the newly gained techniques to forest enrichment, contour planting and bee keeping that improve livelihoods and make people and ecosystems more adaptable and less vulnerable, and function as demonstrations for others
With the help of experts, people who participated in the training are enabled to develop plans, monitor and manage both their new livelihood activities and sustainably used/protected areas; they notice the improvements and spread their knowledge
The trees and plants grow, show first signs of reduced vulnerability and can provide first ecosystem services
Honey production is generating stable revenues; bee hives are expanding and shared with /sold to others
People who participated in activities are well informed about the existence of CC, and its impacts and have seen on-the-ground countermeasures
People have gained technical knowledge on keeping, growing, tending techniques
People have gained knowledge on recording and monitoring their work
People have gained knowledge on planning, legally defining and managing ecosystems for services and livelihood opportunities
People have gained technical knowledge on planting and tending techniques
Native forest protection and enrichment
Plantation on slopes conducted
Bee keeping initiated, bee hives evolving, honey production started
Awareness raising:
Visit to professional nurseries
Visit to good practice intercropping forest
Awareness raising activities on CC, causes and consequences and CCA
Awareness raising activities on water resources
Training and advice:
Technical training and advice on forest enrichment and protection
Technical training and advice on orange planting on slopes
Technical training and advice on contour planting techniques
Technical training and advice on bee keeping
Technical training and advice on compost production
Training on monitor and assessment of activities; periodical monitoring and advice to farmers in the pilot
Material provisioning:
Seedlings: native timber and orange, pineapple, pinto peanut
Bee hives
Chemical and organic fertilizers
Labor tools
On the ground - Enrichment and Protection:
34.5ha forest
Plantation:
4.5 ha orange
9 ha contour planting
Livelihood:
260 bee hives set up

The results framework for Ha Tinh takes a starting point in the activity categories *Awareness raising; Training and advice; Material provisioning* and *On the ground activities*. This structure is different from how the results framework was set up in Quang Binh province, where training and advice activities were divided into two separate fields based on the content of the activities they related to. After thorough consultation with local experts from Ha Tinh, the division as shown above was selected as the most suitable one for the pilot activities in the province.

The above framework shows how different activities are planned to lead to specific short-term outputs, mid-term outcomes and long-term impacts, with the latter being closely linked to the afore identified contribution to adaptation. Multiple activities complement each other or are interlinked, indicated by the double arrows in the results framework. Eventually, all activities aim at contributing to the overall objective of the pilot, namely that farmers in Village 1 are able to cope with the adverse impacts of climate change. This objective in turn synchronizes well with explicit objectives of the EbA project as identified in the project document. These are:

- **Subordinated project objective:** Innovative and effective methods, strategies and policy guidelines for the implementation of ecosystem based adaptation in the area Land use planning and Development planning are available, are integrated in the national adaptation policy in a systematic way as well as implemented continuously in practice
- **Specific project objective 2:** Necessary basis for further implementation (scaling-up) of EbA is developed on the basis of evaluation of existing experiences and a pilot measure
- Indicator 8: Learning experiences from pilot test and political strategic anchoring are perceived as as good practice in national and international networks.

All activities, outputs, outcomes and impacts, and even the overall objective of the pilots are based on certain assumptions, which can be found on the left side of the results framework. These are highly important, as they explain underlying expectations and planned circumstances which are needed for activities to evolve the way they are supposed to, and thus for them to create the intended impact. When developments within a project take unexpected turns, this might be due to wrong or too optimistic assumptions. In such case, it is then possible to go into the Theory of Change framework, adjust assumptions and, based hereon, change outputs, outcomes and impacts of activities, and eventually re-work the indicators identified. Alternatively, if assumptions prove to be entirely wrong, they constitute a useful starting point for the re-assessment of the project and its goals, and potentially the adjustment of activities.

The generation of a results framework is thus extremely crucial for the M&E indicator development process. This point gains even more validity when taking into consideration that the final definition of indicators as conducted below heavily rests on what has been identified on output-, outcome- and impact level of the results framework.

8.1.4 Step 4: Defining indicators and setting a baseline

In a next step, context specific indicators which directly relate to short-term outputs, medium-term outcomes and long-term impacts as defined in the results framework could now be identified (GIZ 2016, p. 5). Here, it was important to include both qualitative and quantitative

indicators, and to define all of these according to 'SMART' criteria (Specific, Measurable, Attainable, Relevant and Time bound). This can be achieved by first, defining the subject (taken from the afore developed results framework); second, specifying the quantity of change; third, defining the quality of change; fourth, defining a time horizon; fifth, specifying disaggregation (i.e. by gender, geographical reference) if applicable; and finally, combining all five steps into one subject-specific indicator for short, medium- and long-term time frames. This procedure is repeated for each theme as defined in the results framework.

For the identification of the indicators' change parameters, baselines need to be set as starting points in comparison to which changes can then be measured. In Ha Tinh province, baseline data was gathered in cooperation with the Department of Natural Resources and Environment and GIZ project staff both in the initial phase of the pilot implementation and specifically for the identification of indicators later on.

The definition of indicators is crucial for the M&E process and was thus done extremely thoroughly. An example of an indicator table for Ha Tinh province can be found below.

Table 8: Indicator identification table

Steps	Process Indicator		Outcome Indicator	Impact Indicator
1. Define subject	***Forest enrichment and protection***	***Technical training and advice on forest enrichment planting***	***Technical training and advice on forest enrichment planting > in-depth technical knowledge and willingness to apply; knowledge sharing***	• People have more products and stable livelihoods that are less vulnerable to extreme weather events from well-managed forest ecosystems • Healthier ecosystems are able to provide goods and services supporting people to be less dependent on nature and less vulnerable to extreme droughts
		Material provisioning and on-the-ground enrichment of forests	***Material supply and on-the-ground enrichment of forests> forest restoration***	
2. Specify quantity of change	• 2 trainings on forest enrichment for farmers in Village 1 • 54 farmers (27 farmers/training) • 50% of time for in-house training and 50% of time for practice in the field • 1 discussion on planning, identifying and managing ecosystems		• 100% of participants (males and females) adopt new technology knowledge on forest enrichment • 100% of participants are ready to share gained knowledge to others	• 34.5 ha of forests are well maintained and provide more goods and services to be less vulnerable to extreme weather events • Increase of 50% of village residents with safe, convenient access to sufficient quantity of water for household use year-round • 90% of participants have stable income from forest goods and services that support them to tackle CC impacts
	12.619 native timber seedlings for plantation on 34.5 ha forest, divided over 26 plantation sites		• 90% of seedlings grow well and 34.5 ha of forests are better managed • About 84% of sites (22 out of 26) are good practice examples that can be shown to others	
	Participants learn new knowledge and gain new skills on		• Participants understand in-depth and adopt new knowledge and technology on forest enrichment and are able and	• Forest ecosystems are healthier and less vulnerable to climate change, and are

