sustainability

MDPI

Article

From Perception to Practices: Adoption of Ecosystem-Based Adaptation in Vietnam Upland Areas—A Case Study in Thua Thien Hue Province

Le Thi Hong Phuong [1], Ho Le Phi Khanh [1], Malin Beckman [2], Do Trong Hoan [3], Le Dinh Phung [1] and Le Thi Hoa Sen [1,*]

[1] University of Agriculture and Forestry, Hue University, Hue City 53000, Vietnam; lthphuongnl@hueuni.edu.vn (L.T.H.P.); holephikhanh@huaf.edu.vn (H.L.P.K.); ldphung@hueuni.edu.vn (L.D.P.)
[2] Department of Urban and Rural Development, Swedish University of Agriculture Sciences, P.O. Box 7012, 750 07 Uppsala, Sweden; malin.beckman@slu.se
[3] Centre for International Forestry Research and World Agroforestry (CIFOR-ICRAF), Hanoi 10000, Vietnam; t.do@cifor-icraf.org
* Correspondence: lthsen@hueuni.edu.vn

Abstract: In the context of increasing interest in ecosystem-based adaptation (EbA), there remains a paucity of discussion regarding the transition from perception to practice in aiding farmer households to adapt to climate change (CC) while maintaining the provision of essential ecosystem services. Thus, this study aims to explore policymakers' and local people's perceptions, from thinking about the implementation of EbA strategies to responding to CC in current and future agricultural production and forestry in upland Thua Thien Hue province, Vietnam. This study has adopted the Model of Private Proactive Adaptation to CC to investigate the perceptions of EbA among various administrative and household levels through in-depth interviews and focus group discussion methods. Our findings indicate a significant relationship between the perceptions and understanding of EbA among policymakers and farmer households, and the adoption of EbA practices. Many EbA practices are already well-established and have demonstrated their ability to enhance ecosystem services provision, adaptation benefits, and livelihood and food security. These benefits are crucial for helping farmer households to adapt to CC. However, current financial, technical, and market constraints hinder the broader adoption of these practices. Therefore, to increase adaptive capacity to CC and upscale EbA practices, EbA interventions must consider technical, financial, and market aspects. Furthermore, it is essential to provide evidence from both scientific and practical perspectives and disseminate information on EbA practices to encourage broader adoption by local farmers. In addition, supportive policies from various departmental and agency levels are necessary for managers in the agricultural and forest sectors as well as households to recognize EbA as a vital strategy for developing agriculture and forestry in a manner that is sustainable and resilient to CC.

Keywords: ecosystem-based adaptation (EbA); smallholder perception; upland; agriculture forest; Vietnam

Citation: Phuong, L.T.H.; Khanh, H.L.P.; Beckman, M.; Hoan, D.T.; Phung, L.D.; Sen, L.T.H. From Perception to Practices: Adoption of Ecosystem-Based Adaptation in Vietnam Upland Areas—A Case Study in Thua Thien Hue Province. *Sustainability* **2024**, *16*, 10094. https://doi.org/10.3390/su162210094

Academic Editor: George N Zaimes

Received: 8 September 2024
Revised: 30 October 2024
Accepted: 5 November 2024
Published: 19 November 2024

1. Introduction

Agriculture and forestry are socio-economic activities particularly susceptible to the effects of climate change (CC) [1]. These sectors represent a major component of the economy that can experience significant and disruptive societal impacts due to CC, as exemplified in Vietnam [2]. Numerous studies have demonstrated that alterations in rainfall and temperature can profoundly affect crop production, animal husbandry, forestry, and aquaculture [2–5]. The livelihoods of rural communities have been significantly impacted by CC due to their reliance on agriculture, forestry, and natural resources [3,6]. Ethnic minority communities in upland areas have been considered more vulnerable to CC due

to living in remote areas, lower levels of education, limited access to formal financial and informational services, and poorer transport connectivity compared to other areas [7]. These factors have contributed to a reduced adaptive capacity to current and future CC, resulting in more vulnerable livelihoods [8].

In recent years, ecosystem-based adaptation to CC (EbA) [9,10] and natural-based solutions [11] have been research topics that have attracted the interest and attention of many scientists and international organizations around the world [9,10]. EbA is considered an adequate strategy, for example in (i) areas of poor adoption of currently applied techniques/methods, and (ii) areas with inadequate biodiversity, as it considers better social and environmental aspects of efforts related to adaptation strategies [12,13]. EbA strategies have many benefits and play important roles in social, environmental, and economic aspects [14–16]. EbA can contribute to CC adaptation and mitigation in agricultural and forestry practices. Underlying criteria to be considered as suitable for smallholder farmers include: (i) ecosystem services provision; (ii) adaptation benefits; and (iii) livelihood and food security [15,17,18]. Therefore, EbA is considered by government agencies as a suitable solution in the current context in Thua Thien Hue province where CC has caused increasing challenges to the livelihoods of rural people [4,19], especially in communities dependent on natural resources such as forest resources [18].

Policymakers play a very important role in guiding development as well as proposing long-term and sustainable policy interventions [17,18,20]. Therefore, policymakers' perceptions have a decisive influence on instructions at lower levels in the field of agricultural production [17,18]. Their perceptions will also affect attitudes and behaviors related to institutions involved in managing, directing, and implementing agricultural development strategies [21,22]. In addition, both formal and informal institutions play an important role in building partnerships among different stakeholders, accelerating social networks that enable effective cooperation between state actors and civil society, to improve capacities and increase the benefits of adaptation [18,23]. Several previous studies indicate that the CC adaptation decisions of smallholder farmers are driven by multiple stressors [24,25]; for example, the perceptions of adopters, contextual factors, and institutional factors [26]. Local people's perceptions play an important role in deciding whether or not to adopt agricultural and forest adaptation strategies in the climate context [19,27,28]. They make their decisions based on their perceptions of the innovation and their own enablers and barriers [25]. However, farmers' perceptions of the use of ecosystem-based agricultural and forestry techniques to adapt to CC are still limited due to the influence of many factors. These include a lack of information provided by extension programs, low levels of education, lack of access to CC information or agricultural technique radio programs, small farm size or limited areas of land used for agriculture and forestry [29–31], as well as a lack of sufficient evidence on the effectiveness of the application of EbA [9,15,32,33].

The perspectives of policymakers and local people are often not considered together when studying EbA, especially regarding the interplay among economic, societal, technical, environmental, and policy aspects. Very few studies exist, for example, on how policymaking is shared between different governmental organizations and how this impacts the process of adoption [34]. Moreover, critical questions remain about how the EbA perceptions of policymakers and local people are integrated into hierarchical, post-communist states that are characterized by rigid bureaucracies with little or no accountability or transparency, weak institutions, and tight controls over information [35]. There is some research on the perceptions of EbA among policymakers in coastal Central Vietnam (e.g., [18]) and the CC awareness of local people in the upland of Central Vietnam. However, little is known about the relationship between the perceptions of policymakers and local people about EbA, the benefits of EbA strategies in helping communities adapt to the threats of CC, and how these changes may affect ecosystem services. Therefore, this study aims to explore policymakers' and local people's perceptions, from thinking to the implementation of EbA strategies to responding to CC in current and future agricultural production and forestry in upland Thua Thien Hue province, Vietnam. Specifically, the study focuses on answering

the following questions: (i) What are the policies and programs that relate to EbA in upland areas? (ii) How do policymakers and local people perceive EbA? (iii) What are the current benefits of EbA practices in the agricultural and forestry sectors that contribute to community resilience? (iv) What are the EbA practices that are employed by local communities as CC adaptation strategies? It thereby makes an important contribution to understanding how the EbA perceptions of policymakers and local people influence the implementation of CC adaptation in order to improve farmers' resilience, particularly in the context of natural resource-dependent and marginalized upland communities in Vietnam.

