Understanding the Gender Dimension of Climate Change Vulnerability in Small-Scale Fisheries

by

Andrew Dominguez, Brynn Rotbart, Queenie Wei

Dr. John Virdin, Advisor

Ben Siegelman, Rare Inc., Client

April 25, 2025

Masters project submitted in partial fulfillment of the requirements for the

Master of Environmental Management degree in the

Nicholas School of the Environment of Duke University

EXECUTIVE SUMMARY

Understanding the gender dimensions of climate vulnerability within small-scale fishing (SSF) communities requires gender-disaggregated data that are often not available to researchers and practitioners. Although women comprise almost half of the workforce in SSF sectors globally, there is often a lack of data about their activities and their labor is often uncounted. As communities around the world face escalating climate change impacts, it is crucial to understand the role that gender plays in climate change vulnerability in SSF communities. The objective of this report is to gather information on the key gender-disaggregated climate change vulnerability indicators and to provide recommendations for improving our client's climate change vulnerability assessments.

This project's client is Rare Inc, a non-profit organization based in the United States. Rare utilizes a household survey method for their Climate Change Vulnerability Assessment (CCVA) instrument, which they use to understand the vulnerabilities of the communities in their program areas. Our client has requested that we provide them research that will inform and enhance their CCVA and to contribute to their Gender Equality and Social Inclusion (GESI) initiatives. Rare's GESI team is interested in learning how to better measure the gender-dimension of climate change vulnerability in small-scale fisheries in order to help Rare improve climate vulnerability outcomes for women and for their communities.

The project's goal is to generate evidence-based recommendations for additional CCVA variables for measuring gender impacts, propose preferred data sources, and identify risk thresholds. To achieve this goal, the team conducted a literature review focused on gender and climate change vulnerability in small-scale fisheries and other small holders, such as agriculture and agroforestry. The literature review focused on peer-reviewed literature from 2007 to 2024. Information from the reviewed literature was encoded and analyzed using NVivo 14 software which allowed the team to identify the key vulnerability indicators that emerged from their review.

The literature review highlights the following factors as key gender-disaggregated climate change vulnerability indicators: Gender of the household head, education, technology, decision making, household duties, financial resources, extension services, income diversification, land tenure, migration, poverty level, cultural norms and beliefs.

Two kinds of recommendations are provided in this document:

(1) Data analysis methods that can be used on Rare's existing gender-disaggregated data, such as for addressing research questions concerning decision-making and non-fisheries roles. These suggestions include the use of regression analysis on existing survey data. Some explanatory variables proposed are proxies for intra-household financial decision-making to better utilize the current household surveys.

(2) Recommendations for collecting new gender-disaggregated data concerning land tenure, perceptions of climate change, and migration. These recommendations include sample questions about community members' perceptions of climate change, land tenure arrangements, internal and international migration, and the duration of a person's absence. Modifications to the current household survey are also suggested to better measure gender in small-scale fishing communities.

TABLE OF CONTENTS

INTRODUCTION

Background

Small-scale fisheries (SSF) play an important role in global food security, livelihoods, and coastal economies. These fisheries "function as critical safety nets that allow people worldwide to avoid poverty and malnutrition… [which] is highly relevant for marginalized households and local economies coping with the effects of a changing climate" (Virdin et al., 2023). These SSF communities are highly vulnerable to climate change (Frawley et al., 2024), which is expected to reduce "fishable biomass" in oceans "by up to 40% in some tropical areas" (Cinner et al., 2022). And in these communities, "it is the social dimensions of vulnerability that determine the degree to which societies are likely to be affected by these changes" (Cinner et al., 2022). Crucially, women in SSF communities often face heightened climate change risks due to their location and socioeconomic limitations (Akinsemolu and Olukoya, 2020).

A large portion, around 40%, of the SSF sector remains unacknowledged and invisible – the role of women. Forty-five million women work in SSF, yet their contributions are largely overlooked and underrepresented due to a persistent gender data gap (FAO et al., 2023).

Many activities within the SSF sector that are undertaken primarily by women are underreported and poorly documented due to these activities being unpaid, informal, or not defined as fishing. What's more, a lot of the SSF data are not gender-disaggregated, making it difficult to tease out female contribution. This underrepresentation leads to negative impacts, including:

- Exacerbation of marginalization: Women are marginalized and have difficulties accessing SSF-related gear, habitat, opportunities, etc. The lack of reflection on women's experiences and contributions in data further perpetuates the gender-blind feedback cycle and further marginalizes women, especially those from vulnerable communities.
- Distorted perception of the sector: Without gender-disaggregated data, policymakers do not have a full picture of women's contribution to the sector, which makes it harder for them to implement strategies and policies to help women.
- Limited access to social security: Women's invisibility in the sector, along with their prevalence in unpaid and informal activities, limits their social protection and security (FAO et al., 2023).
- Reinforcement of gender bias: The absence of data can lead to the reinforcement of traditional gender roles and gender biases, including who is a "fisher" and what responsibilities each gender holds. This can further entrench the gender inequality within the sector.

The Client

The client of this project is Rare and its Fish Forever program. Rare is a global nonprofit organization based in the United States. Fish Forever's mission is to use "an innovative behavior-centered approach to strengthen community-led coastal fisheries management and restore marine ecosystems" (https://rare.org/program/fish-forever/). Rare uses CCVA, which combines household surveys and scientific data, as an instrument for calculating a community's vulnerability to climate change. "The CCVA guidance presents two options for assessing climate change vulnerability: a high-level regional approach for comparing vulnerability across larger areas, and a detailed local approach for exploring the specific drivers of vulnerability unique to each location" (Fish Forever, 2019).

The scoping of our literature review began with understanding the framework that Rare is using to understand climate change vulnerability. Rare cites the Intergovernmental Panel on Climate Change's (IPCC) 2007 definition of vulnerability, which reads as follows: "Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is *exposed*, its *sensitivity*, and its *adaptive capacity*" ("Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change" 2007, 883). Accordingly, Rare uses the formula Vulnerability = Exposure + Sensitivity – Adaptive Capacity, with those latter two terms including both social and ecological dimensions (e.g. ecological sensitivity and social sensitivity).

<u>Rare's definitions of keywords:</u> **"Social sensitivity** measures the local community's *economic dependence* on the fishery, *livelihood dependence* on fishery, and *coastal slope* to understand to what degree the socio-economic system may be disrupted by a changing climate. Ecological vulnerability (also known as social exposure) added to social sensitivity constitutes *social impact potential* for an area." **"Social adaptive capacity** is the most difficult component to measure as it is the collective ability of a community to respond to a yet-unrealized challenge (Whitney et al., 2017, Cinner et al., 2018). However, several characteristics provide understanding and help illuminate a community's capacity to respond to and recover from climate challenges, including: *access to credit, community infrastructure, livelihood diversity, fishing gear diversity, social trust, mobile phone prevalence, governance effectiveness, community empowerment,* and *education*."
(Fish Forever, 2019, 11)

Project Objectives

Our objective is to produce evidence-based recommendations to improve the use of Rare's existing CCVA data and to introduce options for additional CCVA variables to better measure the role of gender, preferred data sources and risk threshold levels. The outputs are a literature review with a bibliography. The client's aim is to learn (1) how gender is measured and utilized in assessing climate vulnerability of small-scale fishing communities, (2) how to incorporate gender-based data collection and data analysis into the existing work of Rare. Our literature search was focused on collecting relevant research concerning small-scale fishing communities. We supplemented these search results with additional research concerning other small-scale producer sectors such as agriculture or agroforestry.

We aimed to:

1. Examine existing literature to determine whether there is consensus (or better approaches) on:
    a. disaggregating climate change vulnerability data by gender (from household-level surveys)
    b. More accurately defining and measuring gender in the context of climate change vulnerability
    c. Identifying relationships between gender data and other variables relevant to climate change vulnerability in small-scale fishing and other small-scale producer communities (e.g., socio-ecological sensitivity, adaptive capacity, resilience, and climate vulnerability)
2. Analyze and translate literature review findings to better inform Rare's GESI data collection and their efforts to improve their Climate Change Vulnerability Assessment

Our literature review is an attempt to answer these questions:

1. How is gender measured and utilized in assessing climate vulnerability in smallholder or small-scale producer communities, including small-scale fishing communities, agroforestry, forestry, pastoral, and mining? Our goal is to gather information on qualitative and quantitative methods, approaches, and frameworks for collecting and analyzing data for understanding gender and climate change.

2. What statistical and data analysis tools are being used for household survey data to understand the intra-household gender dimensions of climate change vulnerability and adaptation? What approaches to data analysis have been used to understand gender dimensions in households? What different approaches? What are suitable data collection methods for obtaining necessary data for this analysis?

Through our research we obtained information on how gender roles and dynamics may impact socio-ecological sensitivity, adaptive capacity, resilience, and climate vulnerability. We hope that our work will aid efforts to improve the Climate Change Vulnerability Assessment, provide meaningful insight on how to better and more accurately take and measure gender data and its impact in small-scale fishing communities, and support Rare's Gender Equality and Social Inclusion (GESI) initiatives.

METHODS

Scoping the search for literature

To prepare for the literature review and research for this project, we read papers and reports suggested by our faculty advisors and research partners to develop background and contextual information about subsistence fishing (Virdin et al., 2023), gender (Harper et al. 2023), and gender-inclusive data systems for small-scale fisheries (Harper et al. *In review*), climate change impacts on fisheries and agriculture (Cinner et al., 2022; Gutierrez et al., 2023), and climate risk reduction through effective fisheries management (Cheung et al., 2018).

We sought subject matter guidance from Duke faculty members John Virdin and Xavier Basurto, and consulted with our client Ben Siegelman at Rare. We consulted with Jenna Strawbridge, Senior Assistant Librarian at the Duke University Libraries, who suggested search and methodology processes, Zotero database management, and who helped refine our final search strings.

The background information and expert and client consultations helped us to determine keywords for our database searches on Web of Science and Google Scholar. The aim of the search string is to narrow the results to peer-reviewed academic papers that focus on gender and climate change vulnerability in small-scale fishing communities. Keywords include "gender," "woman," "climate change," "environment," "vulnerability," "artisanal fishing," "small-scale fishing," "fishing community," "fisher folk", "subsistence," "coastal communities". Our faculty advisors suggested we use search strings that will broaden the scope of the literature to include other small-producer communities, including agricultural, pastoral, mining, and forestry communities.

Rare uses the Intergovernmental Panel on Climate Change's (IPCC) 2007 definition of climate change vulnerability, which is a function of "exposure," "sensitivity," and "adaptive capacity," which could be useful search terms ("Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change" 2007, 883). Because this definition of climate change vulnerability emerged in 2007, we excluded sources published prior to 2007.

Because of the client's interest in improving data analysis methodology for their existing survey data, and because our recommendation for gender-differentiated data collection will be for use in their survey instruments, we also included search sets for papers with survey methodologies that are seeking to address similar questions. One such paper from our background literature searches uses the keyword "intra-household" in its discussion of the different climate risk perceptions held by men and women in agricultural households (Ginbo and Hansson, 2023).

We validated our search strings by ensuring that the results include certain benchmark articles from our background set of citations, including Graziano et. al. 2018, Harper et. al. 2013, and Kawarazuka et. al. 2017.

Search Process

Our primary research database was Web of Science. Additional searches were conducted in Google Scholar and two Proquest databases — Agricultural & Environmental Science and Earth, Atmospheric & Aquatic Science. The Duke Library provided credentials for our use of these databases.

In the Proquest databases we limited our searches to only peer-reviewed papers. For all databases, we limited the results by publication date (January 1, 2007 to December 31, 2024).

In order to limit the search results for relevance, we only searched titles and abstracts and keywords in Web of Science and in the Proquest databases.

We downloaded the first 150 citations, sorted by relevance, from all the databases, to be screened in Zotero.

Search Strings: Gender and Climate Change

Web of Science

((((TS=(gender OR wom*n OR girl OR "gender dimension" OR "gender *quality")) AND TS=(climate OR "climate change" OR "climate-change" OR "changing climate" OR "climate hazard")) AND TS=("small scale" OR "small-scale" OR "subsistence" OR "artisanal" OR smallholder OR “small-holder” OR “small holder”)) AND TS=(fish* OR fish OR farming OR agricul* OR fores* OR livestock OR mining OR pastoral) AND TS=(vuln*))

Google Scholar

(gender OR wom*n OR girl OR "gender dimension" OR "gender *quality") AND (climate OR "climate change" OR "climate-change" OR "changing climate" OR "climate hazard") AND ("small scale" OR "small-scale" OR "subsistence" OR "artisanal" OR smallholder OR “small-holder” OR “small holder”) AND (fish* OR fish OR farming OR agricul* OR fores* OR livestock OR mining OR pastoral) AND vuln*

ProQuest databases combined search: (1) Agricultural & Environmental Science, (2) Earth, Atmospheric & Aquatic Science

(noft((gender OR wom*n OR girl OR "gender dimension" OR "gender equality" OR "gender inequality")) AND noft((climate OR "climate change" OR "climate-change" OR "changing climate" OR "climate hazard")) AND noft(("small scale" OR "small-scale" OR "subsistence" OR "artisanal" OR smallholder OR "small-holder" OR "small holder")) AND noft((fish* OR fish OR farming OR agricul* OR fores* OR livestock OR mining OR pastoral)) AND noft(vulnerab*)) AND (stype.exact("Scholarly Journals") AND pd(20070101-20241231) AND PEER(yes))

Search Results

Web of Science returned 231 results, the first 150 of which were exported to Zotero. Google Scholar returned 18,000 results, the first 150 of which were exported to Zotero. The two ProQuest databases — Agricultural & Environmental Science, and Earth, Atmospheric & Aquatic Science — returned 98 results, all of which were exported to Zotero.

Zotero was used to merge duplicates that were pulled from the three databases. After merging duplicates, the number of results for screening totaled 311 items.

Zotero Database Management

All citations (titles, year, authors, abstracts) were cataloged in a shared Zotero group library. Zotero automatically identifies duplicate citations. We removed (or "merged") these duplicate citations to prevent screening the same paper two or more times.

Initial Screening Process

The titles and abstracts of the literature were downloaded and stored in Zotero. The screening team used five randomly selected articles to train their screening process. They repeated the training to refine the screening and eliminate inconsistencies between the screeners such that all screeners could reasonably be expected to screen in a consistent manner.

Eleven papers were used to practice the screening process. The remaining 300 papers were divided among the three screeners, 100 papers each.

The results of the screening process were tracked in a shared spreadsheet. The citations in Zotero were simultaneously sorted into sub-collections (Climate Change, Survey Methodology, Women in Management, No, Maybe) for organization purposes and to facilitate exporting bibliographies. The reason the team utilized three different sub-collections — Climate Change, Survey Methodology, Women in Management — was to allow for the team to collect research papers for the different research areas of interest. Some papers touched on all three of those broad topics, but most papers only touched on one or two of the categories.

Screening Criteria

1. Is English the language of publication?
    a. Yes, Continue screening
    b. No, stop screening
2. Do the title and abstract indicate or imply that the paper focused on small-scale fisheries or smallholders? (This includes mining, agriculture, forestry, livestock, pastoral communities; can include mention of "developing countries" or "poor communities")
    a. Yes, Continue screening

    b. No, stop screening
3. Do the title and abstract mention women or gender?
    a. Yes, Continue screening
    b. No, stop screening
4. Do the title and abstract mention any of the following:
    a. Climate change
        i. Yes, sort to climate change sub-collection in Zotero
    b. Survey methodology or data collection methods (ex. include questionnaire, survey, "semi-structured", focus groups, key informant interviews)
        i. Yes, sort to survey sub-collection in Zotero
    c. Women's participation in or attendance or experience of local leadership, co-management, cooperative management, local town management, household management, natural resource management
        i. Yes, sort to management sub-collection in Zotero
    d. If none, stop screening.

Additional Screening and Results

Of the initial 311 papers entered into the screening process, 196 papers were accepted into one or more of the three categories, much more than was initially expected. The broadest collection of papers were for the "Climate change" sub-collection (184 titles). The "Women in management" sub-collection had the fewest papers (21 titles). The "Survey methodology" sub-collection had 85 papers. Some titles appear in more than sub-collection given the topics mentioned in the abstract.

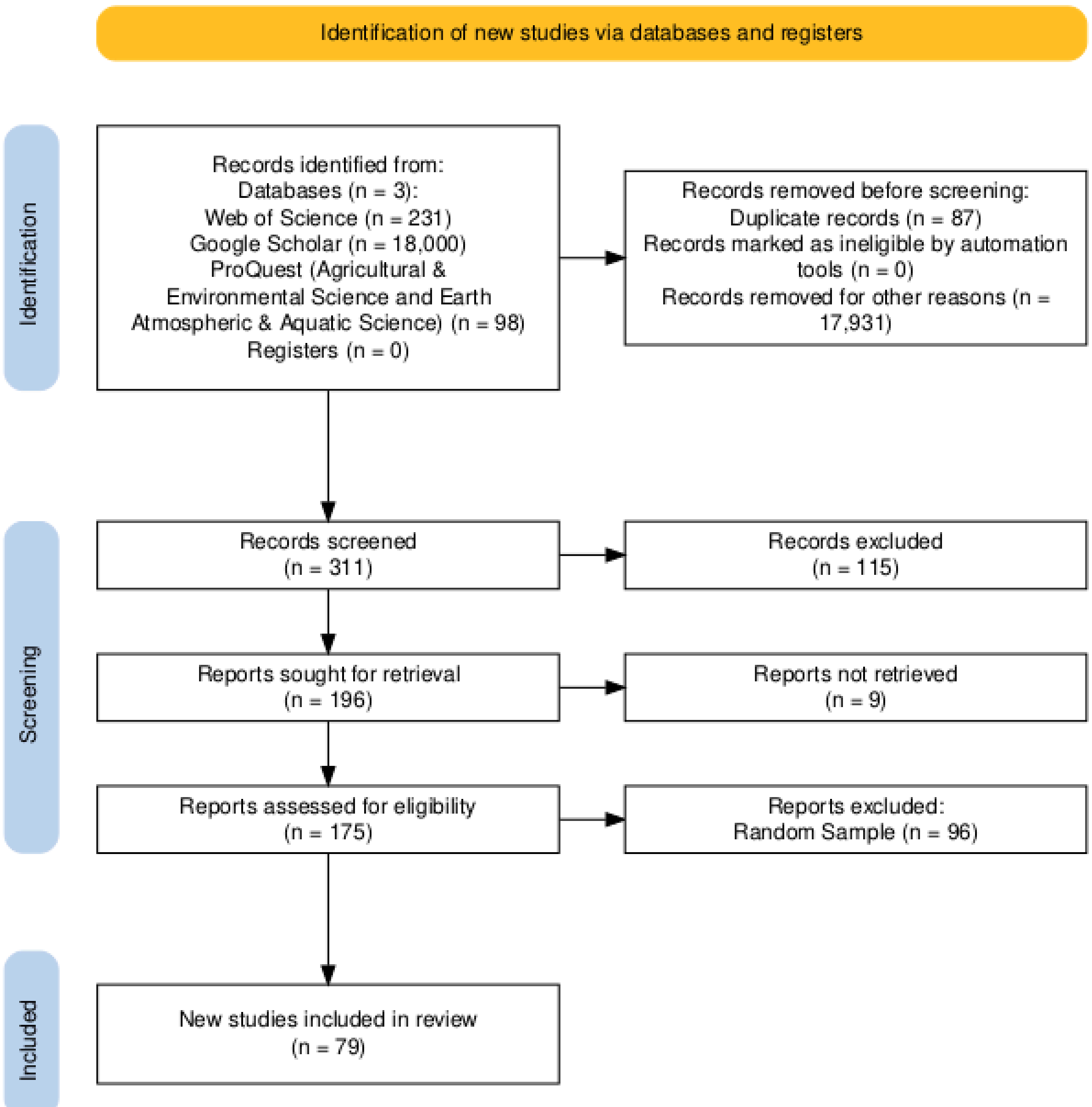
Given the large volume of papers, the research team conducted a secondary screening process to first sort papers within the "Climate change" sub-collection that were principally about small-scale fisheries (i.e. not principally about agriculture, which was most of the screened literature). This resulted in 32 papers being sorted into a "SSF Climate change" sub-collection (three titles were not available from the Duke Library system or online). Of the remaining 152 titles in the "Climate change" sub-collection, a random sample of fifty titles (33% of 152) was selected using the random number function in Google Sheets. Six of these fifty titles were not available online nor from the Duke Library system, so papers next on the list according to the random number generator replaced those missing titles. These 79 papers were compiled into a final sub-collection of papers that were a representative sample of the 184 titles captured in our "Climate change" search and screening process, with an emphasis on the small-scale fisheries titles that are most relevant to our research question.[1]

[1] Our literature review sampling process was modeled on the method used in Smith, H., & Basurto, X. (2019). Defining Small-Scale Fisheries and Examining the Role of Science in Shaping Perceptions of Who and What Counts: A Systematic Review. Frontiers in Marine Science, 6. https://doi.org/10.3389/fmars.2019.00236

All screening documents in Google Sheets and the Zotero databases were maintained so that subsequent researchers can analyze the other literature at a future date.