Steps	Process Indicator	Outcome Indicator	Impact Indicator
3. Specify quality of change	forest enrichment planting and protection	willing to pass gained knowledge on to others	able to provide more goods and services for people (provisioning services - increase of organic food for human's daily use, food for animals and bees is stable over years, water for second term of paddy rice, human and animals; regulating - water storage capacity for humans, crops and animals, micro climate regulation; supporting - improvement of habitat for other species) • People have better adaptation capacity from well-managed forests (reduction of number of water scarcity days; goods and services provided by healthier ecosystems; see quantity above)
	Seedlings provided and plantation as well as protection initiated	• Forests grow well and are better managed for providing immediate ecosystem services (firewood, shoots, wild honey, flower sources, medicinal plants, grass for animals); forest areas with provisioning services increase • Sites are good practice examples that can be shown to others	
4. Define time horizon	Training is concluded by the end of 2016 Seedlings are delivered by the end of 2016	People (understanding and knowledge sharing takes place): 5 months (12.2016-05.2017) Forest growth and sound management creating provisioning services: Year 1 (12.2016 – 12.2017) for wild honey, shoots, grass, flower source (pollination), medicinal plants Year 2 (12.2016 – 12.2018) for firewood Year 4 (12.2016 – 12.2020) for water resource Sites are good practice examples that can be shown to others: From 2017 onwards	After year 4 (after 2020)
5. If applicable, specify disaggregation (i.e. by gender, geographic	• Women and men participated equally in the trainings (2 members/household) • Men and women equally share work in forest enrichment, except strip clearance and hole digging, as these tasks are harder than the others	• Men and women share work appropriately, women take care of housework more than men do, meanwhile men are in charge of hard physical work in the forest • Upper and denser sites likely to provide more services than the others	• Women and men equally receive benefits from healthier ecosystems

Steps	Process Indicator	Outcome Indicator	Impact Indicator
al reference)			
Combine 5 steps into 1 indicator (specific to subject)	By the end of 2016, 54 men and women have actively learned new knowledge and skills from 2 trainings on forest enrichment planting and protection. 50% of the training time has been used for in-house training, and 50% of the time has been used for practice in the field. 1 discussion on planning, identifying and managing ecosystems has taken place. In the trainings, the ratio of male and female participation was 50/50. By the end of 2016, 12.619 native timber seedlings for plantation on 34.5 ha forest, divided over 26 plantation sites, are provided, and plantation as well as forest protection are initiated. Men and women equally share the work in forest enrichment, except strip clearance and hole digging, as these tasks are harder than the others.	Within 05 months after the training, 100% of the male and female training participants have developed in-depth understanding and are able and willing to apply their knowledge on the ground and share it with other farmers. This application and sharing contributes to better forest protection for diversified ecosystem services over the years. After trainings, men and women share housework and work in the forest equally, resulting in women taking on new tasks From 2017, 34.5 ha of forests in 27 sites grow well and are well maintained by both men and women, in which 22 out of 26 sites (about 84%) are good practice examples that can be shown to others. Within year 1 (12.2016 - 12.2017) wild honey, shoots, grass, flower source (pollination) and medicinal plants are provisioning services produced by the forest. From year 2 on (2018), firewood can be extracted from the managed forest. After four years, the forests functions as a resource for water and water storage. More services are likely provided in upper and denser sites.	After four years, 34.5 ha of forest are well maintained. Forest ecosystems are healthier and less vulnerable to climate change, and are able to provide more goods and services for people, which helps them to deal with extreme weather events, particularly droughts (provisioning services - increase of organic food for human's daily use, food for animals and bees is stable over years, water for second term of paddy rice, human and animals; regulating - water storage capacity for humans, crops and animals, micro climate regulation; supporting - improvement of habitat for other species). 50% of the village residents have safe, convenient access to sufficient quantity of water for household use year-round. 90% of participants have stable income from forest goods and services that support them to tackle CC impact

Since indicators are highly context dependent, the tables developed for Ha Tinh vary from the ones identified for Quang Binh not only in terms of content, but also style. For Ha Tinh, indicator subjects for instance were sub-divided into capacity building and material provisioning elements, whilst still running under one overall subject headline and thus being dealt with in one table (see Table 8 above). In Quang Binh, separate tables were developed for capacity building elements and those related to material provisioning and planting activities. Tables in Ha Tinh furthermore contain a lot more detailed information than in Quang Binh, which allows for much more thorough monitoring, yet also makes the process more challenging, as highly detailed and disaggregated data needs to be gathered.

8.1.5 Step 5: Operationalizing the results-based monitoring system

For useful operationalization of the M&E system, it is important to systematically monitor the change process. For this, data needs, data sources, the data collection method, data analysis method and responsibilities need to be identified. This was done in the final step of the indicator development process. An example of one operationalized indicator table for Ha Tinh can be found below.

Table 9: Operationalization table

Indicator (as defined in Step 4)	Data need (how do you intend to quantify the indicator?)	Data source (where will the data come from?)	Data collection method (which methods will be used, frequency)	Data analysis method (how will the data be analysed?)	Responsibility (who will be responsible for collection, analysis, storage?)	Costs (what are the estimated costs?)
Technical training and advice on forest enrichment	Training mode (ratio of male and female, practice and lecture, duration)	At training	Recording	Visualize (using graphs, tables), percentages descriptions (on how training fits to technical needs and how applicable it is)	DONRE, EbA staff, commune staff	
	Gender roles in forest enrichment, farming work and housework after training	Households	Interview			
	Understanding and application of knowledge on forest enrichment by gender after training	"	"			
	No. of people that are able to share knowledge on forest enrichment with others	Focus group discussion (FGD)	FGD			
	Gender benefits from forest enrichment and other ecosystem services	Households	Interview			
Providing timber seedlings	Plantation conditions: No. of seedlings planted, area, sites, households	Site-check (randomly)	Sample plots	Visualize (using graphs, tables) Description on how the rate comes about	DONRE, EbA staff, commune	
	Growing status of trees by time	Site-check and households' logbook	Recording			
	No. of good sites for demonstrations	"	Observation sample plots recording			
	Changes of ecosystems and services by time	Site-check, observation, interview, FGD	Interview, sample plots, calculation			

8.2 Challenges and Recommendations

The development of indicators and an operational plan for their usage were developed over roughly six months in 2017. In a next step, the application of the M&E system needs to be commenced and a routine for strategic M&E established. As part of this, it is already foreseeable that multiple challenges will arise:

First, EbA is often also related to changes in people's awareness and capacity in terms of knowledge. Measuring this is only possible to a limited degree, as assessments can solely be done through qualitative interviews and observations, which still will only reveal people's actual knowledge on EbA-related topics (or lack of it) to a certain extend. This means that quantifications and definite statements on people's awareness and knowledge on EbA might remain hard to make. Second, EbA measures often only prove effective after many years, and regularly in a time frame that lies outside of a project scope. This is also the case for the pilot measures in Ha Tinh province. It is thus highly important to prepare thoroughly described indicators, and to ensure a timely and all-encompassing handover to stakeholders who can monitor the activities over a longer time period and who will work with the results of the M&E. In the case of the project 'Strategic Mainstreaming of Ecosystem-based Adaptation', this task will be taken on by the provincial Departments of Natural Resources and Environment (DONREs). As part of the handover procedure, an M&E plan with and for partners at different levels as well as training for partner staff needs to be developed to ensure the sustainability of the pilot measures and their effects when the project is phased out. This step has already been initiated by developing a manual for the implementation and usage of the M&E tables for Ha Tinh and Quang Binh. Specific on-the-ground training on doing M&E for and with the partners is however still needed.

Furthermore, unexpected changes and divergences from planned developments are normal and inevitable when working with a complex approach like ecosystem-based adaptation, where elements of vulnerability and resilience of nature, economy and society all need to be taken into consideration. This point was factored in when developing the results framework in style of a Theory of Change which allows for changes in planned outputs, outcomes and impacts. Here, it is core to be open and pay attention to such changes, and to understand their origins. In case of unexpected alternative developments, the following questions should be kept in mind:

- What is the different outcome? Is it better, worse, or just different from what was planned and expected?

- What created the different outcome? A results framework usually makes use of very specific assumptions. As pointed out above, these assumptions were potentially wrong, or were not exhaustive enough in terms of the factors they included. Alternatively, other external changes occurred which could not be planned for.

- Can positive (or negative) changes be attributed to one's project/work, or were changes based on other factor or actors, and the project actually did not manage to contribute to this change? This point might be very hard to prove, as ideally, one would also do surveys and interviews with a control community which did not get project support, generating

comparable data. This, however, is very time consuming. It is oftsen simpler to retrospectively ask the project community about people‘s opinion on how different factors and actors (project- and not project-related) have influenced their situation since the project has started (University of Oxford 2014, p. 15).

In more general terms, there clearly exists a need for the development of practical EbA-specific M&E guidance for practitioners that builds on existing M&E frameworks. The manual on implementing M&E for EbA that has been developed as part of the EbA project contributes to filling this gap. At national level, it is necessary to include EbA M&E in legal frameworks and to link it to other M&E concepts that have been developed as part of country-specific guidelines such as Viet Nam’s National Adaptation Plan.

9. Appendices

9.1 Annexes Ha Tinh

9.1.1 Annex 1: The list of documents screened

- ISPONRE. 2009. "Ha Tinh Assessment Report on Climate Change." Assessment Report. Ha Noi: Institute of Strategy and Policy on Natural Resources and Environment.
- Ha Tinh DONRE. 2011. *Promulgating the Action Plan to Respond to Climate Change in Ha Tinh Province in 2011-2015 and Orientation to 2020*. *QĐ-UBND*. Vol. 2313.
- Districts. 2015. Report from districts on CC and impacts.

9.1.2 Annex 2: The criteria to select the vulnerable areas and EbA measures

For selection of vulnerable areas:

- Observed most adverse impacts of the severe problems caused and enforced by CC
- Healthy ecosystems are available in the area
- Strong dependence of local livelihood on natural resources and ecosystem services
- Good/best practices/existing or past experiences in natural resource management of local communities
- Strong commitment of local authorities (communes and villages)
- Communities have experience on the implementation of some CCA measures
- Visitors and policy makers at both national and provincial levels can easily access the area

For selection of EbA measures:

- The measure supports people to tackle the negative impacts of CC
- The measure is simple in implementation
- The measure constitutes an inexpensive option
- The measure optimize the use of local resources including labor force, ecosystem services and traditional knowledge
- The measure holds upscaling potential (suitable for local conditions, feasible and matches certain local legal documents, possibility to get funding from other relevant national funding programs)
- The measure is sustainable, including economic, social and environmental aspects - reduction of CH_4 emission and/or increase of CO_2 sequestration

9.1.3 Annex 3: Forms for field work

Methods used to conduct the identification of promising EbA measures in Ha Tinh with references to the following documents:

1. Technical guideline: Development and implementation of EbA measures (ISPONRE 2013)
2. Negotiation-support toolkit for learning landscapes (World Agroforestry Centre - Southeast Asia Regional Program 2013)

The approach:

1. Discuss with commune staff (leader representative, cadastral officer and agroforestry officer) on steps 1-9. However, it is not expected that all results are available from the commune meeting
2. Select a village which has healthy ecosystems and which is affected by CC
3. Conduct a group discussion with key informants on all steps
4. The final output of working at each commune and village is a list of potential EbA with ranking (5 lists maximum)
5. Meeting with DONRE to discuss and select **one project** (with consultation with DPI and DARD where possible)

Table 10: The approach

Steps	Results	Methods/Tools
1. Identification of the adaptation objectives	EbA	Consultation with provincial staff (DONRE), communes and villages
2. Overview of commune/villages (socio-economic, population, livelihood options, the dependence on natural resources)	- Socio-economic conditions (5 assets/capitals-DFID's framework: access to roads, social and institutional settings, access to land/land tenure/ownership; access to education, loans, remittance, etc.): livelihood options and natural resources to identify adaptive capacity of communes and villages	- Secondary data (natural conditions, socio-economic data, demography data, etc. (report at commune and others) - Group discussions with communes and villages: 1. *Commune:* leader representative, cadastral officer and agro-forestry officer 2. *Village:* village leader, representative of mass organizations, experienced farmers - Natural resource map or/and land use map
3. Identification of natural resources (ecosystems), their benefits (services)	- Maps of major ecosystems/services - Identification of key beneficiaries of major ecosystem services	- Group discussions (with communes and villages) - Natural resource map or/and land use map - Participatory Landscape Appraisal (PaLA)