Different theories have been deployed to understand the perceptions of farmers and policymakers that influence their adaptive behaviors. The behavioral theories considered include socio-cognitive and perceptual processes to identify the determinants of behavior [36]. One comprehensive and effective approach was developed by Grothmann and Patt (2005) [37] as the Model of Private Proactive Adaptation to CC (MPPACC) based on the Protection Motivation Theory. This theory considered that subjective determinants of adaptive capacity are important in determining a person's ability to adapt as well as identifying cognitive drivers of adaptive behavior in the context of CC [37]. The MPPACC included two aspects: (i) CC risk perception and (ii) adaptation appraisal. This framework has become widely popular in research on CC adaptation [19,38,39] because understanding perceptions of climate risks and experiences in handling CC is crucial for further strengthening smallholder farmers' efforts to manage the impact of climatic risks and social vulnerabilities at both the individual and collective levels [19], which are often ignored in traditional studies. Therefore, this research adopted the MPPACC with an integrated set of indicators, including perceptions of EbA and the actions of households and communities for CC adaptation. The participation of policymakers and local people in this research was intended to not only help people and communities to better understand their EbA through understanding their perceptions of EbA and CC knowledge as well as their EbA practices, but also to collect assessments of their needs in identifying solutions to improve livelihoods and enhance the resilience capacity to cope with and adapt to CC.

The structure of the paper is as follows: Section 2 outlines the methodological approach that underpins the data collection and analysis for the study. The study's results are detailed in Section 3. Section 4 provides a discussion of these results, and Section 5 presents the conclusion.

2. Methodology

2.1. Study Sites

This study was conducted in three upland communes, including Phong My, Thuong Lo, and Hong Thuong, which are located in the Phong Dien, Nam Dong, and A Luoi districts, respectively (Figure 1). The selection of these three communes was based on different reasons. Firstly, there are recent studies [3,40] showing that CC has affected livelihood activities and natural resources. Secondly, the local communities consist of different ethnic minority groups who depend on forest resources for their livelihoods and thus potentially exhibit different EbA strategies. Thirdly, the benefits from ecosystem services are closely correlated with the communities' resilience.

The three studied communes are representative of the upland communes of Thua Thien Hue province. The people in the Hong Thuong (A Luoi district) and Thuong Lo (Nam Dong) communes are mostly from the Co Tu ethnic minority, while the people in Phong My (Phong Dien district) are mostly Kinh people. However, the selection of these communes is not for comparison purposes but to better understand the diversity of the ecosystems in the upland region. The ecosystems in the three communes include agricultural ecosystems, home garden ecosystems, acacia forest ecosystems (production forests), and community forest ecosystems. Therefore, the main livelihoods of these households include crop production with annual crops, livestock with buffaloes, cows, pigs, and poultry, forestry (mainly acacia plantations and activities based on community forests), and fruit trees in home gardens.

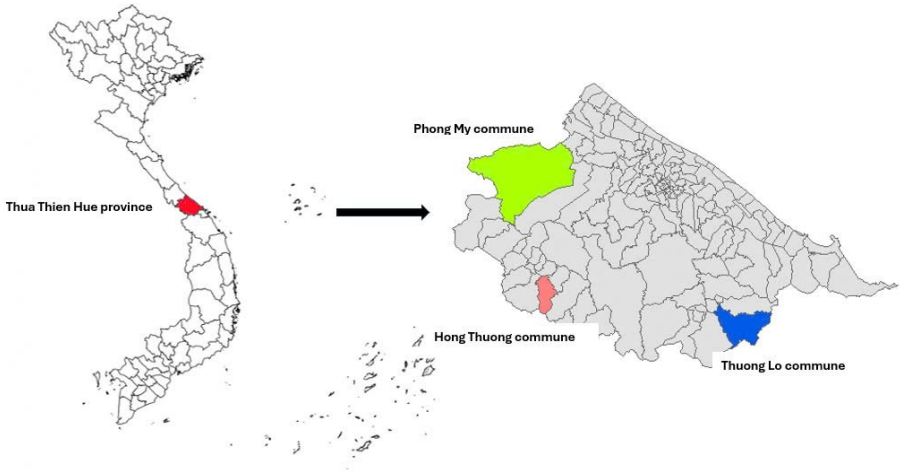

Figure 1. Three studied sites in Phong My, Thuong Lo, and Hong Thuong communes. Source: Global Digital Mapping Alliance (GDMA), Vietnam Open Development.

2.2. Methods

2.2.1. Research Approach

In this study, the pragmatic perspective with an exploratory approach was applied to collect and analyze data, where a number of things remain open to allow for the findings of previous interviews to guide the following interviews. This allows the research to iteratively evolve in a direction that is most meaningful and relevant. Exploratory research is generally applied in cases for which no or only sparse systematic knowledge exists [41], and is often combined with a pragmatic perspective. It is an approach that can be used to gain greater familiarity with a particular topic that is not clear or developed sufficiently enough to enable conceptual distinctions or posit explanatory relationships prior to the start of the research [42]. This approach has been chosen here as it fits well with the explorative ambition to better understand the perceptions of EbA of policymakers and local people, as well as the interplay between their perceptions in implementing CC adaptation.

2.2.2. Data Collection

Multi-methods, which combine different research methods to address a particular research problem [43], were applied in this research. The multi-method research design involves collecting and analyzing qualitative data in a single study in an attempt to investigate a research problem more deeply [44]. There are various reasons why multi-method research is employed by researchers. For example, certain methods do not provide sufficient answers to the research questions, such as interviews which may be open to interpretation. This approach is a variation of the principle of triangulation, where supporting evidence is derived from independent sources.

The process to collect data followed two steps. In the first step, the University of Agriculture and Forestry, Hue University, sent a request for permission to conduct the survey to the relevant management agencies and survey subjects, such as the Department of Agriculture and Rural Development and the People's Committees of the communes. In the second step, after receiving the consent of the relevant management agencies, the survey was carried out according to detailed steps as follows: (i) the researchers introduced the purposes, contents, and methods of information collection to the survey participants; (ii) asked for consent to collect and use information from participants verbally through voting, and 100% of participants agreed. Collected information was recorded in researchers' books or computers and kept as documents throughout the data processing and research completion process; (iii) conducted the survey; and (iv) summarized the collected information with the survey participants to confirm that the information will ultimately be used with the consent of all surveyed participants.

Secondary data: Previous research reports, policy documents, academic papers, project documents, and official documents relating to CC, sustainable techniques for agriculture and forestry activities in the upland Thua Thien Hue province were collected. These have been described as the strategies to develop agriculture in upland areas and scenarios for agriculture and forestry activities as well as key government policies.

Primary data:

Group interviews were conducted, with policy actors in the agricultural and forestry sectors who are responsible for CC adaptation at different administrative levels. At the provincial level, there were four group interviews with the Department of Agriculture and Rural Development of Thua Thien Hue province (DARD), the Department of Thua Thien Hue Forest Management (FMD), the Thua Thien Hue Forest Protection and Development Fund (FPDF), and the Thua Thien Hue Forest Owners' Sustainable Development Association (FOSDA). Group interviews were also conducted at each district and commune. Therefore, in total there were three group interviews at the district level and three group interviews at the commune level.

For staff in the agricultural sector at province and district levels, the main interview questions included: (1) To what extent do the Department of Agriculture and Rural Development/Rural Development (DARD/Rudept) officials understand the EbAs? (2) What programs/policies/projects have been implemented by DARD/Rudept related to CC adaptation, land conversion, and restructuring of the agriculture sector? (3) What are the antecedents to applying EbA at lower levels? (4) What are the achievements/ outputs recognized from the implementation of EbA? (5) How do DARD/ Rudept plan to scale up the use of EbA practices?

For staff in the forest sector at the province and district levels, the main interview questions included: (1) To what extent do officials at the Forest Management Department (FMD)/Forest Owners Sustainable Development Associations (FOSDA)/Forest Payment Development Fund (FPDF), understand the EbAs in the forestry sector? (2) What programs/policies/projects related to EbAs in forestry and forest management have been implemented by the FMD, such as sustainable forestry management, forest enrichment, economic development under the canopy, and REDD+, FSC? (3) What are the antecedents to applying EbA at lower levels? (4) What are the achievements/outputs recognized from the implementation of EbA? How do the FMD/FOSDA/FPDF plan to scale up the use of EbA practices?