The search and screening process is illustrated in this diagram:

PRISMA Diagram of Searching and Screening the Literature



Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis Campbell Systematic Reviews, 18, e1230. https://doi.org/10.1002/cl2.1230

Content Analysis

The final selection of papers for the literature review were exported from Zotero into NVivo 14 (Windows). The team selected four papers for an initial practice round of coding then met and compared inter-reader ratings (Kappa ratings) using NVivo. The team then modified their code book for clarity, selected two new papers for another practice round and inter-reader rating comparison, which were improved to around 0.40 kappa statistic.

The 79 papers were divided among the three readers using a random number generator in Google Sheets. Each reader was assigned 26 papers, with one random chosen for re-testing the kappa score midway through the literature review (after 13 papers were read coded by each reader).

The readers used NVivo 14 to code the final sampled selection of literature. A code book was developed to help the readers coordinate their work. Four main codes were developed.

The code for Gender Disaggregated Climate Change Vulnerability Indicators was used to collect passages and information relevant to answering the first research question:

> *How is gender measured and utilized in assessing climate vulnerability in smallholder or small-scale producer communities, including small-scale fishing communities, agroforestry, forestry, pastoral, and mining? Our goal is to gather information on qualitative and quantitative methods, approaches, and frameworks for collecting and analyzing data for understanding gender and climate change.*

The research team sought to gather information on all the various ways that academics have been defining and discussing gender and climate change vulnerability, and using gender-disaggregated indicators to understand climate change vulnerability. To harmonize coding decisions, the research team described limits to what could be included in this category and provided examples of topics and themes that are relevant. Because the research team did not have prior expectations of what might be contained in the surveyed literature, this category was left fairly open ended and was designed to allow the team to review all the codes to identify the key themes that emerge from the literature.

A second main code for data collection and data analysis methods was created collect passages and information relevant to answering the second research question:

> *What statistical and data analysis tools are being used for household survey data to understand the intra-household gender dimensions of climate change vulnerability and adaptation? What approaches to data analysis have been used to understand gender dimensions in households? What different*

approaches? What are suitable data collection methods for obtaining necessary data for this analysis?

For ease of later review, the team created child codes or sub-codes that sorted the passages and data points according to broad data analysis categories: quantitative methods, qualitative methods, mixed methods, and data sources. Because some methods, such as statistical analysis and survey methods, can be repurposed across disciplines or topics, the research team did not limit this to climate change vulnerability data. Instead, the team sought to gather specific methodologies for gathering and analyzing gender-disaggregated data. When paired with findings from the first code book of climate change vulnerability indicators, the team was able to use these codes to recommend new data analysis and data collection methods for Rare to use.

The final two main codes for best practices for program implementation and for the gender context of smallholder communities were designed to provide the research team with resources for understanding the context of program implementation for gender and climate change vulnerability, as well as important contextual information on the gender dynamics that lead to negative climate change vulnerability outcomes.

Finally, all passages were also assigned to a specific "case" in NVivo. These cases were used to distinguish between the main smallholder communities contained within the research: fisheries, agricultural, and *all others*. Using these cases allowed the research team to categorize the research by the livelihood sector.

Code Book

1. **Gender-Disaggregated Climate Change Vulnerability Indicators** (Parent)
    a. Limits
        i. Must be explicitly linked to climate change
        ii. Must be an indicator that is observable or measurable
        iii. Must mention gender (e.g. "women", "female", "men", "male" in discussion)
    b. Description/Examples
        i. Dependency on natural resources
        ii. Income diversification
        iii. Networks
        iv. Migration
        v. Geohazard preparedness, vulnerability, and resilience
2. **Data-collection and Data Analysis Methods for Gender-Disaggregated Data (parent)**
    a. Limits
        i. Must be gender-disaggregated data
        ii. Does not have to be about climate

        iii. Should be more than just listing the tool used — cannot just say “we conducted key informant interviews” or “we used a survey”. Should be specific/ explain the method
    b. Child Codes
        i. Quantitative Methods (including statistical analysis)
            1. E.g. formulas
        ii. Qualitative Methods
        iii. Mixed Methods
        iv. Data Sources (databases, etc)
3. **Best Practices for Gender-Aware Program Implementation**
    a. Limit
        i. Recommendations and best practices that are specifically useful for NGOs, practitioners and policy advocates
        ii. This includes discussion about gender and climate change vulnerability as well as gender-disaggregated data collection and analysis
    b. Example/Description
        i. Discussions about what organizations should do on a go-forward basis when considering the gender dimensions of climate change vulnerability and gender-disaggregated data collection and analysis
4. **The Gender Context of Small-holder Communities and Households (Parent)**
    a. Gender-differentiated or gender-mediated outcomes (child)
        i. How men and women respond or have differing results in something (not benefiting in the same way, paying in the same way, etc)
    b. Gender Roles (Child)
        i. Description/Examples
            1. Jobs
            2. Household duties
            3. Incomes
            4. Livelihoods
            5. Safety
            6. Health
    c. Larger systems (child)
        i. Description/Examples
            1. Cultural norms, beliefs, or attitudes around gender

Cases:

1. Small-Scale Fishing (SSF)
2. Agriculture
3. Other Small-holders (i.e., not SSF or Agriculture)

The research team used an inductive approach for their content analysis whereby the team collected the most commonly discussed climate change vulnerability indicators that emerged from the literature review (Elo & Kyngäs, 2008). These most commonly discussed indicators are discussed in the Key Results section of this paper.

These coded results were then analyzed using NVivo 14's matrix coding query, which quantifies the frequency and distribution of codes across the three cases, providing a heat map of the quantity of occurrence (**Table 1**). Of the three cases, Agriculture had the highest number of coding occurrences (482), and other smallholders had the lowest (61). Our primary coding target for answering our main research question, Gender-Disaggregated Climate Change Vulnerability Indicators, had the highest number of codes (211), followed by The Gender Context of Small-holder Communities and Household (160) and Data-collection and Analysis Methods for Gender-Disaggregated Data (127). Passages about Data-collection and Analysis Methods and passages about Gender Context were also encoded into child-codes, if appropriate. **Table 1** , for instance, shows that of the 127 coded passages about Data-collection and Analysis Methods, 51 were identified as quantitative methods.

Table 1: Number of coded passages and cases in NVivo 14. (Green marks the highest occurrence, red marks the lowest.)

	Cases			
Codes	A : Agriculture	B : Small-Scale Fishing	C : Other Small-holders	**Total:**
1 : Best Practices for Gender-Aware Program Implementation	32	12	5	49
2 : Data-collection and Analysis Methods for Gender-Disaggregated Data	89	34	4	127
2a : Mixed Methods	13	3	0	16
2b : Qualitative Methods	9	6	0	15
2c : Quantitative Methods	43	8	0	51
3 : Gender-Disaggregated Climate Change Vulnerability Indicators	120	68	23	211
4 : The Gender Context of Small-holder Communities and Household	82	64	14	160
4a : Gender Roles	22	30	7	59
4b : Gender-differentiated or gender-mediated outcomes	61	40	7	108
4c : Larger Systems	11	4	1	16
Total:	482	269	61	812

KEY RESULTS FROM THE LITERATURE REVIEW

Gender of the Household Head: Data Collection

Across most of the literature, the gender of the household head is a demographic data point collected for quantitative and qualitative analyses that seek to understand if data on gender can be used for climate change vulnerability assessments or if the gender of the household head affects climate change adaptation measures and strategies. It is often a significant predictor or estimator in regression analyses of behavior or vulnerability.

Examples where a variable for gender of the household head is used to quantitatively analyze adaptation measures and strategies include research by Ali (2021) on farming communities in Northern Togo, research into farming communities in the Vhembe District of South Africa (Kom et al., 2022), northeast Ethiopia (Ayele et al., 2024), eastern Kenya (Mugi-Ngenga et al., 2016), semi-arid regions of Ghana (Nyantakyi-Frimpong and Bezner-Kerr, 2015), the Zvishavane region of Zimbabwe (Chidakwa et al., 2020), the Shaanxi Plain of China (Ge et al., 2023), and in the Ogun State of Nigeria (Ojo et al., 2022). Koomson et al. (2020) use the variable for their analysis of small-scale fishing in Ghana.

The variable is also used for climate change vulnerability assessment, including for gender-disaggregated discussions about access to services, resources, knowledge: agricultural research by Maja et al. (2023) in Eastern Ethiopia, Chidakwa et al. (2020) in Zimbabwe, Nelson (2010) across Africa, Poudel et al. (2020) in the Lamjung district of Nepal. Sreya et al. (2021) use the variable for their analysis of the climate change vulnerability of small-scale fishing communities in Southern India.

The gender of the household head is also used by researchers interested in understanding household decision-making concerning climate change adaptation strategies. Ayele et al. (2024) used the variable in multivariate probit models to identify the different factors that influence adaptation strategies of farming households in northeast Ethiopia. Ali (2021) used the gender of the household head as a control variable in Poisson and probit regression models to find that access to agricultural credit and extension services is a statistically significant factor in determining the number of adaptation strategies adopted by farm households in Northern Togo.

Research in farming communities in Ghana by Adzawla et al. (2019) moves beyond using a simple data point for gender of the household head and the gender of farm managers. The researchers instead collected gender data to distinguish between male heads of household, female heads of households, male farm hands/managers, female farm hands/managers. These designations were “determined based on their position in the family; thus, a household head was conceptualized as a person who is the leader of a family at a particular point in time, while a farm hand/manager is a person who is a member of a family and operates a personal farm.” Most importantly, they found that the gender of the household farm hands and farm managers was a more significant indicator of climate adaptation than the gender of the household head. The authors suggest that this is the case because farm managers and farm hands are tasked with making most farming decisions while the household head has non-farming household duties that occupy their attention, regardless of gender. They conclude by suggesting that research and interventions should be conducted at the individual level rather than at the household level (Adzawla et al., 2019).

Education

Access to education is a key determinant in understanding vulnerability, especially in marginalized groups such as women. Education shapes the ability to adapt, understand, and decide on climate smart measures to aid resilience towards a changing climate. Azong and Kelso (2021) cite studies showing that "educated farmers are more capable of responding to current and future climatic risks than the… uneducated farmers". However, women do not have equal access to this resource. Women are confined to household duties and the precedent set with cultural gender roles and constraints. In *"The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana"* the authors state that:

> *"..The differences between male and female smallholder farmers' adaptive capacity shows that there is a clear social disparity in relation to gender and education. Male farmers have better access to economic resources such as higher diversity of incomes and better access to credit, to technological resources such as better knowledge of soil fertility and soil moisture retention techniques as well as awareness and training such as level of literacy, access to climate information and extension services. Further, those with formal education perform significantly better than those farmers without formal education"* (Abdul-Razak and Kruse, 2017).

Education extends farther than a classroom setting. Financial literacy, technological access and understanding, awareness about the changing climate, and overall literacy aid in the success of educated individuals. Girls are compelled to drop out of school to assist their mothers with household tasks and their poor literacy levels contribute to early childbearing, further limiting their ability to earn money or adapt to climate change (Akinsemolu and Olukoya, 2020). Lack of access to education can also inhibit women's abilities to engage in alternative livelihood activities according to research by Azong and Kelso (2021). This may partially be due to "education [playing] an important role in awareness building and decision making on adaptation strategies and actions" (Azong and Kelso, 2021).

The lack of education will lead women to make less profitable or less beneficial decisions when it comes to agricultural success. Research by Ali (2021) cites evidence that "men were likely to adopt strategies such as the change of crop varieties… and soil and water conservation practices compared to women. This result might be associated with the lower levels of education or land constraint mostly faced by women". It has been shown that access to education would increase farmers' adaptive capacities and their likelihood of adopting resistant and high-yielding technologies (Ali, 2021).

This is further emphasized by a study conducted on smallholder farms in Ethiopia which found that "the educational status of female household heads significantly impacts their use of irrigation at a 5% significance level" (Ayele et al., 2024). This was also highlighted in another study that found that "education level emerged as a key characteristic influencing CSA adoption. In both sites, women were said to be less educated than men because they had less opportunities to access education in comparison to men" (Khoza et al., 2019). Female-headed households are already at a disadvantage when it comes to adaptation to climate change. Their lack of access to educational resources further entrenches their vulnerability if it causes them to hesitate to pursue climate adaptation strategies. These behavioral patterns do not reflect an inherent gender-differentiated preference, but are instead an outcome of unequal access to education. Ge et al. (2023) cite evidence that "...there is no difference in agriculture technology adoption between male and female farmers when they have equal opportunity access to land, credit, education and agricultural extension services."

Lastly, a woman's level of education can impact the likelihood of migration within a household. A study done in India found that if women were highly educated, men in their household were less likely to migrate (Agarwal et al., 2022). The study found that when a woman has a bachelor's degree only 20% of men in their household migrated, whereas if a woman were illiterate, the percent of male household member migration increased to 42.1%. The trend was present across various levels of educational attainment: if a woman had primary or secondary education, male household members did not migrate 65.1% to 84.2% percent of the time, respectively.

Access to education both in and outside of the classroom is a human right, one that is not given to women in many parts of the world. Improving education levels for women would boost their ability to use adaptive technology, be informed on the climate, have financial literacy, better decision making skills, more successful yields, and much more. Simply put, a "lack of access to education limits women's livelihood options and therefore exacerbates their vulnerability to climate change" (Azong and Kelso, 2021). Other researchers emphasize that "improving women's incomes, educational levels, access to information and their ability to participate in decision-making processes enhances the capabilities of the entire household and of society in general" (Weeratunge et al., 2010).

Technology

Technology is a vital resource for education and equal access to opportunity, and one that women are not always afforded. Agricultural technologies include improved seed varieties, irrigation, fertilizers, pesticides, and access to machinery such as multi-functional platforms (MFPs) which are engines adapted to run on biofuels for powering activities such as milling (Maja et al., 2023; Nelson, 2010). Researchers associate an increased access to these resources with a decreased vulnerability to climate change because these technologies help farmers become more resilient, productive, and efficient. However, the disparities in women's access to these technologies is cited as one of the top concerns when it comes to vulnerability (Abdul-Razak and Kruse, 2017). Nelson (2010) cites evidence from an FAO study to conclude that:

> *"women and men are being differently impacted by climate change, especially extreme events, and have different strategies for coping with longer-term increases in climate variability combined with differential access to institutional support for adaptation. Gender often determines who receives inputs for adaptation strategies, with gender being the biggest determinant (even more so than caste). Frequently new agricultural technologies bypass women farmers, despite women's knowledge"*(Nelson, 2010).

That research by Nelson (2010) reveals that there is inherent bias towards women and their access to necessary technological resources. This also includes less access to information and training concerning technology, climate change, and improved farming methods (Abdul-Razak and Kruse, 2017; Ge et al., 2023). For example, it was found that male farmers not only have better access to economic resources, such as higher diversity of incomes and better access to credit, but they also have better technological resources and increased knowledge about soil fertility and soil moisture retention techniques (Abdul-Razak and Kruse, 2017). Male farmers also had access to information and training to improve their literacy, access to climate information, and extension services (Abdul-Razak and Kruse, 2017). Researchers also found that "those with formal education perform significantly better than those farmers without formal education," (Abdul-Razak and Kruse, 2017), which often leaves female farmers relatively disadvantaged when compared with their male counterparts, as is discussed in the previous section on education. This dynamic creates a cyclical and inequitable pattern, where limited access to education, low literacy rates, insufficient climate awareness, and financial constraints serve to collectively marginalize women. Often, women are consequently excluded, overlooked, or unable to engage with and benefit from new technologies and interventions. Research by Ge et al. (2023) found that "that there is no difference in agriculture technology adoption between male and female farmers when they have equal opportunity access to land, credit, education and agricultural extension services". This finding leads to a conclusion that the problem of unequal climate change vulnerability between men and women is a function of the gender differences in their access to technology.

The introduction of new technology can be impactful. Call and Sellers (2019) cited case studies in Bangladesh and Malawi that found that adoption of new agricultural technologies increased women's household decision making power, women's income, provided more time for girls' education, and improved children's nutritional outcomes. However, introduction of new technology must be done with diligence and equality. Mangheni et al. (2019) suggest that if the introduction of new technologies does not take women and gender-differentiated outcomes into consideration, it may negatively affect the well-being of women farmers and result in more labor, more time spent on farming activities, and lower access to agricultural inputs. The authors cite evidence from other case studies that linked to the fact that "technology adoption decisions are informed by access to resources, and with a demonstrated large gender gap in assets, it means improved varieties are often not 'gender neutral' but depend on the context within which the technology is released" leaving women's ability to access it forgotten (Mangheni et al., 2019).

The literature in our review suggests that information, training, and access to technologies that improve livelihoods and provide means to adapt to climate change are necessary for decreasing women's vulnerability to climate change. Furthermore, equal access to technology as well as gender-neutral options in technology are necessary for increasing women's resilience.

Decision Making

Women's involvement in decision making processes is an important indicator of their adaptive capacity, inclusion, and power in a community. In a study by Nelson (2010) titled "*Climate Change and Gender What role for agricultural research among smallholder farmers in Africa?"* the author discusses how "Gender and power inequalities constrain many women's (and other marginalized groups') abilities to participate in decision-making from the household to the international level. Discrimination is embedded in formal and informal institutions". This is a problem when half of society is removed from the decisions about the society itself. Additionally, this often results in men having more access to resources, stronger decision making process, and therefore increased adaptive capacity according to a study conducted on small scale agriculture in Kenya (Palosaari et al., 2024). This trend has been found in small-scale fishing communities as well, with researchers describing instances when women were not sufficiently influential in the process of developing fishing and coastal policies, resulting in their vocalized concerns going unaddressed by community leaders (Axelrod et al., 2022).

Research by Adzawla et al., 2019 cites evidence that women are often more vulnerable to climate change because they are "often constrained in decision making and access to resources that improve their livelihoods." One example from their study of farmers in Ghana found that women were growing crops with different biophysical characteristics than men (Adzawla et al., 2019). As cited in other sections, women are making decisions to grow crops that are often less resilient to climate change and less technologically advanced because of their lack of access to extension services, education, and resources.

Women's lack of decision making power does not just impact them, but can influence their entire community. According to “cross-national research” in gendered management practices it is suggested that “lower levels of wealth and income inequality in communities are strongly associated with whether women are in leadership positions and the number of women in forest user groups” (Call and Sellers, 2019). The logic suggests that the more contributions, opinions, and perceptions that are involved in decision making, the better the decisions will be. Call and Sellers (2019) also address the challenges communities face when trying to involve multiple stakeholders. They also emphasize that the burden for involving women in decision making does not fall solely on women. “Research from Mozambique, Malawi, and Ghana found that when the participation of women is facilitated through strategies such as gender equity training for men and the use of female extension officers to target women farmers, extension services have the potential to increase the adoption of both agricultural inputs and natural resource management strategies by women” (Call and Sellers, 2019). Employing these strategies may prove successful elsewhere. It has also been found in several studies that designing decision-making processes that are more inclusive increased women's participation. For example, a case study in India found that “creating forest management groups exclusively for women significantly increased participation. Additionally, a ‘critical mass,’ at least 1/4 to 1/3 of a forest user committee comprised of women, can increase the probability that female committee members actively participate as resource decisions are made” (Call and Sellers, 2019). The case studies highlighted by Call and Sellers (2019) suggest a pattern of decision making processes in the study areas that are controlled predominantly by men. Those authors also provide evidence that suggests that women with better access to these decision making processes will experience improved climate change vulnerability outcomes.

The literature suggests that in the documented study areas, women are often not able to or are not permitted to be involved in decision making activities. Akinsemolu and Olukoya (2020) report that for the Ilaje community in Ondo State, Nigeria, a “majority of the women respondents believed that the unequal participation of women in decision-making processes as well as labor markets create inequalities and usually deter women from contributing to climate change mitigation”. The literature suggests that it is possible to improve climate change vulnerability outcomes for communities by providing interventions that increase women's participation and inclusion in decision making activities.

Household Duties, Partners, and Communities

The literature in our review documented many instances when women were relegated to household and familial duties and excluded from opportunities to participate in decision making or generate income. In some countries, gender roles are so segregated that even when husbands are present, “they generally did not help with child care or anything perceived as ‘women’s work’” (Nyantakyi-Frimpong, 2021). By comparison, women were expected, in many cases, to not only attend to the children and household duties but sometimes the farm, crops, and finances.