Steps	Results	Methods/Tools
4. Identification of the past/current CC hazards/threats affect to communities	- Hazard map - Crop calendar and the changes due to CC - Hazard history - List of the current CCA Measures	- Group discussions (with communes and villages) - Crop calendar - Hazard history - Hazard map
5. Identification of the potential impacts of the future CC hazards and opportunities from socio-economic development to communities	- The predictions from CC hazards and impacts to communities - Impacts of socio-economic development to communities	- Secondary data (climate data, hydrological data, loss and damage data from natural disasters, etc. (from the report/plan of commune and others) - Group discussions (with communes and villages)
6. Analysis of the CC threats and socio-economic development impacts to ecosystems and services	- Impacts of CC to main ecosystems and provisions of services - Impacts of socio-economic development	- Secondary data (climate data, hydrological data, loss and damage data from natural disasters, etc. (report of commune) - Group discussions (with communes and villages) - Consultation with experts
7. Analysis of the trends and changes in the dependence of livelihood options on ecosystem services by CC hazards	The matrix on risks of livelihood options is developed	- Group discussions (with communes and villages) - Consultation with experts
8. Evaluate and rank the vulnerabilities of livelihood options by the CC hazards	The matrix of vulnerabilities is developed	- Group discussions (with communes and villages) - Consultation with experts - Power point
9. Propose EbA measures	- A list of the CCA measures applied - A list of EbA measures for planning	- Group discussions (with communes and villages)
10. Multi-criteria analysis for selection of the most promising EbA measures	- The set of criteria for analysis (economic, social, environment, technical, policies)	- Group discussions (with communes and villages) - Consultation with experts

Annex 3.1: Tables providing an overview of communes and villages

The following tables highlight the perceived dependence of people on surrounding ecosystems at both the commune and village level

Step 2

Table 11: Terrestrial ecosystems (ecosystem service inventory)

Villages								Notes
Provisioning services								
Food (e.g. game, fruit)								
Raw materials (e.g. fiber, timber, fuel wood, fodder, fertilizer, other NTFP)								
Water (i.e. drinking, irrigation, cooling)								
Regulating Services								
Moderation of extreme events (e.g. storm protection, flood protection)								
Regulation of water flows (e.g. natural drainage, irrigation, drought prevention)								
Waste treatment (e.g. water purification)								
Erosion prevention								
Maintenance of soil fertility								
Habitat Services								

Villages								Notes
Provisioning services								
Life cycle maintenance (e.g. nursery services)								
Cultural & Amenity services								
Cultural significance (aesthetics, arts and culture inspiration, spiritual importance, cognitive development)								
Tourism and recreation								

Table 12: Aquatic ecosystem - ecosystem service inventory

Villages								Notes
Provisioning services								
Food (e.g. fish, sea foods, sea plants, fruits)								
Raw materials (e.g. fiber, fuel, fodder, fertilizer)								
Water (i.e. drinking, irrigation, cooling)								
Regulating Services								
Moderation of extreme events (e.g. storm protection, flood protection)								
Regulation of water flows (e.g. natural drainage, irrigation, drought prevention)								
Waste treatment (e.g. water purification)								
Erosion prevention								

Villages								Notes
Provisioning services								
Maintenance of soil fertility								
Habitat Services								
Life cycle maintenance (e.g. nursery services)								
Cultural & Amenity services								
Cultural significance (aesthetics, arts and culture inspiration, spiritual importance, cognitive development)								
Tourism and recreation								

Table 13: The dependence of people on the natural resources managed by other stakeholders for their livelihood (ask *both* commune and village)

Main natural resources	Villages									Notes
Terrestrial ecosystems										
Timber										
Firewood										
NTFPs										
Aquatic ecosystems										
Fishing										

Step 3

Table 14: Land use types (ask *both* commune and village)

Main LU types	Villages									Notes/Services
Natural forests										
Plantation forests										
Paddy rice (1-2 crops)										
Annual crops (maize, peanut, bean, …)										
Grazing lands										

Step 4

Table 15: Past climate-related issues (ask *both* commune and village)

Main issues	Villages									Notes
LU changed										
Floods										
Droughts										
Colds										
Soil erosion										
Land degradation										
Landslides										
Pest and disease										
Heat waves										

Table 16: Crop calendar and other changes due to CC - ask *village*

		1	2	3	4	5	6	7	8	9	10	11	12	Notes (any differences among villages)
Events														
	Drought													
	Rains													
	Storms													
	Cyclones													
	Colds													
	Landslides													
	Pest and disease													
	Heat waves													
Fisheries	Capture													
	Aquaculture													
Agriculture	Forest plantation													
	Forest protection													

		1	2	3	4	5	6	7	8	9	10	11	12	Notes (any differences among villages)
	Rice													
	Peanut													
	Green bean													
	Maize													
	Fruit trees													
	Chicken raising													
	Cattle raising													

Table 17: Hazard history (ask *both* commune and village)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Impacts
Floods											
Droughts											
Colds											
Storms											
Heat waves											

Table 18: List of past/current CCA measures (ask *both* commune and village)

	CCA measures	Effectiveness	Sustainability	Who supported	Notes
Floods					
Droughts					
Colds					
Storms					
Heat waves					

Step 5-6

Table 19: Potential impacts of future CC hazards and socio-economic development (ask *both* commune and village)

	Impacts	Responses	Notes
Future CC hazards			
Floods			
Droughts			
Colds			
Storms			
Heat waves			
Socio-economic development			

Step 7

Table 20: Matrix on risks of livelihood options (ask *both* commune and village)

Livelihood options	Ecosystems	Predictions of the risks on the ecosystems	Ranking the risks of the livelihood options	Cumulative risks
Fish capture				
Aquaculture				
Forest plantation				
Forest protection				
Rice				
Peanut				
Green bean				
Maize				
Fruit trees				
Chicken raising				
Cattle raising				

Step 8

Table 21: Matrix of vulnerabilities (ask *both* commune and village)

Ecosystems (from the above table)	The importance to community (services provided)	The current risks	The future risks	Risk ranking	Adaptive capacity	Vulnerabilities

Table 22: Opportunities on PFES (ask *both* commune and village)

Main environmental services	Villages									Notes
Water for hydropower plant										
Water for Water supply factories										
Village to village voluntary scheme on irrigation or domestic consumption										

Step 9-10

Table 23: List of EbA measures proposed (ask *both* commune and village)

Measures	Ecosystems and services	Scale (area, participants...)	Priority (by villagers/commune) based on criteria	Notes

Criteria: 1. Healthy ecosystems 2) Affected or reinforced by CC 3) Inexpensive 4) Scaling up 5) Simple 6) Internal resources