For communal authorities, the main interview questions included: (1) To what extent do the local authorities understand the EbAs? (2) What programs/projects related to forest and agriculture ecosystems have been implemented at the commune level, such as the program on sustainable forest management, economic development under the canopy, restructuring agriculture production/fruit development, PFES, and Emission Reductions Payment Agreement (ERPA)? (3) What are the antecedents to applying EbA in communes? (4) To what extent does the EbA provide opportunities for local livelihood improvement? What is needed to scale up the use of EbA practices in smallholder farming systems?

Focus group discussions were conducted with different households in villages in the three surveyed communes. There were two group discussions for each commune: one with forest-based group households, and one with agricultural-based group households. Therefore, in total there were six focus group discussions with households. Each group discussion took around 2–2.5 h and involved 8–9 households. The main interview questions included: (1) What are the impacts/risks of extreme weather/environmental degradation recognized by local communities? (2) What EbA interventions have been applied by local communities? (3) To what extent does the local community understand the relevant policies on EbA and take part in EBA-enabling activities? (4) What factors inhibit or facilitate EBA activities adoption in the community? (5) What are the outputs of EbA activities recognized by the community? (6) What need do people see for strengthened EbA activities?

In-depth interviews with different households (n = 14) in three surveyed communes were also carried out to gather information related to research objectives. The checklist

questions concern the topic in the focus group discussions but the questions focused on the special case for each household to obtain an in-depth understanding and cross-check the five topics in the focus group discussions.

2.2.3. Data Analysis

This research collected data related to CC, policies in CC and EbA issues, and EbA practices in agriculture and forestry from the provincial to the farmer levels. Therefore, during the data analysis process, the research focuses on exploring the differences in perceptions about EbA of different levels, thereby understanding the applied EbA strategies or agricultural practices in the form of EbA. The data were analyzed through three steps. First, the content of the documents was analyzed by identifying the main events, policies, and (political) decisions to reconstruct the adaptation policy development at different levels. Second, the interviews were written down and recorded, when allowed by the interviewees. The interviews were transcribed shortly after each interview. Third, we clustered and prioritized these based on the research questions. Thematic clustering was used to identify recurring issues in the data.

3. Results

3.1. Policies and Programs Related to EbA That Were Applied in Thua Thien Hue Upland Areas

In Vietnam, there are around 55 government policies, strategies, laws, and action plans that relate to CC issues [45]. These include the National Strategy on CC for the period up to 2050 (issued as Decision No. 896/QD-TTg dated 26 July 2022 by the Prime Minister), which aims to adapt effectively and proactively, reducing vulnerability, loss, and damage due to CC and reducing greenhouse gas emissions according to the net zero emission target by 2050. It takes advantage of responding to CC to transform the growth model and improve the economy's resilience and competitiveness and is considered a fundamental orientation for the development of policies, plans, and guidelines for implementing tasks to cope with CC. In addition, the decision to promulgate the national plan to adapt to CC for the period 2021–2030, with a vision to 2050 (issued as Direction No. 1055/QD-TTg dated 20 July 2020 by the Prime Minister) is the strategy direction for implementing contents related to coping with CC at lower levels. Based on the two decisions above, each province/city develops an action plan to respond to CC appropriately for its specific conditions. In Thua Thien Hue province, the action plan to respond to CC for the period 2021–2030, with a vision to 2050, was issued on 14 July 2021 (issued as Decision No. 1720/QD-UBND of the Chairman of the Provincial People's Committee). The goal of the plan is to improve the capacity of management agencies at all levels and communities in the province to respond to CC, to ensure sustainable development in the context of CC, and adjust policies, mechanisms, and strategies associated with the green growth, adaptation to CC, and mitigation of greenhouse gas emissions.

The interviews with different departments show that at the provincial level, most policies demonstrate a multi-dimensional approach with the goal of green, ecological, and sustainable agriculture. The policy contents have not yet directly mentioned or used the term EbA, but the implications of strategies and plans for agricultural development and responding to CC aim to protect the environment and the ecosystem and develop sustainable livelihoods in the future. All agricultural development policies refer to and address CC adaptation issues by prioritizing production activities to reduce emissions, protecting the environment and ecosystems, and promoting organic and safe production (Resolution No. 20/2020/NQ-HDND of Thua Thien Hue province dated 23 December 2020, stipulating several policies to encourage the development of agricultural production and implement the restructuring of the agricultural sector of Thua Thien Hue province for the period 2021–2025, and Resolution No. 30/2021/NQ-HDND dated 14 October 2021 amending and supplementing several articles of the resolution No. 20).

At the district level, two national target programs to support upland ethnic minority communities (the 1719 program and the New Rural Program) are important programs

in supporting (i) people to develop their livelihoods, especially in reducing poverty, and (ii) people who are largely dependent on forest resources, through many activities in agricultural development. The 1719 program especially is oriented towards activities based on upland ecosystems such as afforestation, restoration, regeneration, planting of medicinal plants under the forest canopy, garden economic development (renovating mixed gardens or developing fruit trees), and agricultural production activities aimed at being environmentally friendly and reducing the impact of CC. In addition, Decree No. 156/2018/ND-CP (issued as Resolution dated 16 November 2018) regulating payments for forest environmental services is considered one of the most effective policies for the protection and development of community forests, natural forests, and protected forests. At the communal level, there have been no specific policies related to CC or EbA, but mainly policies and plans that have been implemented and assigned from the provincial and district levels to specific local conditions. For upland areas, the policies show a multi-dimensional approach to support forest-dependent communities to be willing to participate in forest protection and effectively use forest ecological services. A multi-dimensional approach is indicated through the participation of many stakeholders in different aspects of natural forest protection, including (i) the FMD, with project programs and research on forest restoration and development, applying participatory technologies in monitoring forest situations; (ii) the DARD, with pilot livelihood models to ensure food security and quality of life for communities dependent on forests; and (iii) the FPDF, with different activities that have related to the payment for forest environmental services. In particular, with the support of local authorities, several forestry enterprises and non-governmental organizations (the WWF, Cabi, USAID, IKEA, Scavi Pacific, and FOSDA) have invested in and supported livelihood improvement for local communities, such as native tree nurseries, livelihood models under the forest canopy, techniques in forest plantation, etc. This includes the FOSDA organization, which provides advices and support for acacia plantations following large wood acacia development (FSC), and connections to markets to promote livelihood development for local people. Also, there are credit policies for developing FSC that have been carried out at the household level.

At the district and commune levels, policies rarely mention issues of circular agriculture and sustainable agriculture but mainly focus on using resource efficiency and adapting to CC. Policies focus on solving each problem and mainly target the output of each activity, such as growth, development, and productivity of crops and livestock. There are few programs and policies geared toward comprehensive, long-term, and systematic agricultural development and ecosystem protection in the context of fluctuations in weather, climate, market, and socio-economic conditions, as well as the degradation of local resources (land, forest, water, labor, etc.).

3.2. Perceptions of Policymakers and Local People of EbA

Before exploring the perception of policymakers and local people of EbA, the study explores the perceptions of different respondents on CC. All respondents were asked to indicate if they had noticed any unusual changes in climate conditions and the extent of observed CC and variability as perceived by occupation in the study area during the last 10 years. All respondents from provincial to household levels perceived increasing temperature, drought, landslides, changing rainfall patterns, unseasonal rain and floods, and more rainfall in upland areas.

A farmer in Khe Trang village, in the Phong My commune, mentioned that "previously, about 10 years ago, there were 4 different seasons here, now there are only 2 seasons left. Nature is 'terrible' now and the temperature is 'hot-tempered', it rains continuously out of season, floods are also out of season and very unexpected, and the weather is scorching everything. Nowadays, every thunderstorm is accompanied by a tornado, unlike in the past, the thunderstorms here were very 'gentle'".