Nyantakyi-Frimpong (2021) provides evidence from smallholder agriculture in northern Ghana, writing:

> *"Women's agricultural work is an important precondition for adequate feeding of infants and young children; yet, this same agricultural work creates powerful constraints on child care and feeding practices, particularly during peak labor seasons. This suggests that agricultural interventions for climate change and nutrition should not ignore the burden of work for women. Moreover, men's limited engagement in day-to-day child care and nutrition activities is common in most parts of sub-Saharan Africa"* (Nyantakyi-Frimpong, 2021).

Women often have to do a full day of labor while simultaneously caring for children, and then upon return to her home, she must then do her domestic labor tasks. This leaves little time for women to engage in multiple income streams, attend town meetings, or get an education. This does not just apply to agricultural work, however. This trend is also present in SSF communities. In *Understanding gender intersectionality for more robust ocean science* the authors talk about how women's many duties "demonstrate how the intersection between gender and marriage/motherhood creates barriers for fisherwomen and female traders, particularly those who are married and/or have children, to travel and access more fruitful markets" (Axelrod et al., 2022). Men might contribute to increased financial stress on the family, leaving the responsibilities and income to the woman. Men's ability to trade, barter, or be involved in other market activities have been limited due to it being "inefficient due to their tendency to spend the money on "alcohol, gambling and extra-marital affairs, rather than bringing the money home to the family" (Axelrod et al., 2022). But even when men make money it is often not spent on their household or children. In research by Dah-gbeto and Villamor (2016) in agricultural communities in northern Benin, the authors found that "typically, women participants allocate income for household expenditures. Men are more likely to use proceeds from livestock sales to moving to larger towns or bordering countries (i.e., Nigeria) to seek wage labor opportunities, while some use the funds to purchase new motorcycles, improve their farms, and marry a new wife". This leaves women to allocate almost all of their money to household duties while men spend it on leisure and debaucherous activities, migration, or finding a new family. This, again, is not just present in agricultural communities. A female fish trader stated during a key informant interview "Now things have changed, I thought I was helping my husband to supplement money for our better lives. Now his money is for his own things and mine is for supporting the family" (Limuwa and Synnevåg, 2019).

In some cases depending on the culture, women are at risk if they choose to make an income. In Latin American countries where there are more defined masculine and feminine roles, men felt like their normative breadwinner role was threatened when women started to make an income, and this threat only increased if the income surpassed that of their own (Godden, 2013).

The same author cites previous research that found that "employed women in Peru who have more education than their husbands and are the dominant decision-makers have increased likelihood of violence, which is further fuelled by alcohol" and that "men use violence to sustain their control over women, challenging the threat of women's employment to their masculinity" (Godden, 2013). This creates an environment where women cannot seek alternative livelihoods without fear of consequence. Additionally, this is further evidence that targeting just women in gender equality work fails to acknowledge, in many instances, the perpetrators or instigators when it comes to women's vulnerability, safety, or equality. Equal resilience and equal rights cannot be forged without holding men responsible as well. As Nyantakyi-Frimpong (2021) wisely puts it "to reduce women's work burdens, a transformation of gender norms is required, for example, through the encouragement of men to participate in domestic work. Women also need greater autonomy, which is an aspect of empowerment."

Lastly, it seems women may have less access to community or knowledge sharing. Women in Mali, for example, were found to be more socially isolated and "less likely to receive information about mulching when it was diffused through social networks" (Aberman et al., 2015). This trend is found elsewhere, with male farmers noting that "they often receive climate information during meetings or from neighbors, whereas women face barriers to participation in such gatherings" (Ayele et al., 2024). Even when it comes to warnings about natural disasters, women may not have the same access to resources. In *Economic vulnerability of small-scale coastal households to extreme weather events in Southern India* the authors discuss access to communications and community, stating:

> "*In terms of a warning received against a pending natural disaster, the FHH [Female Household Head] emerged to be a more vulnerable section. All the 120 MHH surveyed were either active, retired, or had shifted from fishing to a different job. As a result, they had greater social connections and access to warning messages which they received mostly as SMS or WhatsApp messages. On the other hand, FHH rarely had members working in fishing groups and mostly received warnings through TV, neighbors or relatives" (Sreya, 2023).*

This means women need more access to communities, meetings, and other things that will enhance their connective capacity. This isolation may be in part due to family members and communities shunning a partnerless woman, or from entrenched gender roles. Either way, women's connective capacities need to be enhanced in order to embolden their resilience to natural disasters and increase their inclusion in community affairs.

Financial Resources

The literature in our review frequently discussed individual and household financial resources as an important factor in climate change vulnerability. Controlling for all other factors, it is often observed or assumed that having a store of wealth or a higher income can reduce a household's sensitivity to climate change shocks, including in scenarios where wealthier households can remain secure when extreme weather events or droughts reduce income in one season or one year. Wealthier households are also observed as having an increased ability to pay to restore their wellbeing after extreme weather events or natural disasters, which represents an increased adaptive capacity to climate change.

Access to financial resources is generally discussed in two ways. The first is a more general measure of the incomes, wealth, and poverty of households and individuals. The second is a more specific measure of a household's or individual's access to credit, typically from formal institutions like banks and credit associations. The trend across the literature is to associate higher incomes, higher wealth, and more access to credit as increasing adaptive capacity and decreasing climate change vulnerability.

Income, Wealth and Poverty

The literature that discusses the gender dimensions of income, wealth, and poverty in smallholder communities tends to observe or conclude that there is gender inequality in these measures of financial resources. Specifically, male-headed households tend to have higher incomes or have wealth than female-headed households. Authors typically link this pattern with relatively higher levels of climate vulnerability for female-headed households.

A study of small-scale fisheries in Southern India by Sreya et al. (2021) found that male household heads were able to recover from extreme weather events more quickly than female household heads because of their stronger social relations and connections that facilitate their receiving financial aid and increasing their financial security. The authors include in their analysis the ability of households to leverage their social relations to access formal or informal sources of financial aid, particularly the financial aid that male-headed households are able to receive from other family members. This study found that in this culture, women and female-headed households were not able to receive financial assistance from social contacts at the same level as male-headed households. The authors also noted that, in general, female households in the study area had lower adaptive capacities because they had fewer assets, fewer savings, and less income. The same study also observed that fishing households in the study area had lower mean annual incomes than the general population of India, and that in this region the mean annual incomes of female-headed households were lower than for the male-headed households. This gendered income inequality prevented the female-headed households from adopting the more sophisticated fishing technologies that wealthier male-headed households were more likely to adopt, which prevented those poorer households from increasing their fisheries-based incomes.

Similar patterns are reported in the academic literature about gender and climate change vulnerability in agricultural and rural communities. Research into farming communities in Northeastern Ethiopia by Ayele et al. (2024) found that household income positively influences farmers' ability to cope with and adapt to climate variability for both male and female household heads. Research into "gender differences in smallholder farmers' adoption of crop diversification" in Shaanxi Plain, China, by Ge et al. (2023) found that access to financial resources is the main barrier female farmers face for increasing crop diversity. The authors correlate this finding with survey results that show that male farmers are more willing to adopt crop diversification practices than female farmers, which contributes to a gendered gap in climate resilience. The authors conclude that policymakers could improve climate resilience outcomes by helping female farmers "to access agricultural credit" and to improve their ability to diversify their crops (Ge et al., 2023). Nelson (2010) summarizes a set of smallholder agricultural research in Africa stating that "women and female headed households are disproportionately represented in groups experiencing poverty and discrimination and thus have fewer resources to cope with and adapt to climate change." This pattern is correlated with the gendered division of labor that often assigns household duties to women, including gathering fuel and water, which makes them "relatively more reliant on climate-sensitive livelihoods". The author does caution against relying too broadly on generalizations, pointing to the fact that women may also perform important roles in trading or non-agricultural livelihoods (Nelson, 2010).

Access to Credit

The other main measure of financial capability to adapt to climate change that was described in the literature is access to credit. As in the gendered patterns seen for wealth and income, female-headed households are observed to have lower access to credit, particularly to formal credit from banks and credit associations, which is correlated with higher climate change vulnerability. These patterns were salient in the published academic literature on gender and climate change vulnerability in rural and agricultural communities.

Abdul-Razak and Kruse (2017) observed that male farmers in Northern Ghana have better access to credit, which improves their adaptive capacity. Similarly, research by Maja et al. (2023) in eastern Ethiopia and research by Poudel et al. (2020) in the Lamjung district of Nepal both found that female-headed households are more vulnerable to climate change disasters because they have less access to credit. Poudel et al. (2020) specify that female-headed households in their study area of Nepal have a lower adaptive capacity because they have less access to savings and credit cooperatives than male-headed households.

Azong and Kelso (2021), citing studies in Burkina Faso and conducting their own research in agricultural communities in the Bamenda Highlands region of Cameroon, identify women's lack of access to credit leading to a "lack of opportunities for" loans "from formal financial institutions” in the areas of Oku and Belo-Kom. The authors observed that this most often occurs because women do not have accounts with banks and credit unions (Azong and Kelso, 2021).

Ayele et al. (2024) published similar observations in farming communities in northeast Ethiopia. The authors found that credit availability significantly affected adaptation decisions for female-headed households, including the ability to diversify income by engaging in off-farm activities. This gendered difference is observable in the pattern of men leveraging credit to engage in higher-income activities like trade in cattle, while women instead engage in lower-income activities like petty trade and the sale of firewood. The researchers published discussions with women who indicate that there are various barriers that limit their access to credit services (Ayele, et al, 2024).

Ali (2021) employs Poisson and probit regression models to quantitatively analyze the climate adaptation decisions of farming households in northern Togo. The author uses the chosen number of adaptation strategies adopted by farming households as the outcome variable in the analysis. The quantitative analysis led the authors to conclude that access to agricultural credit and extension services, controlling for the gender of the household head, is a statistically significant factor in determining the number of adaptation strategies adopted by the farming households (Ali, 2021).

Extension Services

Many researchers use access to agricultural extension services provided by governments as a key factor in a household’s climate change vulnerability. These extension services are often discussed as vectors for distributing climate and weather information as well as improved agricultural technology and practices that help farmers make better decisions and achieve better farming outcomes, particularly in the face of climate change. Due to the fact that the terms “extension service” and “extension agent” are typically used in agricultural contexts, these findings from our literature review are exclusively about gender and climate change vulnerability in agricultural communities.

The pattern observed in the published academic literature is one where women and female-headed households are typically not benefiting from agricultural extension services to the same extent as men and male-headed households. The authors assume or observe that this gender difference results in worse climate change vulnerability outcomes for female-headed households.

In many of the studies, access is discussed in relative terms. There are female-headed households that are recorded as receiving services, but the percentage of female-headed households may be lower than for male-headed households (Ge et al., 2023; Call and Sellers, 2019; Kerr et al., 2023; Mangheni et al., 2019). However, there are observed exceptions to this pattern in some communities where female-headed households or women have equal or better access to extension services than male-headed households or men (Lebel et al., 2014; Murage et al. 2015).

In their research into “gender differences in smallholder farmers’ adoption of crop diversification” in the Shaanxi Plain, China, Ge et al. (2023) found in the survey data that female farmers were statistically likely to have less communication with agricultural extension workers than male farmers. The authors found that “female farmers received less agricultural extension service information about crop diversification than male farmers”, and that female farmers are more reliant on informal information sources “while male farmers are more likely to obtain information” from formal sources including extension services. The authors correlate this finding with survey results that show that male farmers are more willing to adopt crop diversification practices than female farmers, which contributes to a gendered gap in climate resilience (Ge et al., 2023).

A systematic review by Call and Sellers (2019) summarized findings from studies of agricultural communities in Africa and South Asia that show that women were less likely to be targeted by extension services or other initiatives that promote improved seeds and fertilizers that could help women adapt to climate change. These barriers to extension services are worsened by women’s “lack of capital, credit, and equipment”. The same systematic review found cases from Ethiopia, Malawi, and Ghana that suggest that extension services typically benefit men more than women due to socio-cultural barriers and limited mobility. By comparison, the authors cite other research from multiple African nations that show that facilitating women’s participation in extension services and using female extension officers to increase female farmer participation can increase agricultural incomes for women (Call and Sellers, 2019).

This general pattern of female-headed households and women benefitting less from extension services is seen in many studies in Africa. For farmers in northern Ghana, researchers explain that men have better access to climate information and extension services which is a factor in adaptive capacity (Abdul-Razak and Kruse, 2017). For farming communities in northeast Ethiopia, Ayele et al. (2024) found that access to extension services influenced the climate adaptation choices of male and female household heads differently: for women, receiving extension services was shown to significantly impact choices over income diversification. In eastern Ethiopia, female-headed agricultural households were found to be more vulnerable to climate change disasters than male-headed households because they had less access to extension services (Maja et al., 2023). In Malawi, a baseline survey of farmers in the study area found that a “statistically higher percent of men” stated that they had access to extension services in the past five years, and found that “men were more likely to chat with village leaders and extension agents” (Kerr, et al, 2023). Research by Mangheni et al. (2019) found that for farmers in Sub-Saharan Africa access to extension services were mediated by gender norms, which reduces the benefits to women who are not able to fully utilize the extension services to adapt to climate change.

Examples of extension programs that successfully serve women and female-headed households exist in the literature as well. In a published study of farmers in eastern Africa by Murage et al. (2015), extension services were observed to be an important factor in the adoption of climate-smart agriculture. In this study, a larger proportion of female farmers than male farmers reported benefiting from extension services for agricultural information (Murage et al., 2015). Reflecting on much published academic literature, Lebel et al. (2014) write that the observed pattern of men in Africa and South Asia receiving more information from extension services was not occurring in Northern Thailand. Their research suggests that local context matters and that there are multiple factors beyond gender that contribute to differences in climate change vulnerability (Lebel et al., 2014).

As mentioned earlier in the discussion of financial resources, quantitative analysis of farming households in northern Togo found that access to agricultural credit and extension services, controlling for the gender of the household head, is a statistically significant factor in determining the number of adaptation strategies adopted by the farming households (Ali, 2021). Using similar methods to analyze data from farming households in Bangladesh, Anik et al. (2021) similarly found that access to extension services is a statistically significant indicator for climate adaptation strategies.

Income Diversification and Alternative Livelihoods

Income diversification and alternative livelihoods are identified in the academic literature as methods of increasing household incomes and for making household incomes less sensitive to specific climate risks. Increasing income diversification or helping households explore alternative livelihoods is often linked to an improvement in climate change vulnerability outcomes in smallholder communities.

Both female-headed households and male-headed households stand to benefit from a diversification of household income streams and increases in household incomes. And the literature includes examples from both small scale fisheries and from agriculture.

Research in southern India by Sreya et al. (2021) suggests that livelihood diversification outside the small-scale fisheries sector is important for making both male-headed and female-headed households less vulnerable to extreme climatic events. Similarly, Godden (2013) describes in a textbook chapter about gender and fisheries in Lobitos, Peru an example of three women who adapted to declining fisheries revenues by transitioning from being unpaid “ama de casa” (or “female household manager”) to operating small restaurants out of their homes. The author suggests that the outcome of this alternative source of income is a shift in “household’s patriarchal foundation” (Godden, 2013).

Similar correlations between climate change vulnerability and income diversification is observed in the agricultural sector. In a study in northern Ghana, male farmers were observed to have a higher diversity of income which was a factor in adaptive capacity (Abdul-Razak and Kruse, 2017). And, as described in the section on extension services, Ayele et al. (2024) found that for farmers in northeast Ethiopia, women and female-headed households were more likely to diversify their income sources when they had access to agricultural extension services. In that study, female-headed households were observed to be pursuing income diversification strategies by supplementing their income through off-farm jobs under drought conditions including petty trading and producing and selling traditional drinks. This income increased the women’s resilience and adaptive capacity. By comparison, male-headed households more often choose agricultural diversification (e.g. drought-tolerant seeds) (Ayele et al., 2024).

In a study of agricultural communities in Bihar, India, Agarwal et al. (2022) identified labour out-migration as “an important and often-adopted strategy to diversity household livelihood portfolios….” But the availability of this option depends on gender. In India, men are more able to out-migrate than women for opportunities of additional income. This leaves the women to take on agricultural duties on top of their household responsibilities, and doing so in situations where the environmental conditions are more challenging or degraded or sub-optimal — the cause for out-migration in the first place (Agarwal et al., 2022).

Kom et al. (2022) use a multinomial logit regression model to analyze data from farm households in Vhembe District, South Africa. They found that “off-farm income” was a statistically significant indicator of climate change adaptation, which they measure using changes in farming practices (Kom et al., 2022).

Land Tenure / Property Rights / Control of Assets

The literature concerning climate change vulnerability in smallholder communities contains many descriptions of the importance of land tenure, property rights, and control over productive assets — including farming equipment and farmlands — for rural households. Insecure land tenure is typically correlated with worse climate change vulnerability outcomes. Because land tenure is associated with farming, the literature surrounding this topic predominantly concerns agricultural households. By contrast, artisanal and subsistence fishers who fish in open access fisheries are not required to own or rent the areas where they make their living. However, it would be possible to extend the concepts from the ownership of productive assets to fisheries where ownership of fishing vessels and fishing gears does matter.

The pattern observed in the literature for the gender dimensions of land tenure and the control of productive assets is that women and female-headed households usually have less control over productive assets and can face significant barriers to property ownership that may not be faced by male-headed households. This inequality over land tenure is associated with relatively worse climate change vulnerabilities for female-headed households.

In their research into farming communities in Bihar, India, Agarwal et al. (2022) cite studies that poverty, gender inequality, and insecure land rights are reasons for climate change vulnerability. Similarly, Maja et al. (2023) found that female-headed agricultural households in eastern Ethiopia are more vulnerable to climate change disasters than male-headed households because they had lower rates of ownership of livestock and farmland. In the Lampung district of Nepal, Poudel et al. (2020) observed that female-headed households have a lower adaptive capacity because they experience a higher percentage of landlessness than male-headed households.

Insecure land tenure can have knock-on effects on other factors of climate change vulnerability that can compound the relatively worse vulnerability outcomes for female-headed farming households. In their research in the Congo Basin, Molua et al. (2023) found that the insecure land tenures of rural women can be an obstacle to improving agricultural productivity and increasing incomes. Insecure tenure also poses a challenge to women by preventing access to credit or membership in agricultural associations (Molua et al., 2023).

The relatively insecure position of female-headed households can be more acute in societies where strong cultural norms work, such as "patriarchal land inheritance practices," work to strictly prohibit women from owning land and farming (Azong and Kelso, 2021). Research conducted in the Bamenda Highlands region of Cameroon observed "patriarchal rural communities" where the lack of access to and control over productive resources worsens women's challenge in coping with climate change. In the study area, women are excluded from access to and control over "land, farm inputs, training opportunities, job opportunities and income benefits" even though the same women are providing "much of the agricultural productive labour." The patriarchal cultural norms concerning the land inheritance "favor male household members" which contributes to unequal distribution of land and women's limited control of land (Azong and Kelso, 2021). One interviewee who spoke with the researchers cited the lack of control over land as a discouragement from investing in fertilisers to enhance farming productivity and to respond to climate change. (Azong and Kelso, 2021)

If female smallholder farmers are unable to secure land tenure, it reduces their capacity to adjust to climate variability and increases their food insecurity. Antwi (2024) observed that female farmers in Ghana who do not have secure land tenure consequently have less farming experience. Antwi-Agyei et al. (2015) cite additional evidence from Ghana for this negative impact on food insecurity, noting that studies estimate that "women contributed to over 70% of food production and over 85% of food distribution" in Africa. The authors also report that almost half of the respondents in their study describe complex land tenure systems as a hindrance to climate adaptation. Most of these respondents who describe this hindrance are female farmers; by comparison, few male farmers mentioned it (Antwi-Agyei et al., 2015). They also found that gendered customs around land tenure can constrain the ability of women to implement climate change adaptation measures. In their study area of the Bongo district of Ghana, women are not allowed to own land according to village customs. Female farmers have less tenure security which constrains their ability to use land as collateral for credit to implement adaptation practices. This is especially challenging when women are divorced or widowed where land is passed down only to male heirs (sons) (Antwi-Agyei et al., 2015).

Migration

Globally, women make up half of all migrants. However, in small-holder communities, men are the primary migrants as men migrating is more culturally acceptable in many places, such as India and Nigeria (Akinsemolu and Olukoya, 2020; Agarwal et al., 2022). For example, in Ondo, Nigeria, women are less able to out-migrate, even when faced with sudden climate events (Akinsemolu and Olukoya, 2020). The negative impact of climate change is one of the main reasons for men's out-migration (Nelson, 2010).

In the upper west region of Ghana, most men migrate outside their home region for seasonal labour for four or more months each year due to climate change, limited land, and poverty (Nyantakyi-Frimpong, 2021). This pattern is seen in many parts of the world. However, the out-migration of men overburdens women with agricultural activities in addition to their household responsibilities, which leads to deteriorating farm production and poorer well-being of women (Agarwal et al., 2022; Dah-gbeto and Villamor, 2016; Dilshad, et al. 2018; Maharjan et al., 2020; Nelson 2010; Nyantakyi-Frimpong, 2021). In many areas of the world, women have less access to key livelihood resources, further exposing them to climate risks (Nelson, 2010). In addition, the out-migration of men also leads to women taking on traditional male roles and increases the number of female-headed households (Nelson, 2010; Poudel et al., 2020).