Annex 3.2: Overview participants for identification of most vulnerable village

No.	Full name	Gender	Position	Address	Contact
1	Lê Hoàng Thanh	M	Vice Chairman	Cam My commune, Cam Xuyen dist.	0969 658 111
2	Trần Thị Hải	F	Party Secretary	Village 4, Cam My commune	01679 023 172
3	Dương Văn Trung	M	Head of village	Village 4, Cam My commune	0975 340 877
4	Lê Văn Lợi	M	Head of Elderly Ass.	Village 4, Cam My commune	
5	Bùi Đức Hưng	M	Farmer	Village 4, Cam My commune	
6	Trần Cảnh	M	Head of Veteran Ass.	Village 4, Cam My commune	0978 826 806
7	Trần Thị Quế	F	Head of Farmer Ass.	Village 4, Cam My commune	
8	Phan Thị Tâm	F	Head of Women Ass.	Village 4, Cam My commune	
9	Nguyễn Văn Hội	M	Chairman	Sơn Thọ commune, Vũ Quang dist.	
10	Nguyễn Đình Dũng	M	Vice Chairman	"	0948 052 874
11	Nguyễn Văn Hùng	M	Agriculture officer	"	0983 924 357
12	Nguyễn Văn Luận	M	Cadastral officer	"	0949 304 636
13	Nguyễn Tiến Quốc	M	Head of village	Village 1, Sơn Thọ commune	0988 860 182 0947 140 427
14	Phan Thanh Lê	M	Vice Chairman	Hương Liên commune, Hương Khê dist.	01696 554 947
15	Nguyễn Hải Đường	M	Agriculture officer	"	0915 737 786
16	Trần Văn Lựu	M	Head of village	Village 2, Hương Liên commune	
17	Lê Thế Thanh	M	Cadastral-agriculture-environment-New rural Dev. Program officer	Hộ Độ commune, Lộc Hà dist.	0915 815 677
18	Nguyễn Danh Thông	M	Forestry officer	Hộ Độ commune, Lộc Hà dist.	0932 279 345
19	Phan Thanh Sơn	M	Head of village	Village Trung Châu, Hộ Độ commune	01626 471 233
20	Lê Thị Cúc	F	Head of Women Ass.	"	
21	Lê Văn Lĩnh	M	Farmer	"	
22	Trần Đình Nhị	M	Party Secretary	"	
23	Hồ Xuân Hoàng	M	Cadastral officer	Sơn Tây commune, Hương Sơn dist.	0911 486 898
24	Nguyễn Chí Hùng	M	Head of village	Village Trung Lưu, Sơn Tây commune	01695 539 385

9.2 Annexes ICRAF

9.2.1 Annex 4: Methods

The feasibility assignment included additional desk study, data collection (fieldwork) and analyses.

Desk Study

- **Assessing climatic risks**
    - **Meteorological analysis (Annex 5.1)**
        - Daily temperature and rainfall observations for the closest stations available, Huong Khe and Huong Son (1982-2011): focus on frequency, intensity and trends to crops/trees within suitability-optimal range
    - carefully study recent past and near-future climate risks up to 2030s (ranges Tmin-Tmax, rain trends (days without rain—heavy rain/flood risks), changes in seasonality, storm risks)
    - examine temperature and soil suitability of selected species online and agroforestry database; compare with tree-crop suitability from Ky Anh
- **Market potential of interventions**
- **Literature review**
    - Scientific literature and database on tree suitability
    - **Policy and local legal framework basis –** identify potential policy support/gaps by relating to main policies, e.g.
        - Item 3, Article 10, Forest Protection and Development Law 2004
        - Provincial proposal of sustainable forest management, protection and development 2012-2015, orientation to 2020
        - The New Rural Development Program of the commune
        - Land use plans up to 2020 by People's Committee and DARD

Fieldwork

The fieldwork involved getting a better understanding on the following:

- The degree of farmers' participation and gender consideration in the GIZ-report was unclear. Of the interviewed 4 were women and 20 men, of these 22 were representing organizations whereas only 2 men were farmers. Were interventions were not designed with farmers?
- Participatory assessments of
    - Transect walk in "affected" high-risk areas with local farmers
    - Participatory hazard mapping and climate timelines were conducted to put farmers' perceptions of drought impacts into a context of other hazards (Simelton et al. 2013)
    - Identify additional tree/crop species and make a SWOT table of the species

- Visit neighbor villages with high exposure but little impact to understand lessons learned with few key informants
- Recommendations for scaling of the proposed intervention:

Land use plans and market assessment

9.2.2 Annex 5: Data and fieldwork analyses

Annex 5.1: Climate

Figure 12: Monthly rainfall and temperature for Huong Son 1982-2011 with 12 months moving average

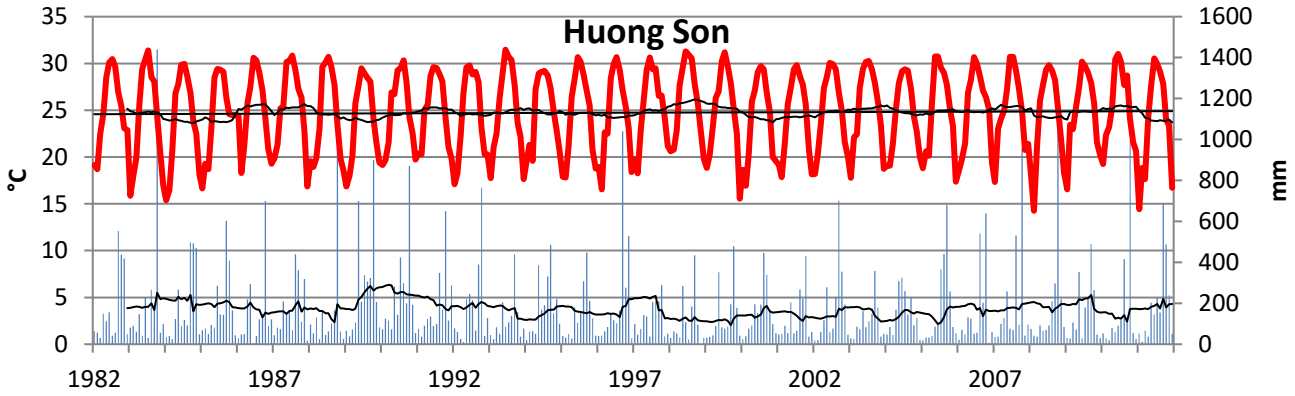


Table 24: Rainfall and temperature averages (1982-2011) and indications of climate scenario toward 2030s

	Meteorological observations (1982-2011)		**Future scenario - 2030s**
Rainfall	**Huong Khe**	**Huong Son**	
Annual total (mm)	2450	2075	+50mm
Dec-Jan* (mm)	~150	~150	
May-July (mm)	525	475	
August-October** (mm)	1425	1140	++
Temperature			
Annual average (°C)	25.0	24.8	+0.6°C
Peak temperatures		April-May	

*) Three driest months; **) Three rainiest months

Rainfall

The annual total rainfall was between 2000 (Huong Son) - 2500 (Huong Khe) mm. We highlight some aspects of rainfall in relation to drought:

- There are no clear long-term trends of reduced rainfall, i.e. meteorological drying conditions (**Figure 12**). This is not excluding the possibilities of agronomic or technical droughts.
- Normal variation of annual rainfall can be up to 1500 mm from one year to another (**Figure 13**), hence very difficult to predict.
- Rainfall anomalies in many years are associated with ENSO (see **Figure 13**) more rain during La Nina (blue marker), less rain during El Nino (red marker) phase – squares indicate when the phase stretches from autumn to spring the following year, and circles for autumn season only).
- Consistent variability between the two meteorological observations in Ha Tinh suggests that patterns are factual, rather than cause of faulty observations.