The perception of EbA of management officials at the provincial and district levels (Nam Dong and Phong Dien) indicated that they understand quite well what EbA is

(Table 1). In policy documents, the term EbA has not been yet used. However, all the interviewers understood EbAs as activities to protect the environment, prevent ecosystem degradation and destruction, adapt to CC, and develop sustainability. Therefore, the development orientation, plans, and resolutions issued related to agricultural production toward green and sustainable agriculture, taking the ecosystem as the root of the process of transformation and development. Only in the A Luoi district was the awareness and perception of EbA among local management officials still quite limited, as they have only recently transferred to their roles at the DARD. However, their understanding of sustainable agricultural production is clear on topics such as integrated livestock–crop systems, conservation tillage, using manure for crop production (particularly for vegetable and fruit trees), and crop rotation or intercropping.

Table 1. Perceptions of the ecosystem-based adaptation to CC of different levels.

Level	Examples of Statements from the Survey
Provincial	EbA included different solutions for sustainable agriculture and adapting to CC. Specifically, cultivation must take soil health or soil nutrition as the foundation for any crop production, plant breeding should be appropriate for the soil conditions, climate, and ecosystem. Therefore, EbA can be understood as circular agriculture to ensure sustainable development; towards green agriculture, clean agriculture; and agricultural adaptation to CC (results from focus group discussion at the provincial level).
District	EbA is an intervention to provide environmental services, such as conservation, biodiversity management, and sustainable development; to ensure benefits of CC adaptation, such as improving plant/animal health, maintaining and increasing productivity to cope well with CC, increasing ability to adapt/cope and reducing pests or diseases caused by CC; and ensuring stable livelihoods and food security such as developing and diversifying income sources, using available resources, reusing and making good use of locally available resources (results from focus group discussion at district level).
Commune	The commune has never had any topics to discuss regarding EbA adaptation strategies. Until now, the communal authorities and agricultural staff never thought about that. Their main responsibilities are to carry out activities under the direction of the district and provincial levels and to improve the income for people in the commune (results from focus group discussion at the communal level)
Household	They do not know of EbA and never heard of it before (results from in-depth interviews at the household level)

Sources: In-depth interviews and focus group discussion with official managers at all levels officials and households, 2024.

At the commune and household levels, the term EbA seemed to be completely new to stakeholders and they had never heard it before. However, when asked about ecological or natural agriculture, the commune-level officials heard, understood, and also directed farmers in their commune to apply a small part of the techniques therein. An agricultural officer in the surveyed communes indicated that "ecological agriculture is a part of organic agriculture. Farming techniques must protect the surrounding ecosystem. For example, to develop tourism activities in the Kazang spring, we must protect watershed forests, planting crops must not use a lot of pesticides, and livestock production must protect the environment by collecting or treating wastewater so that water in streams is clean". The results from the focus group discussions with staff at the communal level indicated that Thuan Thien (nature) agriculture is rain-fed agriculture, planting or raising animals that require little care and are suitable to the conditions and capacities of the farmers. For

example, farmers raise local black pigs. These pigs only feed on vegetables and graze in the garden, without vaccination or any disease treatments.

At the household level, the interviewed farmers were not aware of EbA, had never heard of it, and did not know what EbA is. However, through in-depth interviews and focus group discussions, they shared several stories about their experiences in agricultural production with the implication that they have applied a part of agricultural techniques towards sustainability and CC adaptation, particularly planting and protecting forests and crop production.

3.3. Ecosystem-Based CC Adaptation Practices Used by Local Communities

The results from the focus group discussions at three levels indicated that the ecosystems of the three studied sites are dominated by agricultural and forestry activities, with monoculture hybrid acacia plantations currently accounting for the largest proportion. However, there are also many agricultural and forestry practices that, as forms of EbA, were used to adapt to CC in the study areas. As there are different perceptions and understandings of the meaning of EbA at different levels from agricultural managers to households, agricultural and forestry practices as forms of EbA are different.

At the provincial level, the results of group interviews with different departmental staff mentioned several EbA strategies in the agricultural and forestry sectors in upland areas. These strategies are directional and directive as development orientation in agricultural production and forest plantation. EbA strategies towards circular agriculture, green agriculture, and clean agriculture for sustainable development are the cross-cutting strategy and guide for all agricultural and forestry development solutions at lower levels.

The results in Table 2 show that many ecosystem-based strategies are applied/mentioned by policymakers to adapt to CC in the study area. For the field of horticulture, solutions to select plant variety structure, plant diversity, identify crops adapted to CC and ecosystem change, as well as meet market needs, are key EbAs. Biosecurity and a low-emissions future for animal farming are emphasized as two main EbA strategies for livestock production in upland areas. For the forest sector, four EbA practices were mentioned and effectively evaluated in developing FSC forest plantation and enriching the forest: (i) planting native trees; (ii) rehabilitating the young native forest; (iii) maintaining and developing non-timber forest products, including vegetables, under the forest canopy; and (iv) strengthening forest projection through implementing sustainable forest development plan; and activities for protecting the forest.

Table 2. Main EbA practices in the studied areas and their results.

EbA Practices	Activities Established	Adaptive Function	Site Applied	Cultural and Social Benefit	Economic	Biodiversity
Integrated forestry management	Promotion of non-timber products, promotion of reforestation, create nursery and native trees regeneration, forest patrolling and protection	Protection of natural forests, protection against flood and reduction in landslide risk, water protection	Phong My, Thuong Lo, Hong Thuong	Protection of sacred forest and worship, maintaining their belief in the forest, personal felling, materials from forest for traditional medical treatment Community communication, interaction, and collaboration.	Income from harvesting non-timber forestry products, PFES, Emission reduction payment	The abundance of flora and fauna in forest
Forest Stewardship Council (FSC)-based forestry production	Prolong business circle of acacia, alternative technique applied in forest production, maintain the vegetation	Protection of forestry environment, Protection against flood and reduction in landslide risk, water protection	Phong My, Thuong Lo, Hong Thuong	Networking/producer-consumer interlinkages (farmers-FOSDA-IKEA), perception of long-term benefits, and awareness of environmental protection.	High income for selling FSC timber (20–40% 10% selling up)	Not avaiable

Table 2. *Cont.*

EbA Practices	Activities Established	Adaptive Function	Site Applied	Cultural and Social Benefit	Economic	Biodiversity
Diversification	Intercropping cassava (or upland rice, maize, bean, or pineapple) in acacia plantation, gardening	Increase coverage and minimize runoff to limit soil erosion and washing away, soil fertility protection. Yield stability in more variable climates	Phong My, Hong Thuong Thuong Lo	Not avaiable	Increasing economic efficiency per unit of cultivation, increasing household income	Not avaiable
New rice production techniques applied	Three reduction, three gains model	Yield stability in more variable climates, reducing the risk on soil fertility, saving inputs and water resources, reducing emissions	Phong My, Thuong Lo, Hong Thuong	Not avaiable	Increasing economic efficiency per unit of cultivation, increasing household income	Not avaiable
Land conversion	Converting land for low rice productivity into fruit trees and others Converting acacia land to other tree models such as fruit trees (green pumelo, oranges) or cinnamon	Yield stability in more variable climates	Phong My	Not avaiable	Increasing economic efficiency per unit of cultivation, increasing household income	Not avaiable
Integrated farming system	Integrating vegetables/ fruit trees, livestock, aquaculture, and forestry (VACR)	Agricultural circulation model, sustainable use of resources	Hong Thuong, Thuong Lo	Making use of indigenous practices (offering high quality and safe foods for market)	Increase resource use efficiency	

Source: Field survey, 2024.

For farmers at the household level, the survey results show that, at the research sites, farmers applying forms of EbA focus on two sectors. Firstly, the forms of EbA related to forest ecosystems include (i) community forest management in household groups and at the community level, and forest management in protected and conservation forest areas; (ii) planting large timber forests following FSC certification; (iii) planting medicinal plants and non-timber forest products under the forest canopy, and planting additional native trees to enrich the forest; and (iv) ecotourism. Secondly, EbA forms related to agricultural ecosystems include (i) rice production with three increases and three decreases (reduce the amount of seeds sown, reduce the amount of pesticides, reduce the amount of nitrogen fertilizer; increase rice yield, increase rice quality, and increase economic efficiency); (ii) crop rotation/intercropping; (iii) diversity of crops per unit area; (iv) agroforestry (focusing on renovating mixed gardens); and (v) some sustainable and organic agricultural techniques. The various forms of EbA practices are typical for mountainous communes and are commonly adopted by farmer households.