In some cases, being a migrant also exposes the migrant themselves to more climate risks. Antwi-Agyei et al. (2015) found that migrant farmers in resilient communities and female farmers in vulnerable communities typically have weaker land tenure rights and are less able to implement climate adaptation strategies, such as agro-forestry in sub-Saharan Africa.
On the other hand, women's out-migration is limited by their home-caring activities, social norms, and marital status (N-yanbini et al., 2024; Yiridomoh et al., 2021).

However, there is evidence for women out-migrating, sometimes due to displacement by large industrialized factories. In some Asian countries, women make up the majority of migrants.

The trend of women's out-migration is increasing as climate change progresses (Weeratunge et al., 2010). According to Maharjan et al. (2020), internal migration of women is positively correlated with agricultural land contraction in Chitwan, Nuwakot, and Lamjung, Nepal. However, this pattern is not observed for internal migration of men. This phenomenon is due to the workforce left behind when each gender migrates – when men migrate, women are often left behind to continue doing farm work, whereas only elderly people, who are less productive, are left behind when women migrate. No significant correlation was found for either gender when it comes to international migration.

Seasonal migration in fishing communities is also contributing to the prevalence of the spread of HIV/AIDS, particularly in southern Africa. When women travel to remote fishing camps, they sometimes develop sexual relationships with male fishers to guarantee their access to fish (Weeratunge et al., 2010).

In addition to the downsides of local out-migration, international out-migration also stresses families left behind financially as they often have to take out loans to send the migrant worker abroad. Economically poor families become even more vulnerable after taking out loans to send their family abroad (Dilshad et al., 2018).

Agarwal et al. (2021), through a case study in Bihar, India, found that men are less likely to migrate when women are educated. Climate mitigation strategies at the farm level also help reduce male out-migration.

Poverty level

Poverty level is one of the principal reasons for climate change vulnerability (Agarwal et al., 2021; Dilshad et al., 2018). Although poverty affects both genders negatively, the intersectionality between being female and having low-income levels has been shown to place poor women in an especially disadvantaged position when it comes to climate change.

Women generally have higher poverty levels, which makes them less able to adapt to and more vulnerable to climate change. Poverty prevents women from adapting to climate change in many ways. For example, poverty limits women's ability to invest in new opportunities, such as better fishing equipment. As a result, women are forced to focus on short-term and subsistence livelihoods that are less adaptable, leading to higher vulnerability to climate change (Akinsemolu and Olukoya, 2020; Adzawla et al., 2019; Axelrod et al., 2022; Graziano et al., 2018; Khoza et al., 2019; Nelson, 2010; Poudel et al., 2020; Ayele et al., 2024).

In addition, poverty means higher dependence on natural resources and ecosystem services (Graziano et al., 2018; Limuwa and Synnevåg, 2018; Maja et al., 2023). As climate change progresses, biodiversity loss accelerates, cutting women's sources of income and increasing their vulnerability (Molua et al., 2023; Sreya et al., 2021; Swai et al., 2012).

Further, poverty levels affect women on the intra-household level as well. When climate disasters hit, poor families experience loss. Under these extreme conditions, women are found to prioritize their husbands, leading to intra-household consumption disparities. These disparities eventually lead to the deterioration of women's health, hence exposing them to greater climate risks (Dilshad et al., 2018; Akinsemolu and Olukoya, 2020).

Moreover, poverty prevents poor women from gaining memberships in formal organizations, limiting their access to information and less productivity. Weeratunge et al. (2010) have found that women who are not in formal organizations catch and sell less fish. This vulnerability is compounded by climate change, which reduces fish stock in many parts of the world and subsequently reduces processing and vending opportunities, which are traditionally women's roles, resulting in significant income drops for women (Sreya et al., 2021).

Cultural norms and beliefs

Cultural norms and beliefs (such as patriarchy and gender discrimination) work against women, intensifying their exposure to climate change impacts and diminishing their adaptive capacities to climate change (Adzawla et al., 2019; Nelson, 2010; Maja et al., 2023; Sreya et al., 2021; Akinsemolu et al., 2020; Anik et al., 2021; Antwi-Agyei et al., 2015; Call and Sellers, 2019; Dilshad et al., 2018; Jerneck, 2018; Lebel, 2014). Women in coastal regions in developing countries face heightened climate change risks due to their location and socioeconomic limitations (Akinsemolu and Olukoya, 2020).

Such norms and beliefs confine women to specific roles and professions, such as caregivers, placing them in direct contact with the environment, and increasing their exposure to climate change impacts (Akinsemolu et al. 2020; Azong and Kelso 2021; Chidakwa et al.,2020). Furthermore, patriarchal norms limit women's control over materials and financial resources, and restrict their representation in politics, access to resources and freedom of movement (Akinsemolu et al., 2020).

In many areas, cultural norms prevent women from owning land, forcing them to rely on men and resulting in higher vulnerability (Antwi-Agyei et al.. 2015). Patriarchy also controls women's access to education and information, further exacerbating their vulnerability (Akinsemolu and Olukoya, 2020; Mugi-Ngenga et al., 2016). These norms also create barriers for women to take part in farmers' organizations and receive extension service, which in turn limits women's adaptive capacity. In particular, women's subordinate status has led to gender discrimination in decision-making and deprioritization of women in extension offices (Chidakwa et al., 2020; Mangheni et al., 2019). Societal norms, as a result of patriarchy, also shape women's perception and willingness to use new technologies. Women are found to adopt technology differently compared to men due to the difference in access and control to resources. For example, women in Zambia and Uganda are found to adopt more agroforestry practices due to their role as firewood collectors (Mangheni et al., 2019).

Even within matrilineal societies, despite certain rights, women still experience patriarchal dominance and similar vulnerabilities as women in patrilineal societies (Azong and Kelso, 2021).

Notably, despite popular cultural association, women may feel less connected to nature than men, as exemplified by a study by Graziano et al. (2018) in the Philippines. This challenges the notion that women are more environmentally virtuous and better positioned to help mitigate and adapt to climate change.

In the context of small-scale fishing, women's roles are often overlooked, with female-dominated activities such as shellfish hand-picking often not considered fishing (Pelage et al., 2023). In small-scale farming, women participating in agricultural activities are important for feeding infants and young children. However, these activities are limiting their ability to engage in child care, which is culturally women's job. A change in social norms is needed to engage men in childcare activities to combat climate change effects (Nyantakyi-Frimpong, 2021).

After climate disasters, women are found to experience more health implications due to gender-based social inequalities, such as Sexual and Gender-Based Violence which leads to higher rates of diseases and deaths among women. Additionally, girls are found to be more likely to drop out to help with domestic chores compared to boys after climate disasters, which interferes with girls' future outlook. The destruction of health facilities by climate disasters also increases women's risk of maternal death (Akinsemolu and Olukoya, 2020).

Climate change also affects women's health and survival in other ways. For example, in many communities where women are already primarily tasked with fetching water, they will have to spend more time on this task due to sea level rise and salinization caused by climate change, further burdening them and harming their health. Women will also likely have to walk further distances to obtain clean water, increasing their vulnerability to rape (Akinsemolu and Olukoya, 2020).

Although cultural norms affect women more, men are also negatively impacted – men are expected to be economic providers for families, which burdens them with more responsibilities (Akinsemolu and Olukoya, 2020).

On the bright side, gender roles often shift according to different stressors – climate or nonclimate. For example, livelihoods on the Hawaiian islands are becoming less gendered as the economy shifts from subsistence to cash. Similarly, women in South Africa are increasingly participating in income generating activities because of shifts in HIV/AIDs, poverty, unemployment, and climate change. This opens the door to greater economic opportunities and decision-making power for women (Nelson, 2010). In coastal Peru, new opportunities are present for women to receive education, develop their own businesses, and earn more money (Godden, 2013).

RECOMMENDATIONS FOR IMPROVING RARE'S CCVA

Of the key results that emerged from the literature review, our client has expressed most interest in the following themes: decision-making, non-fisheries roles, migration, land tenure, and perceptions of climate change. For these themes, our client has requested that we provide guidance for improving Rare's Climate Change Vulnerability Assessment based on the best-practices we have observed from the literature and from our close examination of Rare's existing CCVA data collection.

For the themes of decision-making and non-fisheries roles, specifically, our client has requested we provide guidance on data analysis techniques that can be used to better understand the data that Rare is already collecting through its household surveys. For the themes of land tenure, perceptions of climate change, and migration, Rare is not currently collecting this data through their household surveys and has requested guidance on how best to incorporate these important new themes into their current data collection systems.

Data Analysis for Decision Making and Non-Fisheries Roles

Examples from the Academic Literature

Our literature review brought to our attention several studies that incorporated quantitative analysis methods for understanding the gender dimensions of household decision making. All of these studies discussed here were concerned with agricultural households, so the model specifications will need to be adapted for use in fisheries communities.

Many of these studies frame the climate change adaptation outcomes as choices that are made by households. These choices serve as the binary outcome variable and a variety of relevant household characteristics and farming characteristics are used as explanatory variables. These models often use logistic regression analysis — probit and logit models — in order to analyze the marginal effects of the explanatory variables of interest on households choices concerning climate change adaptation behaviors (Kom et al., 2022; Maja et al., 2023; Van Aelst and Holvoet, 2018). One of the studies counts the number of adaptation strategies chosen rather than using a binary outcome variable. For this count data model, the researcher utilized a Poisson regression (Ali, 2021).

Kom et al. (2022) and Maja et al. (2023) utilize similar logistic analysis frameworks to examine farming choices the households have pursued that are considered to be climate change adaptation strategies. For Kom et al. (2023), their study of farming households in South Africa used the following behaviors as binary outcome variables: mixed crop farming, changing planting dates, drought-resistant crops, crop diversification, improved variety of crops, and employing irrigation or furrows. As explanatory variables they use gender, education, farm size, farmer experience, non-farm income, access to climate information, decreasing rainfall, and high temperatures. Maja et al. (2023) uses similar binary outcome variables: soil and water conservation, adjusting planting date, drought tolerant and improved varieties, and crop diversification. For explanatory variables they use sex of the household head, age, educational level, family size, agroecology, landholding, livestock, farming experience, market distance, extension contact, access to information, farm income, and credit.

The key takeaway from these two relatively simple examples of logistic analysis models is: if Rare can identify climate change adaptation behaviors that can be converted into binary outcome variables, then it can use logistic regression analysis to examine the factors that contribute to adaptive behaviors.

The quantitative analysis used by Van Aelst and Holvoet (2018) is more complex. The researchers were concerned with understanding the role women play in intrahousehold decision making for adaptation decisions. They use concepts of intrahousehold bargaining and agricultural technology adoption. Like in the previously discussed analytical studies, a logistic regression is used to examine the factors that are correlated with households choosing to pursue adaptation practices for agricultural and livelihood diversification. Unlike the other studies which model each binary outcome variable separately (e.g., for Maja et al., 2023, the authors have four separate regression models: one for each of the four outcome variables), Van Aelst and Holvoet (2018) construct an index that aggregates all of the 18 identified adaptation practices in their data set. For each selected adaptation practice, a household is given a zero for non-adoption and a 1 for adoption for a minimum score of 0/18 and a maximum score of 18/18. Additionally, the respondents were asked about who of the spouses made the decision to adopt or to not adopt each of the 18 adaptation practices. For each of the 18 decisions, the household received a bonus +1 if the wife was involved in the decision making, either as a part of a joint decision between the husband and wife or if the wife was solely responsible for the decision. Meanwhile, for each of the 18 decisions, the household received a penalty of –1 for each decision that was made by the husband without involving his wife. The scores were then scaled as a percentage from –100 to +100 to construct an index, with a higher index value indicating that the wife is more involved in intrahousehold decision making. The authors used these thresholds as a rule of thumb: scores less than 10 meant there was little decision making by the wife; scores from 10–14 indicated a “considerable degree of female decision making participation”; scores of 15-18 indicated a “high degree of female decision making.” The index value was used as the outcome in the regression analysis. Please refer to Van Aelst and Holvoet (2018) for further details.

The key takeaway from the Van Aelst and Holvoet (2018) study is that analysts can aggregate multiple decisions about climate change adaptation strategies into one outcome variable. For this specific study, it was important to have detailed information on who was making the decisions within the households so as to understand the gender dynamics within a household.

Ali (2021) provides an example of an alternative to the index method used by Van Aelst and Holvoet (2018) which is to count the number of adopted climate adaptation strategies pursued by each household. The analysis used a zero-inflated Poisson regression for examining choices around climate-smart practices in subsistence agriculture in northern Togo. Again, the researcher had identified a set of farming behaviors that were considered to be climate adaptation strategies and used the following explanatory variables: location, age, marital status, education, farming experience, family size, cultivated land, labor, access to extension services, access to electricity, access to farming credit, gender.

The key takeaway from the Ali (2021) study is that Poisson regressions can be used if the outcome variables are counts rather than binary outcomes. This might be a simpler method for aggregating choices concerning adaptation decision making than the index used by Van Aelst and Holvoet (2018), and does not utilize the same amount of granular detail about the gender of the decision maker.

Potential Options for Rare

The first step for Rare would be to identify variables from their household surveys that can be used as outcome variables for regression analysis. One possible outcome variable could be the number of income streams for a household, as our literature review has shown that income diversification is associated with climate change vulnerability. This might be used in a count model, such as a Poisson regression model. Or it could be transformed into a percent of income derived from the fishery and the percent of income derived from all non-fishery sources. The data analyst might consider using household data to compare fishing households and non-fishing households (i.e. using fishing household as a binary explanatory variable), potentially as a fixed effect if panel data is available.

Other potential outcome variables from the household survey that could be used in a choice model are the choices over savings and loan mechanisms (i.e. savings club membership), choice over insurance, and choices over fisheries roles within the household. Data points on choices to participate in management meetings, management leadership, or involvement in monitoring, control, and surveillance (MCS) activities could also be used as an outcome variable in choice or linear models.

Interesting explanatory variables, beyond basic household data fisheries data, might include responses from Q91 that is concerned with who in the household is making financial decisions. This variable might be useful as a proxy for the data used by Van Aelst and Holvoet (2018) in their analysis of intrahousehold decision making. Specifically, this could be used in analysis concerning adaptation behaviors tied directly to financial choices such as savings club membership and insurance. Data on the gender of the financial account holder might similarly be utilized in this analysis. This variable could be simplified to a binary, for example: 0 if male-only and 1 if joint or female-only.

The data analysis team might also consider using responses from Q6 — the household role of the survey respondent — for analyzing the variances in perceptions between different household members across a community.

Understanding Perceptions of Climate Change in SSF:

Examples from the Academic Literature

Perceptions of climate change can be a vital indicator when it comes to climate change vulnerability. It should come as no surprise that the more informed people are about climate change, the easier it is to adapt to it. Assessing a community's level of understanding surrounding climate change can serve as an important guideline for their abilities to interpret what is happening and their capabilities of preparing for climactic events like natural disasters, droughts, or floods. Our literature review brought to light several studies that ask community members about their perceptions of climate change. In fact, one study even described that

> *"The collection of data was, therefore, made participatory to the highest level as a core element of ethnographic methodology. Researchers lived with the study participants and recorded their daily activities in order to understudy their perception, experiences and adaptation to climate change"* (N-yanbini et al., 2024).

Of course, this seems like a somewhat labor intensive technique, although very thorough. Two studies ended up standing out for their questions about perceptions of climate change: *Vulnerability to multiple stressors in coastal communities: A study of the Andaman coast of Thailand* (Bennett et al., 2015) and *Wading past assumptions: Gender dimensions of climate change adaptation in coastal communities of the Philippines* (Graziano et al., 2018).

The Bennett article started with an interview and from there the questions were developed to ask the community. This article also used a rating technique where the participants were asked to rate the severity of what they were experiencing from 1-5. To begin, the topics that were asked about in the Bennett et al. article were:

- Changes in rainy and dry seasons or changing rainfall patterns
- Coral bleaching
- Increased freshwater in mangrove areas making water less salty
- Rising sea levels compared to the past
- Salt water coming up in drinking water or agricultural water sources
- Coastal or beach erosion
- Flooding
- Increasing of sediments in the water
- Overfishing
- Increased garbage in the ocean
- Landslides
- More pollution in the ocean

Unfortunately, the actual questions and surveys were not included in the study. From the results, a chi-square was performed to disaggregate gender and other factors.

The Graziano article gets more detailed about the perceptions of climate change:

Table 1
Dependent variables and associated survey questions.

	Dependent Variable	Question
1	Closeness to nature	Please circle the picture that best describes your relationship with the marine environment (see Fig. 2)
2	Conservation Beliefs	9 Question conservation belief scale (refer to text below)
3	Risk Perception	(1) Do you feel that your assets (house, boat, crops, livestock, land) are presently at risk to the following events … (2) Do you feel that your livelihood/occupation are presently at risk to the following events … … *Flooding, coastal erosion, ocean tides, coral bleaching, and overfishing.*
4	Coastal Resource Perception	In the last five years, have coral reef conditions … In the last five years, have mangrove conditions … … *(1) gotten much worse (2) a little worse (3) not changed (4) improved a little or (5) improved a lot?*
5	Coastal Ecosystem Resource Benefits	(1) What value do coral reefs have for you and your community? (2) What value do mangroves have for you and your community?
6	Climate Change Awareness	Have you heard of climate change or global warming?
7	Climate Change Observation	What changes in weather have you observed in your village over the past thirty years?
8	Climate Change Training	Have you participated in activities that raise public awareness about the condition of the ocean and/or climate change? (i.e., media campaigns, videos, presentations)? Is there a mangrove planting program in this area? Have you been involved in mangrove planting projects?
9	Climate Change Adaptation Planning	Do you, your community, or your municipal government have a plan to cope with climate change events (i.e. flooding, coastal erosion, etc.)?

Graziano et al., 2018

<u>Question 4.1 expanded:</u>
In the last five years, coral reef conditions have:
1) gotten much worse,
2) a little worse,
3) not changed,
4) improved a little or,
5) improved a lot?

Question 4.2 expanded:
In the last five years, have mangrove conditions:
1) gotten much worse,
2) a little worse,
3) not changed,
4) improved a little or,
5) improved a lot?

Question 5.1 expanded:
What value do coral reefs have for you and your community?
a) Fish nurseries/supporting fisheries
b) Building material
c) Protection from waves
d) Tourism
e) Natural habitat

Question 5.2 expanded:
What value do mangroves have for you and your community?
a) Fish nurseries/supporting fisheries \
b) Firewood
c) Building material
d) Protection from flooding and other natural disaster
e) Tourism
f) Natural habitat

Question 7 expanded:
What changes in weather have you observed in your village over the past thirty years?
(a) Rainfall
(b) Coral Bleaching
(c) Temperature
(d) Storms/Cyclones
(e) Wind
(f) Waves
Observed weather changes were circled as they were mentioned, or written in if they did not fall under a prepared category

Potential Options for Rare

Both of these examples rely on asking participants to gauge their observations of their changing environment, using their answers as an indicator for their level of perception of climate change. A community member does not necessarily need to know what climate change is to understand or witness its effects. These questions could be retained from interviews beforehand to understand what the community may be most severely impacted by, or they could be researched beforehand. However, one thing is clear, these questions have to be highly specific to that community's region, ecosystem, and experience. To fine tune it even further making it 1) ecologically precise 2) temporally anchored and 3) behaviorally linked or revealing may help in the effectiveness of these questions. Some examples of questions targeting these three things include:

1. In the past 5 years, how many times has saltwater intruded into your freshwater wells during dry seasons?
2. Compared to 10 years ago, are monsoon start dates now earlier, later, or unpredictable?
3. When coral bleaching occurs, do you shift fishing locations, target different species, or stop fishing entirely?
4. Rank these climate impacts by severity: (a) mangrove death, (b) algae blooms, (c) typhoon frequency (for example)
5. In the past three years, how often have you had to repair fishing gear due to stronger-than-normal waves or storms?

   (1) Never,

   (2) 1–2 times/year,

   (3) 3–5 times/year,

   (4) More than 5 times/year.

Overall, these questions are possible and hinge on the specificity, relatability, and impact climate change may be present in communities lives, even if the formal label of "climate change" has not been introduced.

Examining Land Tenure, Property Rights, and Control of Productive Assets

Examples from the Academic Literature

Land tenure, property rights, and the control of productive assets are considered to be important indicators of climate change vulnerability and also statistically significant explanatory variables for household decision making around climate change adaptation strategies. Our literature review surfaced three clear examples of data collection methods and data analysis methods concerning this topic.