Figure 13: Rainfall anomalies showing interannual variability of annual total rainfall in Huong Son (dashed line) and Huong Khe (thick line) for the period 1982-2011. Blue (red) colors indicate La Nina (El Nino) phase, squares indicate long phases and circles a short (autumn) phase

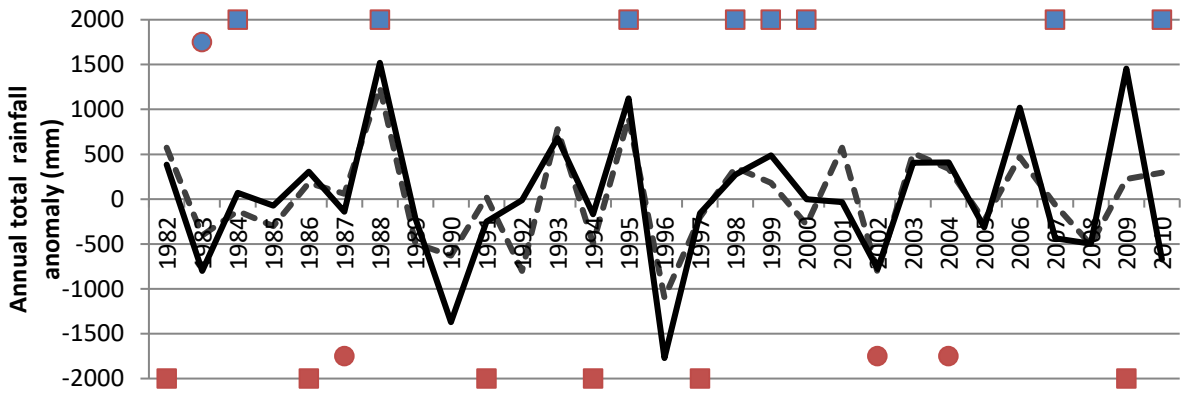
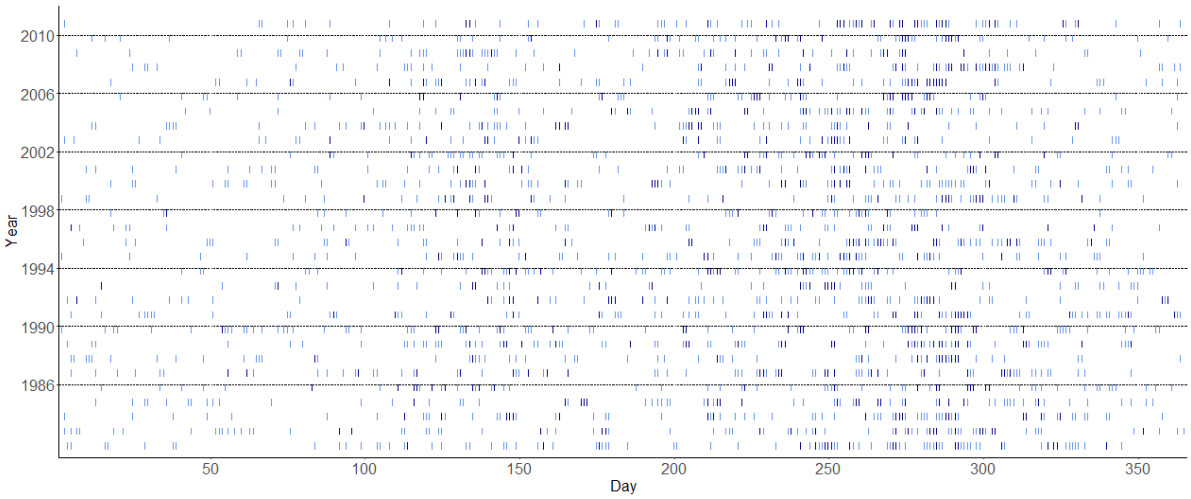


Figure 14: Daily rainfall distribution and intensity, Huong Son (1982-2011). Rainfall intensity marked by color: white 0-5 mm/day, blue 5-30 mm/day, dark blue >30 mm/day (equal to the 95th percentile of precipitation for the station). The x-axis shows day number (1 for January 1st to 365 for December 31st)



Distribution of daily rainfall intensity (**Figure 14**) hints that for Huong Son winters became increasingly drier , springs going through increasing variability, summers and autumns somewhat wetter. Similar patterns for Huong Khe.

- Somewhat less rainfall during winter months (December-February) after 1999 could result in reduced available soil moisture in spring.
- The number of dry days did not change significantly over the period
- Rainfall intensity events (defined as 95th percentile) did not change significantly over the period.

Temperature

The annual average temperature is 25°C. On average the warmest months are June-July with hot spells in April-May. The five coldest records observed during 1982-2011 were between 3.7 and 4.8°C (24 Jan 1983 and 23-26 December 1999, Huong Son). The highest observed temperatures were 42.6°C (Huong Khe) and 40.5°C (Huong Son).

- The data showed only a non-significant increase in annual average temperature during 1982-2011.
- The number of days with temperatures above 40°C (Huong Son) was particularly associated with El Nino-periods, and increased from 1 day in the 1980s, to 16 days in the 1990s, 12 days in 2000s and 2 days in 2010-2011[7]. The daily temperature above 40°C occurred between mid-April and early August [number of observations for Huong Son in brackets]:

  1980s - 21 May 1983 [1]