Some forms of EbA are successful and local people have continued to apply them, such as crop rotation/intercropping, and renovating mixed gardens to develop fruit trees combined with livestock raising. However, "the model of growing medicinal plants or NTFPs under the forest canopy is an appropriate model, as the implementation process has not been really successful because of the lack of connection with the market, the process to select/survey planting areas is still too sketchy, and the seedlings are not guaranteed quality" (a farmer in the Huong Thuong commune). The seedlings are not readily available and are often of poor quality, and most farmers received support for seedlings, such as millennium bale and wild ginger, that are already abundant in the forest. Members of this group said that these young plants are naturally available in their community forests and there is no need to plant them (the opinion of local people in Thuong Lo and Phong My). Moreover, the market is unstable, and the price of these products fluctuates and the

collectors or wholesalers buy small amounts at a low price. Therefore, local people have low motivation to invest in this form of EbA.

A variety of livelihood models have been piloted and transferred by DARD and agricultural staff at the commune level to households. However, there has not been an overall assessment of the sustainability of these models, any assessment of the conditions for maintaining and replicating these models, nor any consideration of risks related to climate and markets. Most models have not been connected to the product value chains and the markets. Therefore, the products are difficult to market, leading local people to gradually abandon them and switch to other production models. The ecotourism model is considered to have a large potential for EbA in terms of biodiversity, income diversification, and cultural and customs conservation. However, this EbA requires comprehensive livelihood resources, especially land in terms of area, topography, and geography; financial resources (high investment cost); and human resources (labor, knowledge, and experience).

The results from group discussions, household interviews, and group interviews showed that one of the challenges with acacia growing activities in general and FSC in particular is the issue of animal husbandry. In the context of limited land resources, livestock development is the most suitable livelihood strategy. However, the lack of particular planning and organizational mechanisms for livestock development leads to many negative economic and social impacts. Cow raising is the activity with the most potential, but has been perceived as posing serious threats to crops/tree plantations, especially for rice and acacia. The results from the in-depth interviews with households show that many acacia plantations were damaged, and local people had to replant and invest in building fences. However, many households could not afford to build fences and had to leave their land vacant. Therefore, in some cases, many households saw buffaloes and cows destroying their acacia areas, so they used machetes to cut off the legs of the buffaloes and cows, causing many cases of conflict in the community.

3.4. The Benefits of EbA Agricultural and Forestry Practices in the Community Resilience

One of the most important factors in considering EbA agricultural and forestry practices for local people to apply and maintain is the benefits of these practices, especially in enhancing community resilience. Based on the framework used to understand EbA practices, three benefit dimensions are considered, including ecosystem service provisions, adaptation benefits, and livelihood and food security.

Regarding ecosystem service provision, according to agricultural staff at all levels, EbA practices in the forest sector clearly show their contribution to the conservation, restoration, and sustainable management of ecological functions and processes of carbon sequestration, water infiltration, and restoration of soils. For the household level, the ecosystem service provision of EbA practices is understood in more detail in specific aspects. Payments for forest environmental services (PFES) and carbon credits are two of the benefits that people in the community perceive most clearly that EbA practices in forest sectors have brought to them. EbA practices in the fields of forest protection, management, and forest planting/caring are considered meaningful in ecosystem service provision, increasing forest reserves, and incomes. According to the results of group discussions at the household level, forests regulate local temperature extremes by providing shade, blocking searing winds, and trapping warmth. Forests especially assist in limiting erosion and preventing landslides (and soil runoff by buffering the direct impacts of heavy rainfall). Natural forests improve the quality and quantity of water in springs to provide for agricultural activities and community/ecosystem-based tourism. Participants who participated in community forest management agreed that natural forests will become a key issue for ecosystem biodiversity in the future and bring environmental services to local people through carbon certification services and PFES. In addition, the importance of ecosystem service provision from home gardens differs from those provided by other agroecosystems.

Regarding adaptation benefits, the respondents at all levels indicated three benefits, including (i) crop and livestock productivity improvement, (ii) reduction in climate risk on

crop and farming systems, and (iii) reduction in crop pests and disease incidence. However, at the commune and household levels, respondents perceived benefits (i) and (ii) as the most important benefits gained from implementing EbA practices in the agricultural sector to resist CC impacts. The results from interviewed households at the three surveyed communes show that the adoption of the new rice production techniques with three increases and three decreases (reduce the amount of seeds sown, reduce the amount of pesticides, reduce the amount of nitrogen fertilizer; increase rice yield, increase rice quality, increase economic efficiency) indicated that yield stability in more variable climates has reduced the risk to soil fertility, saved inputs and water resources, and especially reduced carbon emissions. Crop rotation, integration of crops, and renovating mixed gardens are perceived to improve crop productivity and reduce crop pests, creating income diversification that has led to reduced risks.

In the forest sector, integrated forest management and FSC-based forest production have supported sustainable development not only for the forest sector but also for other sectors such as agriculture and tourism. Forest protection activities, through the responsibilities of household groups or communities, have contributed to protecting natural forests, protective forests, as well as virgin forests. All the agricultural officers of the province and three districts mentioned that participating in forest management and protection models as well as enriching natural forests contributes to environmental protection, flood and landslide risk reduction, and water protection. Besides this, EbA practices in the forest sector have also decreased risks from uncertainties in CC and markets by promoting non-timber products, reforestation, creating a nursery and regenerating native trees, as well as forest patrolling and protection.

Regarding livelihood and food security improvement, improving local income is the best benefit that EbA practices bring to the community. The hybrid acacia plantations, through developing FSC forest plantations and enriching the forests in the study sites, have created many benefits, improved small farmers' livelihoods, and provided enhanced environmental values in rural landscapes. The acacia plantations generate employment, both with the plantations and in associated value-adding activities. Therefore, farmers' incomes have gradually stabilized, ensuring food security throughout the year. In addition, local people have applied EbA strategies related to forest protection and management, which highly contribute to ensuring that natural forests are better protected and developed. Therefore, in the study sites, non-timber forest products from natural or community forests (protected forests) also provide food, income, and traditional medicines. Cash income from the sale of non-timber forest products is highly variable from sources such as honey, bamboo shoots, rattan, banana flowers, and vegetables. Cultivation-related EbA strategies play a very important role in ensuring food security and diversifying local income sources for local people.

According to the vice-chairman of the Hong Thuong commune, "EbA practice with three reduction-three gain technique in rice production is an EbA that brings not only food security and reduced production costs but also saves water and protects the environment. In the context of the fact that agricultural lands are under threat of losing the ability to maintain sufficient production for an expanding population in food-deficient commune, the three reduction-three gain rice production model maintains a crucial role in the commune's food security and provides a foundation for economic and social stability".

Annual crops, including maize and cassava, not only contribute to the income source of farmers but also the cultivation of maize and the residuals of these crops are important fodder sources to animals. More broadly, crop products play a central role in the livelihood of growers. In particular, poorer households depend almost entirely on agricultural products for both food and cash to buy other necessary items. In the study sites, home gardens are important for bringing a stable income to local people. The survey informants agreed that their home gardens not only provide an income source from fruits but also offer a wide range of rewards for the gardeners, providing a large return in terms of ecosystem services and cultural integrity. Immediate access to fresh food, quality control of the food

grown, positive environmental impacts, erosion control, enjoyment, and family satisfaction are recognized as significant benefits by the informants and agricultural staff as well as managers at different levels.

Agricultural production must be increased in the future to meet the food and feed demands of rising human populations. Therefore, increasing livestock production is also considered a component of farming systems in upland areas. However, livestock activities have not yet developed and invested in the upland areas. So, the benefits from these activities are not clear for the livelihoods of local ethnic people, or their environment and society.