The first method is to ask households directly about their perception of the effect of land tenure on their adaptive capacity. Antwi-Agyei et al. (2015) surveyed two communities in Ghana and asked whether they considered land tenure to be a barrier to climate change adaptation. They disaggregated the responses by region, gender, and by “indigenous” and “migrant” groups. An advantage of this survey design is that it could be coupled with research into the climate change vulnerability of migrants. Their results are reproduced here.

Table 2: Number of famers reporting complex land tenure as a barrier for climate change adaptation

Location of farmer	Land tenure as a barrier to climate change adaptation			
			Yes	No
Within Ejura Sekyedumase district	Indigenous	Male	1	55
		Female	4	33
	Migrant	Male	15	7
		Female	17	3
Within Bongo district	Indigenous	Male	7	65
		Female	54	9
	Migrant	Male	0	0
		Female	0	0
Total			**98**	**172**

Source: Antwi-Agyei et al. (2015)

A second method is to ask households how they obtained their home or their farmland. Research by Antwi (2024) collected gender disaggregated data for male and female smallholder farmers and asked each farmer if they (a) inherited their land, (b) rented their land, or (c) purchased their land. These data points on land ownership were compared with different agricultural climate adaptation behaviors such as crop diversification, mixed farming, crop rotation, etc. The author observes the pattern that “both male and female farmers with inherited farmland tenure systems use crop diversification, crop rotation, and intercropping more on their farms than those with rented and purchased farmlands,” which the author considers to be agricultural risk mitigation strategies (Antwi, 2024).

A third approach is to gather continuous data on the amount of land and the amount of productive assets owned by a household. Maja et al. (2023) utilized ownership of livestock and ownership of farmland in their quantitative analysis. They collected continuous data for “tropical livestock units” and hectares of farmland and utilized these as explanatory variables in their choice models for climate change adaptation strategies (as discussed earlier in this section). Question 23 in Rare’s Household Survey, which asks about fishing vessel ownership, could be used analogously to the livestock ownership variable in Maja et al. (2023).

Potential Options for Rare

Rare already gathers information on fishing vessel ownership (Q23), which is a good starting point for understanding the control of productive assets. This can be paired with the information on the gender of the household head. Or Rare could directly ask if the owner of the fishing vessel was male or female. This, however, could get complicated when trying to factor in joint ownership, renting, or other forms of ownership.

Similarly, Rare is collecting binary information on the ownership of other productive assets (Q26) such as boat engines, bicycles, and motor vehicles. Rare could ask follow up questions to understand if male and female household members have equal access to each of the owned household assets. Q26 could be modified to incorporate some of the data collection features of the financial accounts survey question (Q27). This could look as follows:

<table>
<tr><td colspan="4"></td><td colspan="3">Who has Access to the asset?</td></tr>
<tr><td rowspan="3">Please indicate the number of the following items that are owned in the previous 12 months by the household. If the item is not owned, please additionally indicate whether you would consider the item of value (yes/no).</td><td>Asset</td><td>Number Owned</td><td>Yes/ No</td><td>Female</td><td>Male</td><td>Non-Binary</td></tr>
<tr><td>1. Radio / Stereo / CD Player…</td><td>---</td><td>Yes / No</td><td>o</td><td>o</td><td>o</td></tr>
<tr><td>2. TV</td><td>---</td><td>Yes / No</td><td>o</td><td>o</td><td>o</td></tr>
</table>

Adapted from Rare's Household Surveys[2]

Rare could also directly adopt the questions from Antwi (2024) and Antwi-Agyei et al. (2015). The land ownership question could be adapted to incorporate non-ownership or quasi-legal or non-legal land usage. And Rare could choose to ask about home ownership, farmland ownership, or both. These could take the form of:

> *Question: Did your household inherit, rent, or purchase your house and lot?*
> *Responses: (a) Inherited; (b) Rent; (c) Purchased; (d) Communal land; (e) No legal property rights*
>
> *Question: Did your household inherit, rent, or purchase your farmland or agricultural land?*
> *Responses: (a) Inherited; (b) Rent; (c) Purchased; (d) Communal land; (e) No legal property rights*

---

[2] https://portal.rare.org/wp-content/uploads/2023/11/DDM_Global_Household-Surveys_2022.pdf

Question: Do you think it is harder to prepare for climate change or extreme weather if it is difficult to own land or secure land tenure? (Yes / No) Disaggregate these responses using the gender of the survey respondent and whether the respondent is from a fishing household or a non-fishing household.

Examining Migration

Examples from the Academic Literature

Migrants and their family members experience climate change differently compared to non-migrants. Therefore, it is vital to understand how migration works and to measure migration for the communities Rare serves.

Several articles in our literature review have useful information on this matter:

Agarwal et al. (2022) measures Migration using the following logistic regression model:

$$Migration_{ks} = f(Adopter_{ks},\ Age_{ks},\ Female\ Literacy_{ks},\ X_{ks})$$

Source: Agarwal et al. (2022)

In the equation, migration is a binary variable, denoting if the interviewee is a migrant. Migration is then calculated as a function of adopter (whether or not the household adopts a climate adaptation strategy), age (the age of the interviewee), female literacy (women's education attainment in the household), and X (other variables: household size, land size, knowledge index, Other Backward Classes and Scheduled Castes/Scheduled Tribes).

This paper aims to measure the relationship between adoption of climate smart agricultural practices and male out-migration in India, hence including "adopter" as one of the variables.

Another paper, Maharjan et al. (2020), treats migration as 4 different independent variables: male internal migration, male international migration, female internal migration, and female international migration. These variables are then plugged into a logistic regression model to calculate the relationship between agricultural land use change and outmigration in Nepal.

Table 5
Descriptive statistics of variables. The results of the regression analysis showed the influence of some important factors on the contraction of agricultural land (Table 6).

Main dimension	Variable	Mean value	Standard deviation	Min	Max
Dependent variable					
Contraction of agricultural land (D_1)		0.79	0.41	0	1
Independent variables					
Socioeconomic	Education (X_1)	13.42	6.32	1.3	37.3
	Male internal migration (X_2)	19.49	12.10	0	57
	Male international migration (X_3)	18.08	10.59	1	45
	Female internal migration (X_4)	12.38	8.19	0	36
	Female international migration (X_5)	1.89	1.36	0	8
	Population density (X_6)	307.31	304.11	10	2122
Physical	Slope (X_7)	19.17	8.85	0.5	33.4
	Aspect (X_8)	184.2	32.85	93	258
	Ecological zone (D_2)	0.77	0.42	0	1
Climatic	Precipitation (X_9)	1930.32	582.39	407	2922
	Temperature (X_{10})	23.55	5.10	3.4	29

Source: Maharjan et al. (2020)

Another paper by Bennett et al. (2015) measures coastal communities' stressors by conducting interviews that aim to capture the perceived level of impact of each stressor on the different households in the community. The interviewees were asked about themselves and their household. The interviewees were then instructed to rate each stressor based on how much impact they experience from each stressor, from 1 (no impact) to 5 (very high level of impact) and 6 (don't know). Below are the description of stressors and the breakdown of modeled impact of community, household, and individual characteristics on the perception of each stressor. The upward arrows indicate a positive relationship between the predictor and the stressor, and the downward arrows indicate a negative relationship between the two. Community level data is calculated as the mean of all households in a given community.

Table 2 - Qualitative descriptions of stressors that communities are exposed to including sphere, category, and scale

Sphere	Category	Stressor (as coded and used in survey)	Scale of Driver	Description
Socio-Economic	Economic	Declines in the price that you can sell fish	National	Fish prices fluctuate at markets in nearby cities but prices to local fishers are often steady or declining.
		Nobody wants to buy the product I am selling	Local to Global	Market demand for livelihood products - agriculture, fisheries, tourism - declines and people cannot sell products.
		The price of rubber declining	Global	The price of rubber is declining after a historic high and period of heavy investment in the industry, which for many has led to significant household debt.
		The rising price of supplies needed to do my livelihoods	National to Global	The price of agricultural (fertilizers), fisheries (gear), and tourism (building supplies) inputs is steadily increasing.
		The increasing price of gas	Global	The price of gas has been steadily rising over the last couple of decades due to global price increasing, leading to higher travel costs to mainland, market, and for fishing.
		Rising cost of living	Local to Global	The price of household needs, including food, is increasing. At the same time local desires for material goods is on the rise.
		Increasing levels of household debt	Local to Global	Related to all of the previous economic stressors – economic gains (incomes) are not keeping pace with outputs (expenditures).
	Social	More people moving into the area	Regional to Global	Economic opportunities in Thailand are leading to significant regional in-migration of labor and localized in-migration of people. The first is leading to ready supplies of cheap labor, undermining reliance on local labor. The second is driving prices up.
		Health problems of members of your household	Local	Individuals with health issues in the household are likely unemployed and financially dependent.
	Governance and Conflict	Commercial fishers coming into inshore waters (within 3000 meters)	National to Global	Commercial trawlers, squid boats, and seiners fish within the 3000 meter limit reserved for small-scale fishers. Enforcement is limited or non-existent.
		Conflict with other small-scale fisheries or fishers	Local and regional	Small-scale fishers from different communities or using different gears come into conflict with each other due to gear loss, gear damage, or gear theft. Spatial limits, when in place, are not enforced.
		Exclusion from doing livelihoods in certain areas because of tourism industry	Local to Global	Fishers, gleaners, and others are disallowed to enter or harvest in areas where there are resorts or that are used by national and international tourists.
		Trawlers taking or destroying my gears	National	Commercial trawlers fishing inshore can snag and destroy fishing gears, including traps and set nets.
		Destructive and or illegal fishing practices	Local	Local norms and values and middlemen providing illegal gears can lead to destructive or illegal practices.
		Getting arrested when traveling across the border to fish	National to Regional	Less fish in Thai waters can lead fishers to risk fishing on the Burmese side of the border leading to arrests by the Burmese navy.
		Gear or boat being taken when traveling across the border to fish	National to Regional	Same as above. Burmese officials extort money and gear from fishers on the water or hold boats for payment after releasing those arrested.
		Conflict within the community	Local to National	Internal divisions – familial, historical, leadership – and conflicts with district governance structures (i.e., tambon administration office) created by national government.
		Conflict with other communities	Local to National	Conflicts with other communities can be over land encroachment, fisheries, or district governance.
		Corruption in Thailand	Local to National	Perceptions of corruption included with individuals, sectors, or levels of government - effects individuals (property destruction or loss), communities (infrastructure), and sectors (small-scale fisheries).
		Land encroachment in the area	Local to Regional	Outside business and local people encroach into public and private land for agricultural and tourism purposes.
		National government policies	National	National government creates policies that negatively impact fisheries (rights, gear restrictions), tourism (focus on large-scale dev.), and agricultural (reducing subsidies, focus on single crop - rubber) development.
		The national park	Local to National	Implementation and management of national park impacts fishers' livelihoods and loss of land for livelihoods.
		The change of national governments	National	Leadership changes lead to unrest and leads to declines in tourists and ineffective governance.
Biophysical	Climate Change	Extreme weather events such as storms	Global	There are more storms per year and stronger storms than there used to be.
		Changes in rainy and dry seasons or changing rainfall patterns	Global	In the past, dry and rainy seasons used to be more defined – it would only rain in rainy season, there were few sunny days in dry season. Now weather is less predictable making it harder for agriculture (e.g., can't grow cashews anymore, rubber tapping) and fisheries (loss of gear in storms during dry season, more risk).
		Coral bleaching	Global	Increased water temperature leads to bleaching and mortality of corals, affecting fisheries and tourism.
		Increased freshwater in mangrove areas making water less salty	Global	Increasing rains and storms, especially during wrong season, lead to mortality of crustaceans and bivalves.
		Rising sea levels compared to the past	Global	Sea level is higher than it used to be leading to increased erosion and it is going above current walkways and floors – cause unknown.
		Salt water coming up in drinking water or agricultural water sources	Global	Individual households, tourism businesses, and agricultural areas had experienced brackish water in wells or agricultural sources.
		Coastal or beach erosion	Local to Global	Localized removal of mangroves, increases in storminess, and rises in the ocean lead to erosion threatening houses, land, and infrastructure.
		Flooding	Local to Global	Localized flooding caused by outflow from rivers after storms combined with unusually high tides in monsoon season.
	Environmental	Increasing of sediments in the waters	Local to Regional	Sedimentation in coastal waters stems from agricultural practices, logging, coastal development, aquaculture, mangrove destruction, erosion, and sand/gravel mining in Burmese waters.
		Overfishing	Local to Regional	Population growth, increasing numbers of fishers, more numerous and efficient gears, increasing technology on commercial vessels, commercial vessels coming into inshore waters are leading to overfishing.
		Increased garbage in the ocean	Local to National	Increasing garbage in the ocean from boats, tourists, islands, fishers (gears), and regional cities interferes with tourism and fisheries.
		Landslides	Local	Clearing of forests and plantations leads to landslides and damage to housing and infrastructure.
		More pollution in the ocean	Local to Regional	Polluted water coming from boats and regional ports scares the fish away and damages the environment.

Sphere	Category	Individual and Household Characteristics / Stressors	Comm	Household Characteristics					Individual Characteristics							
			Community (a)	HH Most Important Livelihood - Income (a)	HH Dependence on Marine for Livelihoods (b)	HH Income (b)	Number of HH appliances (b)	HH Land ownership for livelihood purposes (a) ##	Primary occupation of interviewee (a)	Age of interviewee (b)	Gender of interviewee (a) #	Level of formal education of interviewee (a)	Occupational Mobility of interviewee (b)	Individual mobility of interviewee (b)	Social capital - Level of involvement (b)	Number of sources that learned about CC (b)
Socio-Economic	Economic	Declines in the price that you can sell fish	****	****	****↑	**↓	****↓	** Y=↓	****			** ↓				
		Nobody wants to buy the product I am selling	****	*		*↑	**↑		***					*↑		
		The price of rubber declining	****	****			****↑	**** Y=↑	****			* ↑		***↑		*↑
		The rising price of supplies needed to do my livelihoods						** Y=↑	*		* M=↓					**↑
		The increasing price of gas		*					**		** M=↓					
		Rising cost of living												**↑		
		Increasing levels of household debt	*				*↑	* Y=↑				*↑		*↑		*↑
	Social	More people moving into the area	**				*↑			*↓		* ↑		*↑		****↑
		Health problems of members of your household						* Y=↓	*		* M=↓					
	Governance and Conflict	Commercial fishers coming into inshore waters (within 3000 meters)	****	**	***↑			* Y=↑	**						**↑	
		Conflict with other small-scale fisheries or fishers			**↑											
		Exclusion from doing livelihoods in certain areas because of tourism industry									* M=↑				*↑	*↑
		Trawlers taking or destroying my gears	***	****	***↑	*↓	**↓		****		* M=↑					
		Destructive and or illegal fishing practices			**↑	*↓									**↑	
		Getting arrested when traveling across the border to fish	****	****	****↑		**↓		****	*↓		** ↓	*↓			
		Gear or boat being taken when traveling across the border to fish	****	***	***↑				*	*↓			*↓			
		Conflict within the community				*↑	*↑			*↓		*** ↑			*↑	**↑
		Conflict with other communities														*↓
		Corruption in Thailand					*↑					* ↑				**↑
		Land encroachment in the area										* ↑	**↓		*↑	*↑
		National government policies					**↑	** Y=↑				** ↑				**↑
		The national park	***				*↑					* →		*↑	**↑	*↑
		The change of national governments					**↑			*↓					*↑	
Biophysical	Climate Change	Extreme weather events such as storms	``	***	**↑				*	*↓	* M=↓		*↓			
		Changes in rainy and dry seasons or changing rainfall patterns						* Y=↑			** M=↓					
		Coral bleaching	**													**↑
		Increased freshwater in mangrove areas making water less salty	*	*	*↑	*↓			*	*↓						
		Rising sea levels compared to the past	***										*↓			
		Salt water coming up in drinking water or agricultural water sources	***	*					*	*↓			*↓		*↑	
		Coastal or beach erosion	**												*↑	
		Flooding	*	***					**		* M= ↓					
	Environmental	Increasing of sediments in the waters			*↑				*		* M=↓					
		Overfishing	***	****	***↑	**↑			****							
		Increased garbage in the ocean									** M=↓					
		Landslides	**										*↓			
		More pollution in the ocean		*	*↑											

Source: Bennett et al. (2015)

Potential Options for Rare

At the moment, migration is not measured in the household surveys. Here are some proposed ideas to include migration in the household surveys incorporating our findings from the literature review.

Under the Basic Information section:

In Question 7: add in another box asking if the person has been:

1. Away from home for less than 3 months
2. Away from home for more than 3 months, but less than 6 months
3. Away from home for more than 6 months, but less than 9 months
4. Away from home for more than 6 months, but less than 12 months

5. Away from home for more than 12 months
6. Away from home for more than 5 years
7. Home the whole time (no migration)

These boxes are drawn because of the different ways migration is defined -- the United Nations defines a long-term migrant to be someone who is away for more than a year, and a short-term migrant to be someone who is away for more than three months but less than a year. However, other sources, such as Maharjan et al. (2020), define a migrant to be someone who is away for more than six months based on the Nepal national survey.

Having these different options could help Rare better understand how long someone has been away and better study the migration patterns. Having this distinction would be especially helpful when studying areas with both long-term and short-term migration, in order to study how the duration of migration affects the communities differently.

Also in Question 7: add in another box for:

1. Migrated internationally
2. Migrated domestically

International and domestic migration post different stressors on the migrant's family members, and this question would help further understand the migration patterns and how the communities are affected.

This data can be then plugged into the equation from Agarwal et al. (2022) to obtain a single migration score for a household, which can then be used to measure the community. Rare could consider modifying the formula to better suit their mission. For example, foregoing the variable Adopter to simply the formula. Additionally, X in the formula could include the original variables, such as household size, but the land size variable could be replaced with the amount of fishing capital, knowledge index could be replaced with interviewee's climate change perception, and the variables on people's caste or classes can be included or excluded as Rare sees fit.

Rare could then use this data, combined with data collected for understanding the perceptions of climate change, on land tenure, and on other stressors (e.g. data from ecological monitoring) to form a table similar to the one by Bennett et al. to better understand how the different stressors impact households and communities.

BIBLIOGRAPHY: BACKGROUND

Cinner, J. E., Caldwell, I. R., Thiault, L., Ben, J., Blanchard, J. L., Coll, M., Diedrich, A., Eddy, T. D., Everett, J. D., Folberth, C., Gascuel, D., Guiet, J., Gurney, G. G., Heneghan, R. F., Jägermeyr, J., Jiddawi, N., Lahari, R., Kuange, J., Liu, W., … Pollnac, R. (2022). Potential impacts of climate change on agriculture and fisheries production in 72 tropical coastal communities. *Nature Communications*, *13*(1), 3530. https://doi.org/10.1038/s41467-022-30991-4

"Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change", 2007, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests – The contributions of small-scale fisheries to sustainable development. Rome. https://doi.org/10.4060/cc4576en

Frawley, T. H., González-Mon, B., Nenadovic, M., Gladstone, F., Nomura, K., Alberto Zepeda-Domínguez, J., Rodriguez-Van Dyck, S., Ferrer, E. M., Torre, J., Micheli, F., Leslie, H. M., & Basurto, X. (2024). Self-governance mediates small-scale fishing strategies, vulnerability and adaptive response. *Global Environmental Change*, *84*, 102805. https://doi.org/10.1016/j.gloenvcha.2024.102805

Fish Forever (2019) Climate Change Vulnerability Assessment: Regional and Local Guidance. VanderBerg, J., and Cox, C., (Eds). Rare, Inc. Arlington, Virginia, 40 pp.

Updated Jan 2021
https://portal.rare.org/wp-content/uploads/2021/05/ccva_updated_040521.pdf

Virdin, J., Basurto, X., Nico, G., Harper, S., Del Mar Mancha-Cisneros, M., Vannuccini, S., Ahern, M., Anderson, C. M., Funge-Smith, S., Gutierrez, N. L., Mills, D. J., & Franz, N. (2023). Fishing for subsistence constitutes a livelihood safety net for populations dependent on aquatic foods around the world. *Nature Food*, *4*(10), 874–885. https://doi.org/10.1038/s43016-023-00844-4

BIBLIOGRAPHY: METHODS

Cheung, W. W. L., Jones, M. C., Reygondeau, G., & Frölicher, T. L. (2018). Opportunities for climate-risk reduction through effective fisheries management. Global Change Biology, 24(11), 5149–5163. https://doi.org/10.1111/gcb.14390

Cinner, J.E., Caldwell, I.R., Thiault, L. et al. Potential impacts of climate change on agriculture and fisheries production in 72 tropical coastal communities. Nat Commun 13, 3530 (2022). https://doi.org/10.1038/s41467-022-30991-4

"Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change." 2007. Cambridge, United Kingdom and New York, NY, USA: IPCC. https://www.ipcc.ch/report/ar4/wg2/.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. Journal of Advanced Nursing, 62(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Ginbo, T., & Hansson, H. (2023). Intra-household risk perceptions and climate change adaptation in sub-Saharan Africa. European Review of Agricultural Economics, 50(3), 1039–1063. https://doi.org/10.1093/erae/jbad011

Graziano, K., Pollnac, R., & Christie, P. (2018). Wading past assumptions: Gender dimensions of climate change adaptation in coastal communities of the Philippines. Ocean & Coastal Management, 162, 24–33. https://doi.org/10.1016/j.ocecoaman.2018.01.029

Gutierrez, N.L., Funge-Smith, S., Gorelli G., Mancha-Cisneros M.M., Defeo O., Johnson, A.F., Melnychuk M.C. 2023. Production and environmental interactions of small-scale fisheries. In: FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests: the contributions of small-scale fisheries to sustainable development. Rome, FAO; Durham, USA, Duke University; Penang, Malaysia, WorldFish.