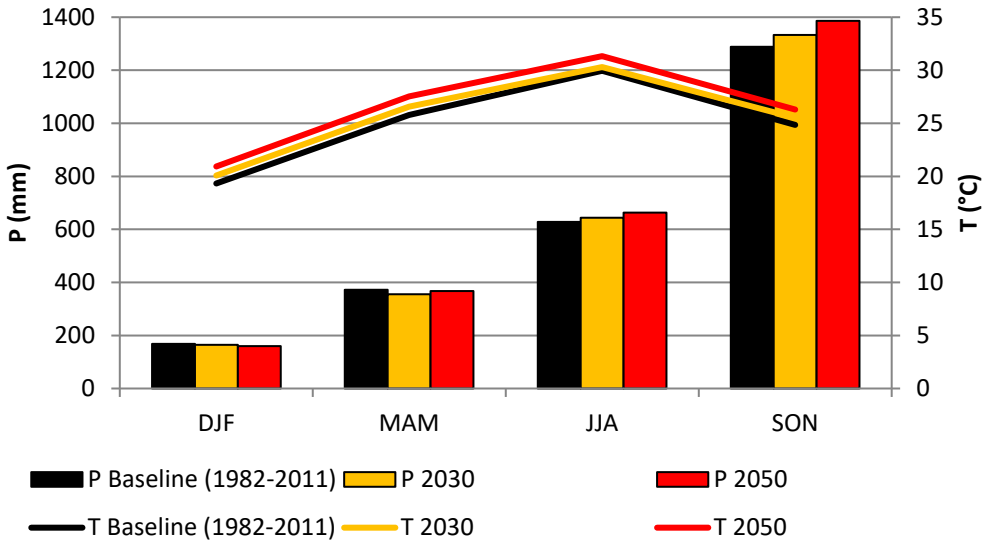
  1990s - 22 April 1990; 2, 7, 8-9 May 1992; 3 May 1994; 24-5, 28, 30 April 1998; 18-21, 27 July 1998; 3 Aug 1998 [16]

[7] Despite having higher max temperature, Huong Khe had only 13 observations above 40°C for the period (possibly relating to missing data?).

2000s - 7 May 2003; 9-10, 21 April 2001; 13 April 2003; 1 May 2005; 1, 22-23 April 2007; 13, 15 July 2007; 18 April 2009 [12]

2010-2011 - 11-12 April 2010; 7 July 2010 [2]

Figure 15: Climate change scenario based on high emission scenario for Huong Khe for 2030s and 2050s compared to baseline period (1982-2011). Scenario from IMHEN (Nguyen Van Thang and Hoang Duc Cuong).



Annex 5.2: Hazard - trees and crops suitability

Flash flood, drought, heavy rain, whirlwind and storm were important natural hazards used in ranking for women and leader's groups, while the men added cold spells but excluded heavy rain and storm (**Table 21**). For the men's and women's groups, nearly no beneficial impacts were observed, while the commune leaders considered suitability of the plants' potentials to resist direct impact of extreme weather as well as indirect impacts in the event that plants were harvested prematurely to avoid damage. Hence, leaders' ranking ranged between 1 (top score for resilience) -5 (lowest score) while the farmers' ranged mainly between 3 and 5, except for sugarcane (men ranked 2 during droughts).

Overall, trees were considered more resilient to natural hazards by all three groups, compared with annual crops, except for peanut during flash flood, whirlwind and storm (see section of annual crops below). All crops and trees were considered sensitive in early growth stages. Water stress at the beginning of planting season, would prevent seed germination delay growth both in the current and subsequent crop planting seasons.

Considerable disagreement between leaders and farmers on the suitability of cassava and sugarcane, as well as acacia (leaders under(?)state the risk). Seem to be a need to identify drought-and-flood tolerant annual crops; all except cassava were ranked 4-5 by farmers.

Flash floods served as good examples on the importance of reducing hazard risks through landscape perspectives and planning. First, leaders said that the hazard risk were/could be avoided by planting on less exposed places in the landscape. Hence, flashfloods generally had no impact on fruit yields as fruit trees (normally) were not planted near streams. Secondly, by

harvesting rainfall in the upper section of the slope, flashfloods could be controlled and trees would grow during periods of water scarcity, particularly during the hot and dry period in April-May.

Trees/crops suitability ranking

Forest trees

Farmers were unable to rank native timber tree species in the natural forest individually and related to them as a system instead.

Overall, the natural forest was seen to have higher resilience to natural hazards due to multistory, wood quality, and diversified tree species and shrubs which reduce the risks of losing all trees during extreme weather events. In particular, some native timber species such as *Erythrophleum fordii* and *Michelia mediocris* were considered more resistant. Having strong roots that would bind them to the soil, and planted in mixed stands, they were not affected by flash floods.

Higher water consumption in acacia monoplantations. According to farmers, acacia broke more easily than *Calophylum soulattri, Michelia mediocris* and natural forest during whirlwind and storm. Most forest trees were unaffected by droughts except for seedlings and young growth stages (nearly planted seedlings). Furthermore, farmers observed that acacia consumed a lot of water and nothing could grow under acacia litter. Also the leaders said that most forest trees were unaffected by natural hazards except for acacia, *Manglietia fordiana* and *M. conifer,* whose inflexible stems may break during storms.

Bamboo was planted near streams and grew naturally in the poor natural forest (not ranked). During the transect walk, it was mentioned as resistant to natural hazards and good for binding soils to reduce impacts of landslide, especially along streams.

Table 25: Nearly all annual crops were ranked as unsuitable during natural hazards by two farmer groups (F=females, M=males), and leaders (L). Cells are left empty when a specie or hazard was not ranked. Highlighted species are considered generally "more suitable".

	Species	**Drought**			**Heavy rain**			**Flash flood**			**Tornado/storm**			**Cold spell**		
		F	***M***	***L***	***F***	***M***	***L***	***F***	***M***	***L***	***F***	***M***	***L***	***F***	***M***	***L***
FOREST TREES	Natural forest	4	3		3			3	4		3-4	5			3	
	Acacia	5	4	2	3		3	4	4	2	4-5	5	4		3	
	Calophylum soulattri	4			3			3			3-4					
	Michelia mediocris	4		2	3		2	3		1	3-4		3			
	Manglietia conifera			2			2			1			4			
	Manglietia fordiana			2			2			1			4			
	Erythrophleum fordii			1			1			1			3			
FRUIT TREES	Orange	5	5	4	5		3	4	4	1	4	5	4		4	
	Lime	4		4	4		3	4		4	4		4			
	Pomelo			4			3			4			4			
	Jackfruit			4			1			1			3			
ANNUAL CROPS	Rice	5	4	4	4		4	4	5	5	3-4	4	4		4	
	Peanut	4	4	2	4		3	3	4	2	3	3	3		4	
	Maize	4-5	5	3	4-5		3	5	5	4	5	5	4		3	
	Cassava	4	3	2	4-5		4	5	4	2	4	3	3		4	
	Sugarcane	4	4	2	4		3	4	5	2	5	5	4		2	
	Mung bean		4						5			5			3	

Fruit trees

Fruit trees were generally perceived as high-risk with regards to natural hazards, except for jackfruit. The jackfruit tree (hardwood) is generally resistant, however cold spells during flowering time and storms during the fruiting period make cause yield loss.