4. Discussion

The findings of this study show that policies related to EbA in the agricultural and forestry sectors are diverse in terms of economic, social, and environmental development in general, and in terms of agricultural development toward green growth and sustainability in Thua Thien Hue province in particular. Although "the concepts of EbA" were not mentioned in the ongoing policy documents, the implications of EbA concepts have been recognized and clearly understood by policymakers and state authorities in the agricultural and forestry sectors at different levels, particularly the provincial and district levels. However, the understanding of EbA concepts among commune-level officials and at the household level is still very limited. Most farmers adopt these concepts quite extensively when the meaning of EbA is explained. We show that there are agricultural and forestry practices in the forms of EbAs that have been adopted by farmers. Beyond providing income, livelihood benefits include resilience to food scarcity, ecosystem service provision, and adaptation of agricultural and forestry EbA practices to CC, bringing more security to local people in the present and future.

Perceptions of EbA have positively influenced the adoption of sustainable techniques in agriculture [18,46]. We found that the EbA perception of provincial officials is at a macro level, therefore EbA strategies are also macro-level and common to the agriculture and forestry sectors, which are the main livelihood activities of farming households in the research sites. Perceptions are shown through their methods and approaches when implementing activities. This is consistent with the numerous earlier studies on understanding EbA perceptions or ecosystem services in the agriculture and forestry sectors [9,12,13,47–49]. Understanding perceptions of EbA in the agricultural sector is essential for more reliable and qualitatively higher environmental decision-making by policymakers [15]. This study's results clearly show that understanding and perceptions of EbA can inform courses of action to improve conservation and governance at scales ranging from household initiatives to provincial policies. Each stakeholder in the process of adopting or not adopting adaptation strategies depends largely on their perception and attitude in terms of risks and benefits. In addition, in Vietnam, in the context of the market economy, economic factors are always considered in EbA strategies in addition to environmental and social factors. Therefore, the MPPACC framework in this study is considered suitable to understand the views of stakeholders on EbA, thereby stakeholders will have a direction for adaptation in the present and the future, particularly in the climate change impact context.

Farmers' perceptions and adoption of EbA strategies in agricultural production and forestry depend on what they perceive to be the benefits of these strategies [20,48]. Our findings indicate that much more can be gained by demonstrating the benefits of EbA practices, particularly economic benefits that can support and bring to local people. In addition, environmental benefits, especially environmental services provided to local people, are extremely important in promoting the adoption of EbA strategies into practice. This result is completely consistent with previous studies related to EbA strategies on ecosystem-based tourism that have been implemented [11,50]. In addition, the results also show a continuous process of social learning between different farmers and between agricultural extension staff and farmers about how to promote the adoption and application of EbA strategies in practices in the long term. Most of the farmers indicated that the lack of

knowledge of EbA and disconnected social networks are major barriers to increasing their perception of EbA, as well as the process of adoption and adaptation. The provision of tailor-made courses and training, as well as mediated communication between peers, friends, neighbors, and cooperatives, particularly agricultural managers in orientation development, will increase perceptions and knowledge, and improve their adaptive capacity as well as resilience. However, a word of caution is needed: despite learning and provision support from outside stakeholders, not all or any learning or provision will lead to promoting the adoption and application of EbA strategies or increasing community resilience. When poorly designed and/or supported, it could even have the opposite effects.

From the perspective of agricultural managers, who are policymakers in the agricultural sector, EbA strategies are "guiding principles" at the macro level, directing and orienting development based on a clear understanding and knowledge of EbA. However, local farmers, who are the direct implementers of these policies/strategies, perceived EbA as practical applications at the micro-level. Most of the EbA strategies mentioned by local people in this study can be trained, guided, and directed by superiors, such as agricultural staff from DARD, NGOs, or agricultural extensions. However, some EbA practices stem from the needs and perceptions of the farmers who implement them on the ground. For example, district agricultural staff introduce and build models of crop conversion towards sustainability and adaptation to CC, which are widely adopted by farmers.

Although farmers and communities are familiar with and use some EbA practices, new EbA practices and model replacement crops often do not adapt well to CC. Raising awareness at all departmental levels about the applicability and long-term effectiveness of EbA strategies is crucial. Further efforts are needed to integrate these strategies into agricultural policies to enhance community resilience against various challenges, particularly CC and market fluctuations. This integration can contribute to the broader sustainable and green development goals of the province and locality. However, support from external sources, including domestic organizations and NGOs, often overlooks critical factors such as economic conditions, socio-cultural aspects, and the motivations of farmers. Addressing these elements is essential for the successful implementation of EbA practices [46,51]. Local people's motivation is one of the first factors that need to be considered when proposing to implement a certain EbA strategy and can include economic motivation, cultural motivation, social motivation, or environmental motivation [18,52]. In reality, locally at the three research sites, economic motivation is one of the decisive factors in changing awareness and accepting, applying, and sustainably maintaining EbA when applied. Therefore, to improve the success of EbA strategies in agriculture, the economic motivation of farmers should be the first consideration [53]. According to results from previous studies [54,55], farmers' willingness to apply EbA strategies and diversify these strategies is based on their economic interests and their understanding of the market, as well as on the quality of their social network and social communication [56]. Opportunities in the local market were found in other studies to be a key driver of change in agriculture in developing countries [57]. The application of EbA strategies does not only depend on making changes in agronomic practices and the attitudes of farmers but also on supportive functions provided by other farm enterprises and institutions at both the micro and macro levels [58]. Therefore, increasing community resilience to adapt to the impacts of CC and other challenges should not only focus on technical or social and human interventions but also consider market interventions to generate sufficient market access and fair and stable prices for products. In addition, it needs to improve understanding and scientific evidence of the long-term effectiveness of different EbA practices in enhancing the resilience of crops, livestock, farming systems, and forestry sectors in the face of CC. The extension workers/agricultural staff should provide more information on which EbA options are most appropriate for smallholder farmers living in different socio-economic and agroecological contexts, such as upland areas. The agriculture and forestry policies should promote incentives or actions to provide on and off-site ecosystem services and help improve farmers' livelihoods in the face of CC.

5. Conclusions

This research on perceptions and practices of EbA in upland areas of Thua Thien Hue province explores the understanding of EbA among policymakers in the agricultural and forestry sectors at various administrative and household levels. It examines their EbA practices and their perceptions of the benefits derived from these practices. The results show a good understanding of EbA among policymakers and farmer households on the co-benefits of EbA, and the effectiveness of EbA practices is found to have a strong correlation with the adoption of EbA practices. The perception of EbA in the agricultural and forestry sectors offers an important opportunity to help policymakers provide appropriate directions in the process of directing the implementation of policies/programs on agriculture and forestry, helping households adapt to CC, improving livelihood and environmental co-benefits while providing important perspectives from policymakers at all levels. Many practices that qualify as EbA are already well-known and have proven to provide ecosystem services, adaptation benefits, and enhanced livelihood and food security. These benefits help farmer households to adapt to CC, but current financial, technical, and market constraints limit the more widespread adoption of these practices among farmer households. To overcome these challenges, further research and interventions should consider comprehensive aspects to ensure that farmers can adopt EbAs when they clearly perceive the economic, social, and environmental benefits that EbAs can bring to them. Therefore, key strategies to promote EbA include: (i) EbA interventions have to consider both social and market aspects; (ii) providing evidence from both science and practice, as well as information on EbA options to convince local people of the benefits of adopting EbA; and (iii) supportive policies from different levels of departments and agencies that consider EbA as an important strategy for developing agriculture and forestry towards sustainability and CC resilience.