Harper, S., Zeller, D., Hauzer, M., Pauly, D., & Sumaila, U. R. (2013). Women and fisheries: Contribution to food security and local economies. Marine Policy, 39, 56–63. https://doi.org/10.1016/j.marpol.2012.10.018

Harper, S., et al. 2023. Towards gender inclusivity and equality in small-scale fisheries. In: FAO, Duke University & WorldFish. 2023. Illuminating Hidden Harvests: the contributions of small-scale fisheries to sustainable development. Rome, FAO; Durham, USA, Duke University; Penang, Malaysia, WorldFish.

Harper, S., et al (n.d.). Designing gender inclusive data systems in small-scale fisheries. (in review)

Kawarazuka, N., Locke, C., McDougall, C., Kantor, P., & Morgan, M. (2017). Bringing analysis of gender and social-ecological resilience together in small-scale fisheries research: Challenges and opportunities. Ambio, 46(2), 201–213. https://doi.org/10.1007/s13280-016-0814-5

Virdin, J., Basurto, X., Nico, G., Harper, S., Del Mar Mancha-Cisneros, M., Vannuccini, S., Ahern, M., Anderson, C. M., Funge-Smith, S., Gutierrez, N. L., Mills, D. J., & Franz, N. (2023). Fishing for subsistence constitutes a livelihood safety net for populations dependent on aquatic foods around the world. *Nature Food*, *4*(10), 874–885. https://doi.org/10.1038/s43016-023-00844-4

BIBLIOGRAPHY: SAMPLED LITERATURE

Abdul-Razak, M., & Kruse, S. (2017). The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana. *CLIMATE RISK MANAGEMENT*, *17*, 104–122. https://doi.org/10.1016/j.crm.2017.06.001

Aberman, N.-L., Ali, S., Behrman, J., Bryan, E., Davis, P., Donnelly, A., Gathaara, V., Koné, D., Nganga, T., Ngugi, J., Okoba, B., & Roncoli, C. (2015). *Climate Change Adaptation Assets and Group-Based Approaches: Gendered Perceptions from Bangladesh, Ethiopia, Mali, and Kenya* (SSRN Scholarly Paper No. 2564556). Social Science Research Network. https://doi.org/10.2139/ssrn.2564556

Adam, R., Amani, A., Kuijpers, R., Smits, E., & Kruijssen, F. (2022). *Climate change, gender and aquatic food systems: Call for action to address gender and social inequalities matters in the nexus*. https://hdl.handle.net/20.500.12348/5305

Adzawla, W., Azumah, S. B., Anani, P. Y., & Donkoh, S. A. (2019). Gender perspectives of climate change adaptation in two selected districts of Ghana. *Heliyon*, *5*(11). https://doi.org/10.1016/j.heliyon.2019.e02854

Agarwal, T., Prarthna Agarwal Goel, Hom Gartaula, Rai, M., Bijarniya, D., Rahut, D. B., & Jat, M. L. (2022). Gendered impacts of climate-smart agriculture on household food security and labor migration: Insights from Bihar, India. *International Journal of Climate Change Strategies and Management*, *14*(1), 1–19. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-01-2020-0004

Akinsemolu, A. A., & Olukoya, O. A. P. (2020). The vulnerability of women to climate change in coastal regions of Nigeria: A case of the Ilaje community in Ondo State. *Journal of Cleaner Production*, *246*, 119015. https://doi.org/10.1016/j.jclepro.2019.119015

Ali, E. (2021). Farm Households' Adoption of Climate-smart Practices in Subsistence Agriculture: Evidence from Northern Togo. *Environmental Management*, *67*(5 pp.949–962), 949–962. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s00267-021-01436-3

Anik, A., Rahman, S., Sarker, J., & Al Hasan, M. (2021). Farmers' adaptation strategies to combat climate change in drought prone areas in Bangladesh. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *65*. https://doi.org/10.1016/j.ijdrr.2021.102562

Antwi, K. (2024). Merging adoption of natural climate solutions in agriculture with climatic and non-climatic risks within an (intra)gendered framework. *SCIENTIFIC REPORTS*, *14*(1). https://doi.org/10.1038/s41598-024-60469-w

Antwi-Agyei, P., Dougill, A. J., & Stringer, L. C. (2015). Impacts of land tenure arrangements on the adaptive capacity of marginalized groups: The case of Ghana's Ejura Sekyedumase and Bongo districts. *Land Use Policy*, *49 pp.203–212*, 203–212. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.landusepol.2015.08.007

Antwi-agyei, P., Quinn, C. H., Adiku, S. G. K., Codjoe, S. N. A., Dougill, A. J., Lamboll, R., & Dovie, D. B. K. (2017). Perceived stressors of climate vulnerability across scales in the Savannah zone of Ghana: A participatory approach. *Regional Environmental Change*, *17*(1), 213–227. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10113-016-0993-4

Axelrod, M., Vona, M., Novak Colwell, J., Fakoya, K., Salim, S. S., Webster, D. G., & Torre-Castro, M. de la. (2022). Understanding gender intersectionality for more robust ocean science. *Earth System Governance*, *13*, 100148. https://doi.org/10.1016/j.esg.2022.100148

Ayele, E., Temesgen, D., Lemma, T., & Wordofa, M. (2024). Gender Dimensions of Determinants of Adaptation Strategies to Climate Change among Smallholder Farmers in Northeast Ethiopia. *GLOBAL SOCIAL WELFARE*. https://doi.org/10.1007/s40609-024-00364-4

Azong, M. N., & Kelso, C. J. (2021). Gender, ethnicity and vulnerability to climate change: The case of matrilineal and patrilineal societies in Bamenda Highlands Region, Cameroon. *Global Environmental Change*, *67*, 102241. https://doi.org/10.1016/j.gloenvcha.2021.102241

Bennett, N. J., Dearden, P., & Peredo, A. M. (2015). Vulnerability to multiple stressors in coastal communities: A study of the Andaman coast of Thailand. *Climate and Development*, *7*(2), 124–141. https://doi.org/10.1080/17565529.2014.886993

Call, M., & Sellers, S. (2019). How does gendered vulnerability shape the adoption and impact of sustainable livelihood interventions in an era of global climate change? *Environmental Research Letters*, *14*(8), 083005. https://doi.org/10.1088/1748-9326/ab2f57

Carvalho, D. A. de, Amaral, S., & Alves, L. M. (2023). Climate change adaptation frameworks in fishing communities: A systematic review. *Ocean & Coastal Management*, *243*, 106754. https://doi.org/10.1016/j.ocecoaman.2023.106754

Chambon, M., Wambiji, N., Alvarez Fernandez, S., Azarian, C., Ngunu Wandiga, J., Vialard, J., Ziveri, P., & Reyes-Garcia, V. (2024). Weaving scientific and local knowledge on climate change impacts in coastal Kenya, Western Indian Ocean. *Environmental Science & Policy*, *160*, 103846. https://doi.org/10.1016/j.envsci.2024.103846

Chidakwa, P., Mabhena, C., Mucherera, B., Chikuni, J., & Mudavanhu, C. (2020). Women's Vulnerability to Climate Change: Gender-skewed Implications on Agro-based Livelihoods in Rural Zvishavane, Zimbabwe. *INDIAN JOURNAL OF GENDER STUDIES*, *27*(2), 259–281. https://doi.org/10.1177/0971521520910969

Chingala, G., Mapiye, C., Raffrenato, E., Hoffman, L., & Dzama, K. (2017). Determinants of smallholder farmers' perceptions of impact of climate change on beef production in

Malawi. *Climatic Change*, *142*(1–2), 129–141. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10584-017-1924-1

Dah-gbeto, A. P., & Villamor, G. B. (2016). Gender-specific responses to climate variability in a semi-arid ecosystem in northern Benin. *Ambio*, *45*(Supplement 3 p.297-308), 297–308. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s13280-016-0830-5;

de la Torre-Castro, M. (2019). Inclusive Management Through Gender Consideration in Small-Scale Fisheries: The Why and the How. *Frontiers in Marine Science*, *6*. https://doi.org/10.3389/fmars.2019.00156

Dilshad, T., Mallick, D., Udas, P. B., Goodrich, C. G., Prakash, A., Gorti, G., Bhadwal, S., Anwar, M. Z., Khandekar, N., Hassan, S. M. T., Habib, N., Abbasi, S. S., Syed, Md. A., & Rahman, A. (2019). Growing social vulnerability in the river basins: Evidence from the Hindu Kush Himalaya (HKH) Region. *Environmental Development*, *31*, 19–33. https://doi.org/10.1016/j.envdev.2018.12.004

Fan, S., & Ramirez, A. (2012). Achieving food security while switching to low carbon agriculture. *Journal of Renewable and Sustainable Energy*, *4*(4). Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1063/1.3670412

Ford, J. D., & Goldhar, C. (2013). Climate change vulnerability and adaptation in resource dependent communities: A case study from West Greenland. *Climate Research*, *54*(2), 181–196. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.3354/cr01118

Ge, Y., Fan, L., Li, Y., Guo, J., & Niu, H. (2023). Gender differences in smallholder farmers? Adoption of crop diversification: Evidence from Shaanxi Plain, China. *CLIMATE RISK MANAGEMENT*, *39*. https://doi.org/10.1016/j.crm.2023.100482

Godden, N. J. (2013). Gender and Declining Fisheries in Lobitos, Perú: Beyond Pescador and Ama De Casa. In M. Alston & K. Whittenbury (Eds.), *Research, Action and Policy: Addressing the Gendered Impacts of Climate Change* (pp. 251–263). Springer Netherlands. https://doi.org/10.1007/978-94-007-5518-5_18

Graziano, K., Pollnac, R., & Christie, P. (2018). Wading past assumptions: Gender dimensions of climate change adaptation in coastal communities of the Philippines. *Ocean & Coastal Management*, *162*, 24–33. https://doi.org/10.1016/j.ocecoaman.2018.01.029

Guodaar, L., & Bardsley, D. (2024). Social networks can mitigate climate change-related food insecurity risks in dryland farming systems in Ghana. *MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE*, *29*(7). https://doi.org/10.1007/s11027-024-10165-x

Hidayati, I., Putri, I. A. P., Ghani, M. W., Situmorang, A., & Widayatun. (2021). Small-scale fishing families and their daily multiple-stressor on climate change and COVID-19: Preliminary findings. *IOP Conference Series: Earth and Environmental Science*, *739*(1), 012047. https://doi.org/10.1088/1755-1315/739/1/012047

Jellason, N., Conway, J., & Baines, R. (2023). Exploring smallholders' cultural beliefs and their implication for adaptation to climate change in North-Western Nigeria. *SOCIAL SCIENCE JOURNAL*, *60*(3), 561–576. https://doi.org/10.1080/03623319.2020.1774720

Jerneck, A. (2018). What about Gender in Climate Change? Twelve Feminist Lessons from Development. *Sustainability*, *10*(3), Article 3. https://doi.org/10.3390/su10030627

Jørstad, H., & Webersik, C. (2016). Vulnerability to climate change and adaptation strategies of local communities in Malawi: Experiences of women fish-processing groups in the Lake Chilwa Basin. *Earth System Dynamics*, *7*(4), 977–989. https://doi.org/10.5194/esd-7-977-2016

Kawarazuka, N., Locke, C., McDougall, C., Kantor, P., & Morgan, M. (2016). *Bringing gender analysis and resilience analysis together in small scale fisheries research: Challenges and opportunities*. https://hdl.handle.net/20.500.12348/247

Keleman, P., Sá, R., & Temudo, M. (2024). Drifting Away from the Roots: Genderfluidity as Diola's Mangrove Fishing Strategies in Three Island-Villages of Northern Guinea-Bissau. *HUMAN ECOLOGY*. https://doi.org/10.1007/s10745-024-00544-y

Kerr, R., Nyantakyi-Frimpong, H., Dakishoni, L., Lupafya, E., Shumba, L., Luginaah, I., & Snapp, S. (2018). Knowledge politics in participatory climate change adaptation research on agroecology in Malawi. *RENEWABLE AGRICULTURE AND FOOD SYSTEMS*, *33*(3), 238–251. https://doi.org/10.1017/S1742170518000017

Khan, F. N., Collins, A. M., Nayak, P. K., & Armitage, D. (2018). Women's perspectives of small-scale fisheries and environmental change in Chilika lagoon, India. *Maritime Studies*, *17*(2), 145–154. https://doi.org/10.1007/s40152-018-0100-1

Khoza, S., Dewald van Niekerk, & Nemakonde, L. D. (2022). Gendered vulnerability and inequality: Understanding drivers of climate-smart agriculture dis- and nonadoption among smallholder farmers in Malawi and Zambia. *Ecology and Society*, *27*(4).

Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.5751/ES-13480-270419

Khoza, S., Niekerk, D. V., & Nemakonde, L. D. (2019). Understanding gender dimensions of climate-smart agriculture adoption in disaster-prone smallholder farming communities in Malawi and Zambia. *Disaster Prevention and Management: An International Journal*, *28*(5), 530–547. https://doi.org/10.1108/DPM-10-2018-0347

Kom, Z., Nethengwe, N. S., Mpandeli, N. S., & Chikoore, H. (2022). Determinants of small-scale farmers' choice and adaptive strategies in response to climatic shocks in Vhembe District, South Africa. *GeoJournal*, *87*(2 pp.677–700), 677–700. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10272-7

Koomson, D., Davies-Vollum, K. S., & Raha, D. (2020). Characterising the vulnerability of fishing households to climate and environmental change: Insights from Ghana. *Marine Policy*, *120*, 104142. https://doi.org/10.1016/j.marpol.2020.104142

Kumasi, T., Antwi-Agyei, P., & Obiri-Danso, K. (2019). Small-holder farmers' climate change adaptation practices in the Upper East Region of Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *21*(2), 745–762. https://doi.org/10.1007/s10668-017-0062-2

Lauria, V., Das, I., Hazra, S., Cazcarro, I. https://orcid.org/0000-0001-7517-0053, Arto, I. https://orcid.org/0000-0001-6427-7437, Kay, S. https://orcid.org/0000-0003-1510-8578, Ofori-Danson, P., Ahmed, M., Hossain, M. A. R., Barange, M., & Fernandes, J. A. (2018). Importance of fisheries for food security across three climate change vulnerable deltas. *Science of the Total Environment*, *640–641 pp.1566–1577*, 1566–1577.

Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.scitotenv.2018.06.011

Lebel, L., Lebel, P., & Lebel, B. (2014). Gender and the management of climate-related risks in Northern Thailand. *International Social Science Journal*, *65*(217–218), 147–158. https://doi.org/10.1111/issj.12090

Limuwa, M. M., & Synnevåg, G. (2018). Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate change—Insights from Malawi's small-scale fisheries. *African Journal of Food, Agriculture, Nutrition and Development*, *18*(2), Article 2. https://doi.org/10.18697/ajfand.82.17580

Maharjan, A., Kochhar, I., Chitale, V. S., 'Ābid, Ḥusain, 1962-, & Gioli, G. (2020). Understanding rural outmigration and agricultural land use change in the Gandaki Basin, Nepal. *Applied Geography*, *124 pp.102278-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.apgeog.2020.102278

Maja, M. M., Idiris, A. A., Terefe, A. T., & Fashe, M. M. (2023). Gendered Vulnerability, Perception and Adaptation Options of Smallholder Farmers to Climate Change in Eastern Ethiopia. *Earth Systems and Environment*, *7*(1), 189–209. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s41748-022-00324-y

Mangheni, M., Tufan, H., Nkengla, L., Aman, B., & Boonabaana, B. (2019). Gender Norms, Technology Access, and Women Farmers' Vulnerability to Climate Change in Sub-Saharan Africa. In Y. Bamutaze, S. Kyamanywa, B. Singh, G. Nabanoga, & R. Lal (Eds.), *AGRICULTURE AND ECOSYSTEM RESILIENCE IN SUB SAHARAN*

AFRICA: LIVELIHOOD PATHWAYS UNDER CHANGING CLIMATE (WOS:000489289500034; pp. 715–728). https://doi.org/10.1007/978-3-030-12974-3_32

Mapfumo, P., Mtambanengwe, F., & Chikowo, R. (2016). Building on indigenous knowledge to strengthen the capacity of smallholder farming communities to adapt to climate change and variability in southern Africa. *Climate and Development*, *8*(1), 72–82. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2014.998604

Melese Gezie. (2019). Farmer's response to climate change and variability in Ethiopia: A review. *Cogent Food & Agriculture*, *5*(1). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1080/23311932.2019.1613770

Molua, E. L., Sonwa, D., Bele, Y., Foahom, B., Jean Pierre Mate Mweru, Salomon Mampeta Wa Bassa, Gapia, M., Ngana, F., Assoua Eyong Joe, & Masumbuko, E. M. (2023). Climate-Smart Conservation Agriculture, Farm Values and Tenure Security: Implications for Climate Change Adaptation and Mitigation in the Congo Basin. *Tropical Conservation Science*, *16*. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1177/19400829231169980

Mugi-Ngenga, E., Mucheru-Muna, M., Mugwe, J., Ngetich, F., Mairura, F., & Mugendi, D. (2016). Household's socio-economic factors influencing the level of adaptation to climate variability in the dry zones of Eastern Kenya. *JOURNAL OF RURAL STUDIES*, *43*, 49–60. https://doi.org/10.1016/j.jrurstud.2015.11.004

Murage, A. W., Pittchar, J. O., Midega, C. A. O., Onyango, C. O., & Khan, Z. R. (2015). Gender specific perceptions and adoption of the climate-smart push–pull technology in eastern Africa. *Crop Protection*, *76 pp.83–91*, 83–91. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.cropro.2015.06.014

Nelson, V. (2010). *Climate Change and Gender What role for agricultural research among smallholder farmers in Africa?* (Working Document No. 222). CIAT. https://cgspace.cgiar.org/server/api/core/bitstreams/bc4297d9-03ae-4fa5-89ce-290c9cc94492/content

Ngajilo, D., Adams, S., Kincl, L., Guernsey, J., & Jeebhay, M. F. (2023). Occupational Health and Safety in Tanzanian Aquaculture – Emerging Issues. *Journal of Agromedicine*, *28*(2), 321–333. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1080/1059924X.2022.2058139

N-yanbini, N., Toku, A., Osumanu, I., & Sarfo, A. (2024). Exploring agro-ecological implications and gendered adaptation to climate change in Northern Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *26*(8), 20485–20505. https://doi.org/10.1007/s10668-023-03484-7

Nyantakyi-Frimpong, H. (2021). Climate change, women's workload in smallholder agriculture, and embodied political ecologies of undernutrition in northern Ghana. *HEALTH & PLACE*, *68*. https://doi.org/10.1016/j.healthplace.2021.102536

Nyantakyi-Frimpong, H., & Bezner-Kerr, R. (2015). The relative importance of climate change in the context of multiple stressors in semi-arid Ghana. *Global Environmental*

Change, *32*, 40–56. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.gloenvcha.2015.03.003

Obert Jiri, Mafongoya, P. L., & Chivenge, P. (2017). Building climate change resilience through adaptation in smallholder farming systems in semi-arid Zimbabwe. *International Journal of Climate Change Strategies and Management*, *9*(2), 151–165. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-07-2016-0092

Ogundeji, A. (2022). Adaptation to Climate Change and Impact on Smallholder Farmers' Food Security in South Africa. *AGRICULTURE-BASEL*, *12*(5). https://doi.org/10.3390/agriculture12050589

Ojo, T. O., Ogundeji, A. A., & Emenike, C. U. (2022). Does Adoption of Climate Change Adaptation Strategy Improve Food Security? A Case of Rice Farmers in Ogun State, Nigeria. *Land*, *11*(11), 1875. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.3390/land11111875