Citrus - orange and lime easily broke and were uprooted during whirlwinds; lost fruit during storms; and leaves wilted and dried during droughts. Men said cold spells slowed down the orange regrowth and reduced the number of flowers. Leaders said the citrus tree stems would easily break, loose fruit during storms, leaves wild and dry during droughts and flowers falling off during heavy rains.

Mango flowers were sensitive to cold spells and rainy conditions, causing flowers rotten and fewer fruits.

Annual crops

Droughts generally delay harvest of the spring crop and/or restrict the second rice crop (planted in June). Recurring droughts have reduced rice yields to the degree that about half of the rice area in Village 1 has been converted to mung bean or maize. Rice yields on the remaining areas were hampered by insufficient water at the beginning of the second planting season (June-September). According to the leaders rice was the most sensitive crop as it potentially can be affected by all hazards. Heavy rain, flash floods, whirlwinds and storm during the pollination/flowering stage cause crop failures of rice and maize. For example in March 2016, whirlwinds broke the stems of rice and maize. If rice falls during the pollination period, the harvest is lost. Rice is often affected by brown plant hopper during hot and humid periods, heavy rain as well as irregular rainy and sunny conditions. Humid conditions also favor blight development.

Peanut rated among the most tolerant crops. Of the crops most prone to natural hazards, rice, peanut and maize, farmers considered peanut drought resistant and less affected by whirlwind, storm and flash flood as a result of short species and could be harvested before slash flood and storm events (before August). Leaders considered peanut, sugarcane, and cassava more resistant to drought and flash floods.

Cold spells killed crops planted early in the year, typically rice and peanut, and replanting reduce the crop growth and delayed the cropping season.

Cassava is often planted on poor soils, as the last resort. Tubers may get stunted during droughts and rotten during heavy rain. Cassava and sugarcane stems may fall during storms, whirlwind and flash flood. The male farmers said sugar content in sugarcane increased during drought conditions.

Maize and mung bean were planted in July to August, and thus not affected by cold snaps. The timing avoids the main drought period, as drought during maize heading stage reduces seed formation (causing seedless cobs). Timing of mung beans is somewhat problematic as the crop is

sensitive to drought, flash flood and whirlwinds ripping off leaves. Leaders also said that maize and sugarcane broke during storms.

Annex 5.3: Implemented adaptation and coping strategies

Table 26: Coping and adaptation strategies before, during, and after natural hazards according to farmers in Village 1. Source: fieldwork July 2016

	Strategy/action		
Natural hazards	Before	During	After
Flash flood	Harvest early		
Drought	Mulch orange with dried leaves/plants		
	Plant before drought season Listen to forecasts: plant (sow) seedlings (seeds) when having rain	Pump water/open dredges to irrigate fields (prioritized for rice) Irrigate orange trees with stream water	Replant Change rice variety from 130 to 90 days duration
Cold spells	Mulch orange with dried leaves/plants		
	Add ash, phosphorous Listen to forecasts. Sow rice seeds in one small farm. Cover seedlings. Rice: Plant early to harvest before storm season, plant short-duration varieties	Add ash, manure, husk, and phosphate Spray to stimulate orange flower	Add manure, ash, phosphate, pesticide Replant
Whirlwind	Cover tree bases/roots with soil, stabilize trees		Clear out broken branches Cover tree bases/roots with soil, stabilize trees
Heavy rain	Harvest rice early Mulch orange to avoid soil loss/stabilize trees		Add manure and ash Replant
Storm	Harvest early		

Annex 5.4: Revised EbA interventions

The feasibility study involved a SWOT analysis of the first proposed EbA interventions (**Table 27**) for developing tentative stepwise indicators for EbA-interventions (**Table 28**) in collaboration with gendered farmer groups.

SWOT analysis of proposed interventions

Table 27: SWOT analysis of proposed interventions (men and women). Bold font represent shared opinions among men and women, 'italic font' is used for opinions expressed only in the women's group, and 'plain font' represents opinions expressed only in the men's group.

STRENGTHS	**WEAKNESSES**
• *Land has been allocated to farmers for plantation* • Interest among farmers to change from acacia because of low economic return and poor environmental benefits. The People's committee and forest protection officers promote natural forest protection after allocation to households • **Some farmers understand the importance of planting trees**	• *Limited space for grass with orange where orange is already planted* • **Difficult to establish agreements among farmers for an entire slope (community agreement required to maintain and protect natural forests)** • Few farmers can afford to invest and have technical skills required for planting (native) trees and orange • **Uncertainty about fast-growing high-economic-return alternative species to replace acacia** • *Lack sources for fruit trees and timber tree seedlings* • **Limited capital (time consuming procedures) for buying high-quality seedlings and fertilizer** • Limited irrigation infrastructure even where water is available
OPPORTUNITIES	**THREATS**
• *Plant (fruit) trees after acacia harvest* • *Establishing household nursery for timber and orange trees could enable locally available seedlings for plantation and for replacing dead ones* • Policy support from People's Committee: for natural forest protection after allocation, and reducing acacia plantation by encouraging projects that promote planting native tree species in the allocated natural forests • *Costs for orange seedlings partly supported by commune and/or district if farmers plant more than 250 trees* • The EbA-project can establish demonstration models for villagers, to strengthen the uptake	• *Weather risks during seedling stage of orange and timber trees* • *Unstable market prices for orange* • Farmers give up the models if they see no short-term benefits (first four years) • Native trees species are(perceived?) more difficult than acacia because farmers lack experience in planting these trees • Without support from district and commune for natural forest protection, farmers may plant acacia again
Solutions for overcoming weaknesses and threats • Establish farmer working group with support from the EbA-project (GIZ) and commune People's Committee to establish this group • Establish (geographical) trademark for some products such as orange, molasses and honey (+ market analysis) • Technical training and continuous information on planting and tending (native timber and fruit) trees, pests and disease prevention • Means to reduce exposure to weather risk – drip irrigation, timely planting, weather forecasts • Market potential and assessments	

Table 28: Proposed interventions to better cope with natural hazards proposed by men and women groups in Village 1. Source: focus group discussion, July 2016.

				• Canopy cover cause: (1) increased soil moisture through litter; (2) build-up of top soil layer • Increased canopy cover in orange and natural forests • Fruits start to generate income						• Increased natural forest cover
			• Orange harvests generate income • *Year 3-4: Nursery provides stable supply of indigenous tree seedlings*							• Increase soil moisture • *Stream water regulated* • Improve ground-water recharge downstream
	• First grass harvest • Income from pine apple • Reduced soil erosion in orange-fodder grass plots; • Fertilizer plants improve soil nutrient status in orange fields • Improved technical skills through training and guidance									
• Harvest annual crops – gradually stabilizing yields • Income from honey										
Year 1*	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10+**

*) Assuming Year 0 is the layout of the slope, contours and planting schedule, first planting initiated.

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