Author Contributions: Methodology, M.B., H.L.P.K., L.T.H.S., L.D.P. and L.T.H.P.; Investigation, L.T.H.P., M.B., D.T.H., H.L.P.K. and L.T.H.S.; Resources, M.B., L.D.P. and L.T.H.S.; Writing—original draft, L.T.H.P. Revising the manuscript: L.T.H.P., M.B., D.T.H. and L.D.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Swedish Research Council, No. 2021-05215; Hue University under the Core Research Program, Grant No. NCTB.DHH.2025.03.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Acknowledgments: This work was supported by the Swedish Research Council, No. 2021-05215. The authors also acknowledge the support of the Swedish University of Agricultural Sciences; Hue University under the Core Research Program, Grant No. NCTB.DHH.2025.03; and the International Center for Research in Agroforestry (ICRAF) Vietnam country office.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Georgopoulou, E.; Mirasgedis, S.; Sarafidis, Y.; Vitaliotou, M.; Lalas, D.P.; Theloudis, I.; Giannoulaki, K.-D.; Dimopoulos, D.; Zavras, V. Climate change impacts and adaptation options for the Greek agriculture in 2021–2050: A monetary assessment. *Clim. Risk Manag.* **2017**, *16*, 164–182. [CrossRef]
2. Anh, D.L.T.; Anh, N.T.; Chandio, A.A. Climate change and its impacts on Vietnam agriculture: A macroeconomic perspective. *Ecol. Inform.* **2023**, *74*, 101960. [CrossRef]
3. Bond, J.; Winkels, A.; Linh, N.H.K.; Dung, N.T. Climate change resilience and adaption of ethnic minority communities in the upland area in Thừa Thiên-Huế province, Vietnam. *NJAS-Wagening. J. Life Sci.* **2020**, *92*, 100324.
4. Boonstra, W.J.; Hanh, T.T.H. Adaptation to climate change as social–ecological trap: A case study of fishing and aquaculture in the Tam Giang Lagoon, Vietnam. *Environ. Dev. Sustain.* **2015**, *17*, 1527–1544. [CrossRef]
5. Duc, K.N.; Ancev, T.; Randall, A. Evidence of climatic change in Vietnam: Some implications for agricultural production. *J. Environ. Manag.* **2019**, *231*, 524–545.

6. Dasgupta, P.; Morton, J.; Dodman, D.; Karapinar, B.; Meza, F.; Rivera-Ferre, M.G.; Toure Sarr, A.; Vincent, K.E. Rural areas, in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. In *Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., et al., Eds.; Cambridge University Press: New York, NY, USA, 2014; pp. 613–657.
7. Chinh, N.C.; Thang, P.D.; Hai, V.M.; Mai, N.T.H.; Phuong, L.T.H. Costs and benefits analysis of applying agro-climate information to agricultural cultivation for ethnic minority farmers in the mountainous communities of Vietnam. *Int. J. Sustain. Agric. Manag. Inform.* **2024**, *10*, 185–210. [CrossRef]
8. Nguyen, Y.T.B.; Leisz, S.J. Determinants of livelihood vulnerability to climate change: Two minority ethnic communities in the northwest mountainous region of Vietnam. *Environ. Sci. Policy Brief* **2021**, *123*, 11–20. [CrossRef]
9. Harvey, C.A.; Martínez-Rodríguez, M.R.; Cárdenas', J.M.; Avelino, J.; Rapidel, B.; Vignola, R.; Donatti, C.I.; Vilchez-Mendoza, S. The use of Ecosystem-based Adaptation practices by smallholder farmers in Central America. *Agric. Ecosyst. Environ.* **2017**, *246*, 279–290. [CrossRef]
10. Ojea, E. Challenges for mainstreaming ecosystem-based adaptation into the international climate agenda. *Curr. Opin. Environ. Sustain.* **2015**, *14*, 41–48. [CrossRef]
11. Gkiatas, G.; Kasapidis, I.; Koutalakis, P.; Iakovoglou, V.; Savvopoulou, A.; Germantzidis, I.; Zaimes, G.N. Enhancing urban and sub-urban riparian areas through ecosystem services and ecotourism activities. *Water Supply* **2021**, *21*, 2974–2988. [CrossRef]
12. Huq, N.; Renaud, F.; Sebesvari, Z. Ecosystem based adaptation (EBA) to climate change—Integrating actions to sustainable adaptation. In *Impacts World 2013: International Conference on Climate Change Effects*; Potsdam Institute for Climate Impact Research: Potsdam, Germany, 2013.
13. McKinnon, M.C.; Hole, D.G. Exploring Program Theory to Enhance Monitoring and Evaluation in Ecosystem-Based Adaptation Projects. *New Dir. Eval.* **2015**, *2015*, 49–60. [CrossRef]
14. Scarano, F.R. Ecosystem-based adaptation to climate change: Concept, scalability and a role for conservation science. *Perspect. Ecol. Conserv.* **2017**, *15*, 65–73. [CrossRef]
15. Vignola, R.; Harvey, C.A.; Bautista-Solis, P.; Avelino, J.; Rapidel, B.; Donatti, C.; Martinez, R. Ecosystem-based adaptation for smallholder farmers: Definitions, opportunities and constraints. *Agric. Ecosyst. Environ.* **2015**, *211*, 126–132. [CrossRef]
16. Bhusal, K.; Udas, E.; Bhatta, L.D. Ecosystem-based adaptation for increased agricultural productivity by smallholder farmers in Nepal. *PLoS ONE* **2022**, *17*, e0269586. [CrossRef]
17. Vignola, R.; Locatelli, B.; Martinez, C.; Imbach, P. Ecosystem-based adaptation to climate change: What role for policy-makers, society and scientists? *Mitig. Adapt. Strateg. Glob. Chang.* **2009**, *14*, 691–696. [CrossRef]
18. Wolf, S.; Pham, M.; Matthews, N.; Bubeck, P. Understanding the implementation gap: Policy-makers' perceptions of ecosystem-based adaptation in Central Vietnam. *Clim. Dev.* **2021**, *13*, 81–94. [CrossRef]
19. Phuong, L.T.H.; Biesbroek, G.R.; Sen, L.T.H.; Wals, A.E.J. Understanding smallholder farmers' capacity to respond to climate change in a coastal community in Central Vietnam. *Clim. Dev.* **2018**, *10*, 701–716. [CrossRef]
20. Moretti, D.M.; Baum, C.M.; Ehlers, M.-H.; Finger, R.; Bröring, S. Exploring actors' perceptions of the precision agriculture innovation system—A Group Concept Mapping approach in Germany and Switzerland. *Technol. Forecast. Soc. Chang.* **2023**, *189*, 122270. [CrossRef]
21. Lamarque, P.; Tappeiner, U.; Turner, C.; Steinbacher, M.; Bardgett, R.D.; Szukics, U.; Schermer, M.; Lavorel, S. Stakeholder perceptions of grassland ecosystem services in relation to knowledge on soil fertility and biodiversity. *Reg. Environ. Change* **2011**, *11*, 791–804. [CrossRef]
22. Phuong, L.T.H.; Biesbroek, G.R.; Wals, A.E. Barriers and enablers to climate change adaptation in hierarchical governance systems: The case of Vietnam. *J. Environ. Policy Plan.* **2018**, *20*, 518–532. [CrossRef]
23. Islam, M.T.; Nursey-Bray, M. Adaptation to climate change in agriculture in Bangladesh: The role of formal institutions. *J. Environ. Manag.* **2017**, *200*, 347–358. [CrossRef] [PubMed]
24. Burnham, M.; Ma, Z. Linking smallholder farmer climate change adaptation decisions to development. *Clim. Dev.* **2016**, *8*, 289–311. [CrossRef]
25. Roussy, C.; Ridier, A.; Chaib, K. Farmers' innovation adoption behaviour: Role of perceptions and preferences. *Int. J. Agric. Resour. Gov. Ecol. Soc.* **2017**, *13*, 138–161. [CrossRef]
26. Prager, K.; Posthumus, H. Socio-economic factors influencing farmers' adoption of soil conservation practices in Europe. In *Human Dimensions of Soil and Water Conservation*; Nova Science Publishers: Hauppauge, NY, USA, 2010; pp. 203–223.
27. Pirard, R.; Petit, H.; Baral, H.; Achdiawan, R. Perceptions of Local People Toward Pulpwood Plantations: Insights from the Q-Method in Indonesia. *Int. For. Rev.* **2016**, *18*, 218–230. [CrossRef]
28. Sen, L.T.H.; Bond, J.; Hoang, H.D.T. Exploring smallholder farmers' climate adaptation decision-making in mountainous areas of Central Vietnam: Implications for extension services. *J. Agric. Educ. Ext.* **2021**, *29*, 247–268. [CrossRef]
29. Muhamadi, S.; Boz, I. Factors influencing farmers' perception of sustainable agriculture: A case study of Musanze District, Rwanda. *Int. J. Sustain. Agric. Manag. Inform.* **2022**, *8*, 408–424.