Okeke-Ogbuafor, N., Atela, J., Nantongo, M., Aoko, L., Tonui, C., Rajah, E., Osamba, J., Odongo, J., Atchade, A., & Gray, T. (2024). Locally led adaptation metrics for Africa: A framework for building resilience in smallholder farming sectors. *FRONTIERS IN CLIMATE*, *6*. https://doi.org/10.3389/fclim.2024.1429462

Onyimadu, C. (2023). Climate change adaptation and wellbeing among smallholder women farmers in Gwagwalada and Kokona, Nigeria. *FUTURES*, *153*. https://doi.org/10.1016/j.futures.2023.103238

Palosaari, M., Autio, A., Mbinga, E., Pellikka, P., & Johansson, T. (2024). The biased narrative of vulnerable women: Gender analysis of smallholder farmers' contextual vulnerability to climate change in the Taita Hills, Kenya. *Mitigation and Adaptation Strategies for Global Change*, *29*(6), 51. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s11027-024-10147-z

Pelage, L., Bertrand, A., Siqueira, S., Araújo, A., Avelino, K., da Silva, C., & Frédou, T. (2023). Fishers' perceptions of global change to inform coastal planning in a data-poor socio-ecological system. *MARINE POLICY*, *155*. https://doi.org/10.1016/j.marpol.2023.105784

Poudel, S., Funakawa, S., Shinjo, H., & Mishra, B. (2020). Understanding households' livelihood vulnerability to climate change in the Lamjung district of Nepal. *Environment, Development and Sustainability*, *22*(8 pp.8159–8182), 8159–8182. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10668-019-00566-3

Queiros, A., Talbot, E., Msuya, F., Kuguru, B., Jiddawi, N., Mahongo, S., Shaghude, Y., Muhando, C., Chundu, E., Jacobs, Z., Sailley, S., Virtanen, E., Viitasalo, M., Osuka, K., Aswani, S., Coupland, J., Wilson, R., Taylor, S., Fernandes-Salvador, J., … Popova, E. (2024). A sustainable blue economy may not be possible in Tanzania without cutting emissions. *SCIENCE OF THE TOTAL ENVIRONMENT*, *947*. https://doi.org/10.1016/j.scitotenv.2024.174623

Quiros, T. E. A. L., Beck, M. W., Araw, A., Croll, D. A., & Tershy, B. (2018). Small-scale seagrass fisheries can reduce social vulnerability: A comparative case study. *Ocean & Coastal Management*, *157*, 56–67. https://doi.org/10.1016/j.ocecoaman.2018.02.003

Sanogo, K., Binam, J., Bayala, J., Villamor, G. B., Kalinganire, A., & Dodiomon, S. (2017). Farmers' perceptions of climate change impacts on ecosystem services delivery of parklands in southern Mali. *Agroforestry Systems*, *91*(2), 345–361. https://doi.org/10.1007/s10457-016-9933-z

Sekabira, H., Tepa-Yotto, G. T., Kaweesa, Y., Simbeko, G., Tamò, M., Agboton, C., Osman Damba Tahidu, & Tahirou Abdoulaye. (2023). Impact of CS-IPM on Key Social Welfare Aspects of Smallholder Farmers' Livelihoods. *Climate*, *11*(5), 97. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.3390/cli11050097

Singh, P., Tabe, T., & Martin, T. (2022). The role of women in community resilience to climate change: A case study of an Indigenous Fijian community. *Women's Studies International Forum*, *90*, 102550. https://doi.org/10.1016/j.wsif.2021.102550

Sonko, E., Florkowski, W., Agodzo, S., & Antwi-Agyei, P. (2020). Subsistence farmer knowledge of strategies alleviating food insecurity in the context of climate change in the lower river region of the Gambia. *FOOD SECURITY*, *12*(3), 607–624. https://doi.org/10.1007/s12571-020-01024-z

Sreya, P. S., Parayil, C., Aswathy, N., Bonny, B. P., Aiswarya, T. P., & Nameer, P. O. (2021). Economic vulnerability of small-scale coastal households to extreme weather events in Southern India. *Marine Policy*, *131*, 104608. https://doi.org/10.1016/j.marpol.2021.104608

Swai, W, O., Mbwambo, S, J., Magayane, & T, F. (2012). Gender and perception on climate change in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Journal of African Studies and Development*, *4*(9), 218–231. https://doi.org/10.5897/JASD12.038

Van Aelst, K., & Holvoet, N. (2018). Climate change adaptation in the Morogoro Region of Tanzania: Women's decision-making participation in small-scale farm households. *CLIMATE AND DEVELOPMENT*, *10*(6), 495–508. https://doi.org/10.1080/17565529.2017.1318745

Wagner, S., Rigal, C., Liebig, T., Mremi, R., Hemp, A., Jones, M., Price, E., & Preziosi, R. (2019). Ecosystem Services and Importance of Common Tree Species in Coffee-Agroforestry Systems: Local Knowledge of Small-Scale Farmers at Mt. Kilimanjaro, Tanzania. *Forests*, *10*(11). Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.3390/f10110963

Weeratunge, N., Snyder, K. A., & Sze, C. P. (2010). Gleaner, fisher, trader, processor: Understanding gendered employment in fisheries and aquaculture. *Fish and Fisheries*, *11*(4), 405–420. https://doi.org/10.1111/j.1467-2979.2010.00368.x

Yiridomoh, G. Y., Appiah, D. O., Owusu, V., & Bonye, S. Z. (2021). Women smallholder farmers off-farm adaptation strategies to climate variability in rural Savannah, Ghana. *GeoJournal*, *86*(5 pp.2367–2385), 2367–2385. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10191-7

Zorrilla-Miras, P., Lisboa, S., López-Gunn, E., & Giordano, R. (2024). Farmers' information sharing for climate change adaptation in Mozambique. *INFORMATION DEVELOPMENT*. https://doi.org/10.1177/02666669241227910

BIBLIOGRAPHY: ALL SCREENED LITERATURE

CLIMATE CHANGE AND GENDER RESULTS

Abdul-Razak, M., & Kruse, S. (2017). The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana. *CLIMATE RISK MANAGEMENT*, *17*, 104–122. https://doi.org/10.1016/j.crm.2017.06.001

Aberman, N.-L., Ali, S., Behrman, J., Bryan, E., Davis, P., Donnelly, A., Gathaara, V., Koné, D., Nganga, T., Ngugi, J., Okoba, B., & Roncoli, C. (2015). *Climate Change Adaptation Assets and Group-Based Approaches: Gendered Perceptions from Bangladesh, Ethiopia, Mali, and Kenya* (SSRN Scholarly Paper No. 2564556). Social Science Research Network. https://doi.org/10.2139/ssrn.2564556

Acheampong, P., Yeboah, S., Adabah, R., Asibuo, J., Nchanji, E., Opoku, M., Toywa, J., & Lutomia, C. (2023). Gendered perceptions and adaptations to climate change in Ghana: What factors influence the choice of an adaptation strategy? *FRONTIERS IN SUSTAINABLE FOOD SYSTEMS*, *7*. https://doi.org/10.3389/fsufs.2023.1091812

Adam, R., Amani, A., Kuijpers, R., Smits, E., & Kruijssen, F. (2022). *Climate change, gender and aquatic food systems: Call for action to address gender and social inequalities matters in the nexus*. WorldFish (WF). https://hdl.handle.net/20.500.12348/5305

Adhikari, S. (2018). Drought Impact and Adaptation Strategies in the Mid-Hill Farming System of Western Nepal. *Environments*, *5*(9). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.3390/environments5090101

Adzawla, W., Azumah, S. B., Anani, P. Y., & Donkoh, S. A. (2019). Gender perspectives of climate change adaptation in two selected districts of Ghana. *Heliyon*, *5*(11). https://doi.org/10.1016/j.heliyon.2019.e02854

Adzawla, W., Baumüller, H., Donkoh, S., & Serra, R. (2020). Effects of climate change and livelihood diversification on the gendered productivity gap in Northern Ghana. *CLIMATE AND DEVELOPMENT*, *12*(8), 743–755. https://doi.org/10.1080/17565529.2019.1689093

Agarwal, T., Prarthna Agarwal Goel, Hom Gartaula, Rai, M., Bijarniya, D., Rahut, D. B., & Jat, M. L. (2022). Gendered impacts of climate-smart agriculture on household food security and labor migration: Insights from Bihar, India. *International Journal of Climate Change Strategies and Management*, *14*(1), 1–19. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-01-2020-0004

Ahmed, S., Eklund, E., & Kiester, E. (2023). Adaptation outcomes in climate-vulnerable locations: Understanding how short-term climate actions exacerbated existing gender inequities in coastal Bangladesh. *Journal of Environmental Planning and Management*, *66*(13 pp.2691–2712), 2691–2712. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/09640568.2022.2082928

Aiswarya, T., Parayil, C., Bonny, B., Nameer, P., Prema, A., & Sreya, P. (2023). Gendered vulnerabilities in small scale agricultural households of Southern India. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *84*. https://doi.org/10.1016/j.ijdrr.2022.103475

Akinsemolu, A. A., & Olukoya, O. A. P. (2020). The vulnerability of women to climate change in coastal regions of Nigeria: A case of the Ilaje community in Ondo State. *Journal of Cleaner Production*, *246*, 119015. https://doi.org/10.1016/j.jclepro.2019.119015

Alhassan, S. I., Kuwornu, J. K., & Osei-Asare, Y. B. (2019). Gender dimension of vulnerability to climate change and variability: Empirical evidence of smallholder farming households in Ghana. *International Journal of Climate Change Strategies and Management*, *11*(2), 195–214. Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-10-2016-0156

Ali, E. (2021). Farm Households' Adoption of Climate-smart Practices in Subsistence Agriculture: Evidence from Northern Togo. *Environmental Management*, *67*(5 pp.949–962), 949–962. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s00267-021-01436-3

Alpízar, F., Saborío-Rodríguez, M., Martínez-Rodríguez, M., Viguera, B., Vignola, R., Capitan, T., & Harvey, C. (2020). Determinants of food insecurity among smallholder farmer households in Central America: Recurrent versus extreme weather-driven events. *REGIONAL ENVIRONMENTAL CHANGE*, *20*(1). https://doi.org/10.1007/s10113-020-01592-y

Anik, A., Rahman, S., Sarker, J., & Al Hasan, M. (2021). Farmers' adaptation strategies to combat climate change in drought prone areas in Bangladesh. *INTERNATIONAL*

JOURNAL OF DISASTER RISK REDUCTION, *65*. https://doi.org/10.1016/j.ijdrr.2021.102562

Antwi, K. (2024). Merging adoption of natural climate solutions in agriculture with climatic and non-climatic risks within an (intra)gendered framework. *SCIENTIFIC REPORTS*, *14*(1). https://doi.org/10.1038/s41598-024-60469-w

Antwi-Agyei, P., Dougill, A. J., & Stringer, L. C. (2015). Impacts of land tenure arrangements on the adaptive capacity of marginalized groups: The case of Ghana's Ejura Sekyedumase and Bongo districts. *Land Use Policy*, *49 pp.203–212*, 203–212. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.landusepol.2015.08.007

Antwi-Agyei, P., & Nyantakyi-Frimpong, H. (2021). Evidence of Climate Change Coping and Adaptation Practices by Smallholder Farmers in Northern Ghana. *SUSTAINABILITY*, *13*(3). https://doi.org/10.3390/su13031308

Antwi-agyei, P., Quinn, C. H., Adiku, S. G. K., Codjoe, S. N. A., Dougill, A. J., Lamboll, R., & Dovie, D. B. K. (2017). Perceived stressors of climate vulnerability across scales in the Savannah zone of Ghana: A participatory approach. *Regional Environmental Change*, *17*(1), 213–227. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10113-016-0993-4

Asante, F., Guodaar, L., & Arimiyaw, S. (2021). Climate change and variability awareness and livelihood adaptive strategies among smallholder farmers in semi-arid northern Ghana. *ENVIRONMENTAL DEVELOPMENT*, *39*. https://doi.org/10.1016/j.envdev.2021.100629

Asravor, R. (2018). Livelihood Diversification Strategies to Climate Change among Smallholder Farmers in Northern Ghana. *JOURNAL OF INTERNATIONAL DEVELOPMENT*, *30*(8), 1318–1338. https://doi.org/10.1002/jid.3330

Assan, E., Suvedi, M., Schmitt Olabisi, L., & Bansah, K. J. (2020). Climate change perceptions and challenges to adaptation among smallholder farmers in semi-arid Ghana: A gender analysis. *Journal of Arid Environments*, *182*, 104247. https://doi.org/10.1016/j.jaridenv.2020.104247

Awazi, N. P., Tchamba, M. N., & Avana, T. M.-L. (2019). Climate change resiliency choices of small-scale farmers in Cameroon: Determinants and policy implications. *Journal of Environmental Management*, *250 pp.109560-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.jenvman.2019.109560

Awiti, A. O. (2022). Climate Change and Gender in Africa: A Review of Impact and Gender-Responsive Solutions. *Frontiers in Climate*, *4*. https://doi.org/10.3389/fclim.2022.895950

Axelrod, M., Vona, M., Novak Colwell, J., Fakoya, K., Salim, S. S., Webster, D. G., & Torre-Castro, M. de la. (2022). Understanding gender intersectionality for more robust ocean science. *Earth System Governance*, *13*, 100148. https://doi.org/10.1016/j.esg.2022.100148

Ayele, E., Temesgen, D., Lemma, T., & Wordofa, M. (2024). Gender Dimensions of Determinants of Adaptation Strategies to Climate Change among Smallholder Farmers in Northeast Ethiopia. *GLOBAL SOCIAL WELFARE*. https://doi.org/10.1007/s40609-024-00364-4

Azong, M. N., & Kelso, C. J. (2021). Gender, ethnicity and vulnerability to climate change: The case of matrilineal and patrilineal societies in Bamenda Highlands Region, Cameroon. *Global Environmental Change*, *67*, 102241. https://doi.org/10.1016/j.gloenvcha.2021.102241

Barbon, W., Myae, C., Vidallo, R., Thant, P., Monville-Oro, E., & Gonsalves, J. (2021). Applying Participatory Action Research Methods in Community-Based Adaptation With Smallholders in Myanmar. *FRONTIERS IN CLIMATE*, *3*. https://doi.org/10.3389/fclim.2021.734053

Bee, B. (2014). “Si no comemos tortilla, no vivimos:” women, climate change, and food security in central Mexico. *AGRICULTURE AND HUMAN VALUES*, *31*(4), 607–620. https://doi.org/10.1007/s10460-014-9503-9

Bennett, N. J., Dearden, P., & Peredo, A. M. (2015). Vulnerability to multiple stressors in coastal communities: A study of the Andaman coast of Thailand. *Climate and Development*, *7*(2), 124–141. https://doi.org/10.1080/17565529.2014.886993

Bessah, E., Raji, A. O., Taiwo, O. J., Agodzo, S. K., Ololade, O. O., Strapasson, A., & Donkor, E. (2021). Gender-based variations in the perception of climate change impact, vulnerability and adaptation strategies in the Pra River Basin of Ghana. *International Journal of Climate Change Strategies and Management*, *13*(4/5), 435–462. https://doi.org/10.1108/IJCCSM-02-2020-0018

Bezner Kerr, R., Kangmennaang, J., Dakishoni, L., Nyantakyi-Frimpong, H. https://orcid.org/0000-0002-6407-1970, Lupafya, E., Shumba, L., Msachi, R., Boateng, G. O., Snapp, S. S. https://orcid.org/0000-0002-9738-0649, Chitaya, A., Maona, E., Gondwe, T., Nkhonjera, P., & Luginaah, I. (2019). Participatory agroecological research on climate change adaptation improves smallholder farmer household food security and dietary diversity in Malawi. *Agriculture, Ecosystems & Environment*, *279 pp.109–121*, 109–121. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.agee.2019.04.004

Bhatta, G. D., Aggarwal, P. K., Poudel, S., & Belgrave, D. A. (2015). Climate-induced Migration in South Asia: Migration Decisions and the Gender Dimensions of Adverse Climatic Events. *Journal of Rural and Community Development*, *10*(4), Article 4. https://journals.brandonu.ca/jrcd/article/view/1177

Call, M., & Sellers, S. (2019). How does gendered vulnerability shape the adoption and impact of sustainable livelihood interventions in an era of global climate change? *Environmental Research Letters*, *14*(8), 083005. https://doi.org/10.1088/1748-9326/ab2f57

Carranza, M., & Niles, M. T. (2019). Smallholder Farmers Spend Credit Primarily on Food: Gender Differences and Food Security Implications in a Changing Climate. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00056

Carvalho, D. A. de, Amaral, S., & Alves, L. M. (2023). Climate change adaptation frameworks in fishing communities: A systematic review. *Ocean & Coastal Management*, *243*, 106754. https://doi.org/10.1016/j.ocecoaman.2023.106754

Castro, B. (2019). Challenges, Futures and Possibilities of Land Use in Rural Areas of Cela Municipality: Risks, Climate Change Impacts, Adaptation and Links to Sustainability. In P. Castro, A. Azul, W. Filho, & U. Azeiteiro (Eds.), *CLIMATE CHANGE-RESILIENT AGRICULTURE AND AGROFORESTRY: ECOSYSTEM SERVICES AND SUSTAINABILITY* (WOS:000620171600008; pp. 115–136). https://doi.org/10.1007/978-3-319-75004-0_7

Chambon, M., Wambiji, N., Alvarez Fernandez, S., Azarian, C., Ngunu Wandiga, J., Vialard, J., Ziveri, P., & Reyes-Garcia, V. (2024). Weaving scientific and local knowledge on climate change impacts in coastal Kenya, Western Indian Ocean. *Environmental Science & Policy*, *160*, 103846. https://doi.org/10.1016/j.envsci.2024.103846

Chandra, A., McNamara, K. E., Dargusch, P., Caspe, A. M., & Dalabajan, D. (2017). Gendered vulnerabilities of smallholder farmers to climate change in conflict-prone areas: A case study from Mindanao, Philippines. *Journal of Rural Studies*, *50 pp.45–59*, 45–59. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.jrurstud.2016.12.011

Chersich, M., Wright, C., Venter, F., Rees, H., Scorgie, F., & Erasmus, B. (2018). Impacts of Climate Change on Health and Wellbeing in South Africa. *INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH*, *15*(9). https://doi.org/10.3390/ijerph15091884

Chidakwa, P., Mabhena, C., Mucherera, B., Chikuni, J., & Mudavanhu, C. (2020). Women's Vulnerability to Climate Change: Gender-skewed Implications on Agro-based

Livelihoods in Rural Zvishavane, Zimbabwe. *INDIAN JOURNAL OF GENDER STUDIES*, *27*(2), 259–281. https://doi.org/10.1177/0971521520910969

Chingala, G., Mapiye, C., Raffrenato, E., Hoffman, L., & Dzama, K. (2017). Determinants of smallholder farmers' perceptions of impact of climate change on beef production in Malawi. *Climatic Change*, *142*(1–2), 129–141. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10584-017-1924-1

Chisale, H., Chirwa, P., & Babalola, F. (2023). Awareness, Knowledge and Perception of Forest Dependent Communities on Climate Change in Malawi: A Case of Mchinji and Phirilongwe Forest Reserves in Malawi. *JOURNAL OF SUSTAINABLE FORESTRY*, *42*(7), 728–745. https://doi.org/10.1080/10549811.2022.2123353

Chitiga-Mabugu, M., Henseler, M., Maisonnave, H., & Mabugu, R. (2023). Climate Change and Women—Impacts and Adaptation. *INTERNATIONAL REVIEW OF ENVIRONMENTAL AND RESOURCE ECONOMICS*, *17*(1), 99–152. https://doi.org/10.1561/101.00000151

Dah-gbeto, A. P., & Villamor, G. B. (2016). Gender-specific responses to climate variability in a semi-arid ecosystem in northern Benin. *Ambio*, *45*(Supplement 3 p.297-308), 297–308. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s13280-016-0830-5;

Das, U., Ansari, M., & Ghosh, S. (2022). Effectiveness and upscaling potential of climate smart agriculture interventions: Farmers? Participatory prioritization and livelihood indicators as its determinants. *AGRICULTURAL SYSTEMS*, *203*. https://doi.org/10.1016/j.agsy.2022.103515

Davila, F., Bourke, R. M., McWilliam, A., Crimp, S., Robins, L., Van Wensveen, M., Alders, R. G., & Butler, J. R. A. (2021). COVID-19 and food systems in Pacific Island Countries, Papua New Guinea, and Timor-Leste: Opportunities for actions towards the sustainable development goals. *Agricultural Systems*, *191 pp.103137-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.agsy.2021.103137

de la Torre-Castro, M. (2019). Inclusive Management Through Gender Consideration in Small-Scale Fisheries: The Why and the How. *Frontiers in Marine Science*, *6*. https://doi.org/10.3389/fmars.2019.00156

Deshar, R., & Koirala, M. (2020). *Climate Change and Gender Policy* (V. Venkatramanan, S. Shah, & R. Prasad, Eds.; WOS:000560077000015; p. 422). https://doi.org/10.1007/978-981-13-9570-3_14

Dilshad, T., Mallick, D., Udas, P. B., Goodrich, C. G., Prakash, A., Gorti, G., Bhadwal, S., Anwar, M. Z., Khandekar, N., Hassan, S. M. T., Habib, N., Abbasi, S. S., Syed, Md. A., & Rahman, A. (2019). Growing social vulnerability in the river basins: Evidence from the Hindu Kush Himalaya (HKH) Region. *Environmental Development*, *31*, 19–33. https://doi.org/10.1016/j.envdev.2018.12.004

Djoudi, H., & Brockhaus, M. (2011). Is Adaptation to Climate Change Gender Neutral? Lessons from Communities Dependent on Livestock and Forests in Northern Mali.