30. Donatti, C.I.; Harvey, C.A.; Hole, D.; Panfil, S.N.; Schurman, H. Indicators to measure the climate change adaptation outcomes of ecosystem-based adaptation. *Clim. Change* **2020**, *158*, 413–433. [CrossRef]
31. Doswald, N.; Munroe, R.; Roe, D.; Giuliani, A.; Castelli, I.; Stephens, J.; Möller, I.; Spencer, T.; Vira, B.; Reid, H. Effectiveness of ecosystem-based approaches for adaptation: Review of the evidence-base. *Clim. Dev.* **2014**, *6*, 185–201. [CrossRef]
32. Eta, H.C.; Yekinni, O.T.; Elemi, G.F. Perceived capacities of public extension personnel for climate information dissemination to farmers in Cross River State, Nigeria. *J. Agric. Ext.* **2022**, *26*, 44–52. [CrossRef]
33. Munang, R.; Thiaw, I.; Alverson, K.; Goumandakoye, M.; Mebratu, D.; Liu, J. Using ecosystem-based adaptation actions to tackle food insecurity. *Environ. Sci. Policy Sustain. Dev.* **2013**, *55*, 29–35. [CrossRef]
34. Gupta, J. The multi-level governance challenge of climate change. *Environ. Sci.* **2007**, *4*, 131–137. [CrossRef]
35. Cooper, S.J.; Wheeler, T. Adaptive governance: Livelihood innovation for climate resilience in Uganda. *Geoforum* **2015**, *65*, 96–107. [CrossRef]
36. Leventhal, H.; Cameron, L. Behavioral theories and the problem of compliance. *Patient Educ. Couns.* **1987**, *10*, 117–138. [CrossRef]
37. Grothmann, T.; Patt, A. Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Glob. Environ. Change* **2005**, *15*, 199–213. [CrossRef]
38. Zobeidi, T.; Yaghoubi, J.; Yazdanpanah, M. Farmers' incremental adaptation to water scarcity: An application of the model of private proactive adaptation to climate change (MPPACC). *Agric. Water Manag.* **2022**, *264*, 107528. [CrossRef]
39. Le Dang, H.; Li, E.; Nuberg, I.; Bruwer, J. Farmers' assessments of private adaptive measures to climate change and influential factors: A study in the Mekong Delta, Vietnam. *Nat. Hazards* **2014**, *71*, 385–401. [CrossRef]
40. Nguyen, V.B.; Ho, N.L. Study the impact factors of climate change on agricultural land use in Phong Dien district, Thua Thien Hue province. *J. Vietnam. Environ.* **2020**, *12*, 62–69. [CrossRef]
41. Kummar, R. *Research Methodology: A Step-by-Step Guide for Beginners*; SAGE: Los Angles, CA, USA, 2011.
42. Shields, P.M.; Rangarajan, N. *A Playbook for Research Methods: Integrating Conceptual Frameworks and Project Management*; New Forums Press: Stillwater, OK, USA, 2013.
43. McKendrick, J.H. Multi-Method Research: An Introduction to Its Application in PopulationGeography. *Prof. Geogr.* **1999**, *51*, 40–50. [CrossRef]
44. Creswell, J.W. Mapping the developing landscape of mixed methods research. *SAGE Handb. Mix. Methods Soc. Behav. Res.* **2010**, *2*, 45–68.
45. Gverdtsiteli, G. Authoritarian environmentalism in Vietnam: The construction of climate change as a security threat. *Environ. Sci. Policy Brief* **2023**, *140*, 163–170. [CrossRef]
46. Reidsma, P.; Ewert, F.; Lansink, A.O.; Leemans, R. Adaptation to climate change and climate variability in European agriculture: The importance of farm level responses. *Eur. J. Agron.* **2010**, *32*, 91–102. [CrossRef]
47. Campos, M.; Velázquez, A.; McCall, M. Adaptation strategies to climatic variability: A case study of small-scale farmers in rural Mexico. *Land Use Policy* **2014**, *38*, 533–540. [CrossRef]
48. Muccione, V.; Daley, B. The Role of Ecosystem-based Adaptation in the Swiss Mountains, in Climate Change Adaptation Strategies—An Upstream-downstream Perspective. Springer: Berlin, Germany, 2016; pp. 161–177.
49. Bourne, A.; Holness, S.; Holden, P.; Scorgie, S.; Donatti, C.I.; Midgley, G. A socio-ecological approach for identifying and contextualising spatial ecosystem-based adaptation priorities at the sub-national level. *PLoS ONE* **2016**, *11*, e0155235. [CrossRef] [PubMed]
50. Schismenos, S.; Zaimes, G.N.; Iakovoglou, V.; Emmanouloudis, D. Environmental sustainability and ecotourism of riparian and deltaic ecosystems: Opportunities for rural Eastern Macedonia and Thrace, Greece. *Int. J. Environ. Stud.* **2019**, *76*, 675–688. [CrossRef]
51. Dang, H.L.; Li, E.; Nuberg, I.; Bruwer, J. Factors influencing the adaptation of farmers in response to climate change: A review. *Clim. Dev.* **2019**, *11*, 765–774. [CrossRef]
52. Mustafa Saroar, M.; Mahbubur Rahman, M.; Bahauddin, K.M.; Abdur Rahaman, M. Ecosystem-based adaptation: Opportunities and challenges in coastal Bangladesh. In *Confronting Climate Change in Bangladesh: Policy Strategies for Adaptation Resilience*; Springer: Cham, Swizerland, 2019; pp. 51–63.
53. Phuong, L.T.H.; Wals, A.; Sen, L.T.H.; Hoa, N.Q.; Van Lu, P.; Biesbroek, R. Increasing Vietnamese smallholder farmers' adaptive capacity to respond to climate change. *Local Environ.* **2018**, *23*, 879–897. [CrossRef]
54. Onofri, L.; Nunes, P.A. Economic valuation for policy support in the context of ecosystem-based adaptation to climate change: An indicator, integrated based approach. *Heliyon* **2020**, *6*, e04650. [CrossRef]
55. Riera-Spiegelhalder, M.; Campos-Rodrigues, L.; Enseñado, E.M.; Dekker-Arlain, J.D.; Papadopoulou, O.; Arampatzis, S.; Vervoort, K. Socio-economic assessment of ecosystem-based and other adaptation strategies in coastal areas: A systematic review. *J. Mar. Sci. Eng.* **2023**, *11*, 319. [CrossRef]
56. Below, T.; Artner, A.; Siebert, R.; Sieber, S. Micro-level practices to adapt to climate change for African small-scale farmers. *Int. Food Policy Res. Inst. Discuss. Pap.* **2010**, *953*, 1–20.

57. Ojha, H.R.; Sulaiman, V.R.; Sultana, P.; Dahal, K.; Thapa, D.; Mittal, N.; Thompson, P.; Bhatta, G.D.; Ghimire, L.; Aggarwal, P. Is South Asian agriculture adapting to climate change? Evidence from the Indo-Gangetic Plains. *Agroecol. Sustain. Food Syst.* **2014**, *38*, 505–531. [CrossRef]
58. Nyanga, P.H.; Johnsen, F.H.; Aune, J.B.; Kalinda, T.H. Smallholder farmers' perceptions of climate change and conservation agriculture: Evidence from Zambia. *J. Sustain. Dev.* **2011**, *4*, 73–85. [CrossRef]