International Forestry Review, *13*(2), 123–135. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1505/146554811797406606

Dube, N. (2023). Forty years of climate risk research in Zimbabwe-1980-2021. *DEVELOPMENT SOUTHERN AFRICA*, *40*(6), 1308–1342. https://doi.org/10.1080/0376835X.2023.2229874

Fan, S., & Ramirez, A. (2012). Achieving food security while switching to low carbon agriculture. *Journal of Renewable and Sustainable Energy*, *4*(4). Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1063/1.3670412

Feliciano, D. (2019). A review on the contribution of crop diversification to Sustainable Development Goal 1 "No poverty" in different world regions. *Sustainable Development*, *27*(4), 795–808. ABI/INFORM Collection; Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1002/sd.1923

Ford, J. D., & Goldhar, C. (2013). Climate change vulnerability and adaptation in resource dependent communities: A case study from West Greenland. *Climate Research*, *54*(2), 181–196. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.3354/cr01118

Funk, C., Raghavan Sathyan, A., Winker, P., & Breuer, L. (2020). Changing climate—Changing livelihood: Smallholder's perceptions and adaption strategies. *Journal of Environmental Management*, *259 pp.109702-*. Agricultural & Environmental

Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.jenvman.2019.109702

Garcia, A., Tschakert, P., & Karikari, N. A. (2020). ‘Less able’: How gendered subjectivities warp climate change adaptation in Ghana’s Central Region. *Gender, Place & Culture*, *27*(11), 1602–1627. https://doi.org/10.1080/0966369X.2020.1786017

Ge, Y., Fan, L., Li, Y., Guo, J., & Niu, H. (2023). Gender differences in smallholder farmers? Adoption of crop diversification: Evidence from Shaanxi Plain, China. *CLIMATE RISK MANAGEMENT*, *39*. https://doi.org/10.1016/j.crm.2023.100482

Godden, N. J. (2013). Gender and Declining Fisheries in Lobitos, Perú: Beyond Pescador and Ama De Casa. In M. Alston & K. Whittenbury (Eds.), *Research, Action and Policy: Addressing the Gendered Impacts of Climate Change* (pp. 251–263). Springer Netherlands. https://doi.org/10.1007/978-94-007-5518-5_18

Godoy, R., Reyes-García, V., Vadez, V., Magvanjav, O., Leonard, W. R., McDade, T., Kumar, S., Iqbāl, J., Wilkie, D., Tanner, S., & Huanca, T. (2009). Does the Future Affect the Present? The Effects of Future Weather on the Current Collection of Planted Crops and Wildlife in a Native Amazonian Society of Bolivia. *Human Ecology*, *37*(5 pp.613–628), 613–628. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10745-009-9263-0

Goh, A. H. X. (2012). *A literature review of the gender-differentiated impacts of climate change on women’s and men’s assets and well-being in developing countries*. https://hdl.handle.net/10568/154055

Goli, I., Abadi, M., Lashgarara, F., Tanaskovik, V., Chukaliev, O., Viira, A., Pour, M., Sklenicka, P., Janeckova, K., & Azadi, H. (2023). Women and climate change adaptation behaviour: What's the problem and solution? *CLIMATE AND DEVELOPMENT*, *15*(6), 535–552. https://doi.org/10.1080/17565529.2022.2121597

Gorettie, N., Justine, N., & Allan, B. (2019). Impacts of Climate Change on Small Holder Households in Mt. Elgon Region of Uganda: Does Gender Matter? In Y. Bamutaze, S. Kyamanywa, B. Singh, G. Nabanoga, & R. Lal (Eds.), *AGRICULTURE AND ECOSYSTEM RESILIENCE IN SUB SAHARAN AFRICA: LIVELIHOOD PATHWAYS UNDER CHANGING CLIMATE* (WOS:000489289500032; pp. 673–690). https://doi.org/10.1007/978-3-030-12974-3_30

Graef, F., & Uckert, G. (2016). Male and female scientists differ in their suitability assessments of food-securing upgrading strategies. *International Journal of Agricultural Resources, Governance and Ecology*, *12*(3), 305–326. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1504/IJARGE.2016.078317

Graziano, K., Pollnac, R., & Christie, P. (2018). Wading past assumptions: Gender dimensions of climate change adaptation in coastal communities of the Philippines. *Ocean & Coastal Management*, *162*, 24–33. https://doi.org/10.1016/j.ocecoaman.2018.01.029

Guodaar, L., & Bardsley, D. (2024). Social networks can mitigate climate change-related food insecurity risks in dryland farming systems in Ghana. *MITIGATION AND*

ADAPTATION STRATEGIES FOR GLOBAL CHANGE, *29*(7). https://doi.org/10.1007/s11027-024-10165-x

Gutiérrez, J., dos Santos, C., Celentano, D., Rousseau, G., & da Silva, T. (2024). Perception of the Vulnerability of Quilombola Farmers in Alcantara, Eastern Amazonia, Brazil. *SOCIETY & NATURAL RESOURCES*, *37*(1), 113–130. https://doi.org/10.1080/08941920.2023.2263857

Henriksson, R., Vincent, K., Archer, E., & Jewitt, G. (2021). Understanding gender differences in availability, accessibility and use of climate information among smallholder farmers in Malawi. *CLIMATE AND DEVELOPMENT*, *13*(6), 503–514. https://doi.org/10.1080/17565529.2020.1806777

Hidayati, I., Putri, I. A. P., Ghani, M. W., Situmorang, A., & Widayatun. (2021). Small-scale fishing families and their daily multiple-stressor on climate change and COVID-19: Preliminary findings. *IOP Conference Series: Earth and Environmental Science*, *739*(1), 012047. https://doi.org/10.1088/1755-1315/739/1/012047

Huluka, A. (2022). Is there any gender difference in environmental concern? Evidence from the smallholder farmers in Oromia regional state of Ethiopia. *COGENT SOCIAL SCIENCES*, *8*(1). https://doi.org/10.1080/23311886.2022.2103284

Hussein, J., Bilotto, F., Mbui, D., Omondi, P., Harrison, M., Crane, T., & Sircely, J. (2024). Exploring smallholder farm resilience to climate change: Intended and actual adaptation. *PASTORALISM-RESEARCH POLICY AND PRACTICE*, *14*. https://doi.org/10.3389/past.2024.13424

Huyer, S. (2016). Closing the Gender Gap in Agriculture. *Gender, Technology and Development*, *20*(2), 105–116. https://doi.org/10.1177/0971852416643872

Jawo, T., Teutscherová, N., Negash, M., Sahle, K., & Lojka, B. (2023). Smallholder coffee-based farmers' perception and their adaptation strategies of climate change and variability in South-Eastern Ethiopia. *INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT AND WORLD ECOLOGY*, *30*(5), 533–547. https://doi.org/10.1080/13504509.2023.2167241

Jellason, N., Conway, J., & Baines, R. (2023). Exploring smallholders' cultural beliefs and their implication for adaptation to climate change in North-Western Nigeria. *SOCIAL SCIENCE JOURNAL*, *60*(3), 561–576. https://doi.org/10.1080/03623319.2020.1774720

Jennifer Twyman, Molly Green, Quinn Bernier, Patti Kristjanson, Sandra Russo, Arame Tall, Edidah Ampaire, Mary Nyasimi, Joash Mango, Sarah McKune, Caroline Mwongera, & Yacine Ndourba. (2014). *Adaptation Actions in Africa: Evidence that Gender Matters* (Working Paper No. 83; CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)). CGIAR. https://cgspace.cgiar.org/server/api/core/bitstreams/af94f721-442e-42c3-9378-da63e00f67fa/content

Jerneck, A. (2018a). Taking gender seriously in climate change adaptation and sustainability science research: Views from feminist debates and sub-Saharan small-scale agriculture. *Sustainability Science*, *13*(2), 403–416. https://doi.org/10.1007/s11625-017-0464-y

Jerneck, A. (2018b). What about Gender in Climate Change? Twelve Feminist Lessons from Development. *Sustainability*, *10*(3), Article 3. https://doi.org/10.3390/su10030627

Jha, C., & Gupta, V. (2021). Farmer's perception and factors determining the adaptation decisions to cope with climate change: An evidence from rural India. *ENVIRONMENTAL AND SUSTAINABILITY INDICATORS*, *10*. https://doi.org/10.1016/j.indic.2021.100112

Jørstad, H., & Webersik, C. (2016). Vulnerability to climate change and adaptation strategies of local communities in Malawi: Experiences of women fish-processing groups in the Lake Chilwa Basin. *Earth System Dynamics*, *7*(4), 977–989. https://doi.org/10.5194/esd-7-977-2016

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M., Tapio-Biström, M.-L., Nelson, S., & Kristjanson, P. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. *Climate and Development*, *8*(2 pp.133–144), 133–144. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2015.1050978

Jummai Othniel Yila, & Resurreccion, B. P. (2014). Gender perspectives on agricultural adaptation to climate change in drought-prone Nguru Local Government Area in the semiarid zone of northeastern Nigeria. *International Journal of Climate Change Strategies and Management*, *6*(3), 250–271. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-12-2012-0068

Kawarazuka, N., Locke, C., McDougall, C., Kantor, P., & Morgan, M. (2016). *Bringing gender analysis and resilience analysis together in small scale fisheries research: Challenges and opportunities*. https://hdl.handle.net/20.500.12348/247

Keleman, P., Sá, R., & Temudo, M. (2024). Drifting Away from the Roots: Genderfluidity as Diola's Mangrove Fishing Strategies in Three Island-Villages of Northern Guinea-Bissau. *HUMAN ECOLOGY*. https://doi.org/10.1007/s10745-024-00544-y

Kerr, R., Nyantakyi-Frimpong, H., Dakishoni, L., Lupafya, E., Shumba, L., Luginaah, I., & Snapp, S. (2018). Knowledge politics in participatory climate change adaptation research on agroecology in Malawi. *RENEWABLE AGRICULTURE AND FOOD SYSTEMS*, *33*(3), 238–251. https://doi.org/10.1017/S1742170518000017

Khalil, M. B., Jacobs, B. C., McKenna, K., & Kuruppu, N. (2020). Female contribution to grassroots innovation for climate change adaptation in Bangladesh. *Climate and Development*, *12*(7), 664–676. https://doi.org/10.1080/17565529.2019.1676188

Khan, F. N., Collins, A. M., Nayak, P. K., & Armitage, D. (2018). Women's perspectives of small-scale fisheries and environmental change in Chilika lagoon, India. *Maritime Studies*, *17*(2), 145–154. https://doi.org/10.1007/s40152-018-0100-1

Khoza, S., Dewald van Niekerk, & Nemakonde, L. D. (2022). Gendered vulnerability and inequality: Understanding drivers of climate-smart agriculture dis- and nonadoption among smallholder farmers in Malawi and Zambia. *Ecology and Society*, *27*(4). Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.5751/ES-13480-270419

Khoza, S., Niekerk, D. V., & Nemakonde, L. D. (2019). Understanding gender dimensions of climate-smart agriculture adoption in disaster-prone smallholder farming communities in Malawi and Zambia. *Disaster Prevention and Management: An International Journal*, *28*(5), 530–547. https://doi.org/10.1108/DPM-10-2018-0347

Kleiber, D., Frangoudes, K., Snyder, H. T., Choudhury, A., Cole, S. M., Soejima, K., Pita, C., Santos, A., McDougall, C., Petrics, H., & Porter, M. (2017). Promoting Gender Equity and Equality Through the Small-Scale Fisheries Guidelines: Experiences from Multiple Case Studies. In S. Jentoft, R. Chuenpagdee, M. J. Barragán-Paladines, & N. Franz (Eds.), *The Small-Scale Fisheries Guidelines: Global Implementation* (pp. 737–759). Springer International Publishing. https://doi.org/10.1007/978-3-319-55074-9_35

Kom, Z., Nethengwe, N. S., Mpandeli, N. S., & Chikoore, H. (2022). Determinants of small-scale farmers' choice and adaptive strategies in response to climatic shocks in Vhembe District, South Africa. *GeoJournal*, *87*(2 pp.677–700), 677–700. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10272-7

Koomson, D., Davies-Vollum, K. S., & Raha, D. (2020). Characterising the vulnerability of fishing households to climate and environmental change: Insights from Ghana. *Marine Policy*, *120*, 104142. https://doi.org/10.1016/j.marpol.2020.104142

Kumasi, T., Antwi-Agyei, P., & Obiri-Danso, K. (2019). Small-holder farmers' climate change adaptation practices in the Upper East Region of Ghana. *ENVIRONMENT*

DEVELOPMENT AND SUSTAINABILITY, *21*(2), 745–762. https://doi.org/10.1007/s10668-017-0062-2

Lauria, V., Das, I., Hazra, S., Cazcarro, I. https://orcid.org/0000-0001-7517-0053, Arto, I. https://orcid.org/0000-0001-6427-7437, Kay, S. https://orcid.org/0000-0003-1510-8578, Ofori-Danson, P., Ahmed, M., Hossain, M. A. R., Barange, M., & Fernandes, J. A. (2018). Importance of fisheries for food security across three climate change vulnerable deltas. *Science of the Total Environment*, *640–641 pp.1566–1577*, 1566–1577. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.scitotenv.2018.06.011

Lawson, E. T., Alare, R. S., Salifu, A. R. Z., & Thompson-Hall, M. (2020). Dealing with climate change in semi-arid Ghana: Understanding intersectional perceptions and adaptation strategies of women farmers. *GeoJournal*, *85*(2 pp.439–452), 439–452. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-019-09974-4

Lebel, L., Lebel, P., & Lebel, B. (2014). Gender and the management of climate-related risks in Northern Thailand. *International Social Science Journal*, *65*(217–218), 147–158. https://doi.org/10.1111/issj.12090

Limuwa, M. M., & Synnevåg, G. (2018). Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate change—Insights from Malawi's small-scale fisheries. *African Journal of Food, Agriculture, Nutrition and Development*, *18*(2), Article 2. https://doi.org/10.18697/ajfand.82.17580

Lottering, S., Mafongoya, P., & Lottering, R. (2021). Assessing the social vulnerability of small-scale farmer's to drought in uMsinga, KwaZulu-Natal. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *65*. https://doi.org/10.1016/j.ijdrr.2021.102568

Lwando, C. (2013). Climate Variability and Gender: Emerging Experiences From Western Zambia. *Environment and Natural Resources Research*, *3*(4), p133. https://doi.org/10.5539/enrr.v3n4p133

Maharjan, A., Kochhar, I., Chitale, V. S., ʻĀbid, Ḥusain, 1962-, & Gioli, G. (2020). Understanding rural outmigration and agricultural land use change in the Gandaki Basin, Nepal. *Applied Geography*, *124 pp.102278-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.apgeog.2020.102278

Maja, M. M., Idiris, A. A., Terefe, A. T., & Fashe, M. M. (2023). Gendered Vulnerability, Perception and Adaptation Options of Smallholder Farmers to Climate Change in Eastern Ethiopia. *Earth Systems and Environment*, *7*(1), 189–209. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s41748-022-00324-y

Mangheni, M., Tufan, H., Nkengla, L., Aman, B., & Boonabaana, B. (2019). Gender Norms, Technology Access, and Women Farmers' Vulnerability to Climate Change in Sub-Saharan Africa. In Y. Bamutaze, S. Kyamanywa, B. Singh, G. Nabanoga, & R. Lal (Eds.), *AGRICULTURE AND ECOSYSTEM RESILIENCE IN SUB SAHARAN AFRICA: LIVELIHOOD PATHWAYS UNDER CHANGING CLIMATE*

(WOS:000489289500034; pp. 715–728). https://doi.org/10.1007/978-3-030-12974-3_32

Mapfumo, P., Mtambanengwe, F., & Chikowo, R. (2016). Building on indigenous knowledge to strengthen the capacity of smallholder farming communities to adapt to climate change and variability in southern Africa. *Climate and Development*, *8*(1), 72–82. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2014.998604

Mariwah, S., Evans, R., & Kwabena Barima Antwi. (2019). Gendered and generational tensions in increased land commercialisation: Rural livelihood diversification, changing land use, and food security in Ghana's Brong‐Ahafo region. *Geo*, *6*(1). ProQuest Central; SciTech Premium Collection. https://doi.org/10.1002/geo2.73

McElwee, P., Tuyến, N. P., Lê Thị Vân Huệ, & Vũ Thị Diệu Hương. (2023). Climate precarity in rural livelihoods: Agrarian transformations and smallholder vulnerability in Vietnam. *Journal of Agrarian Change*, *23*(4), 661–686. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection; Sociological Abstracts. https://doi.org/10.1111/joac.12555

McKune, S. L., Borresen, E. C., Young, A. G., Auria Ryley, T. D., Russo, S. L., Diao Camara, A., Coleman, M., & Ryan, E. P. (2015). Climate change through a gendered lens: Examining livestock holder food security. *Global Food Security*, *6*, 1–8. https://doi.org/10.1016/j.gfs.2015.05.001

McKune, S., Poulsen, L., Russo, S., Devereux, T., Faas, S., McOmber, C., & Ryley, T. (2018). Reaching the end goal: Do interventions to improve climate information services lead to greater food security? *CLIMATE RISK MANAGEMENT*, *22*, 22–41. https://doi.org/10.1016/j.crm.2018.08.002

McOmber, C. (2020). *Women and climate change in the Sahel*. OECD. https://doi.org/10.1787/e31c77ad-en

Mekuyie, M. (2021). Vulnerability of rural households to climate-induced shocks in Lokka Abaya district, Sidama zone, southern Ethiopia. *Jàmbá*, *13*(1). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.4102/jamba.v13i1.1051

Melese Gezie. (2019). Farmer's response to climate change and variability in Ethiopia: A review. *Cogent Food & Agriculture*, *5*(1). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1080/23311932.2019.1613770

Mensah, M., Villamor, G., Fosu-Mensah, B., & Vlek, P. (2021). Exploring the Gender-Specific Adaptive Responses to Climate Variability: Application of Grazing Game in the Semi-Arid Region of Ghana. *AGRICULTURE-BASEL*, *11*(11). https://doi.org/10.3390/agriculture11111048

Mensah, M., Vlek, P. L. G., & Fosu-Mensah, B. Y. https://orcid.org/0000-0003-3569-472X. (2022). Gender and climate change linkages in the semi-arid region of Ghana. *GeoJournal*, *87*(1 pp.363–376), 363–376. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10261-w

Meyiwa, T., Maseti, T., Ngubane, S., Letsekha, T., & Rozani, C. (2014). Women in selected rural municipalities: Resilience and agency against vulnerabilities to climate change.

Agenda (Durban), *28*(3), 102–114. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/10130950.2014.955686

Michalscheck, M., Kizito, F., Kotu, B., Avornyo, F., Timler, C., & Groot, J. (2023). Preparing for, coping with and bouncing back after shocks. A nuanced resilience assessment for smallholder farms and farmers in Northern Ghana. *INTERNATIONAL JOURNAL OF AGRICULTURAL SUSTAINABILITY*, *21*(1). https://doi.org/10.1080/14735903.2023.2241283

Molla, E., Melka, Y., & Desta, G. (2023). Determinants of farmers' adaptation strategies to climate change impacts in northwestern Ethiopia. *HELIYON*, *9*(8). https://doi.org/10.1016/j.heliyon.2023.e18514

Molua, E. L., Sonwa, D., Bele, Y., Foahom, B., Jean Pierre Mate Mweru, Salomon Mampeta Wa Bassa, Gapia, M., Ngana, F., Assoua Eyong Joe, & Masumbuko, E. M. (2023). Climate-Smart Conservation Agriculture, Farm Values and Tenure Security: Implications for Climate Change Adaptation and Mitigation in the Congo Basin. *Tropical Conservation Science*, *16*. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1177/19400829231169980

Moore, M., & Niles, M. (2024). Gendered implications for climate change adaptation among farmers in Madagascar. *CLIMATE AND DEVELOPMENT*. https://doi.org/10.1080/17565529.2024.2363377

Mphande, E., Umar, B., & Kunda-Wamuwi, C. (2022). Gender and Legume Production in a Changing Climate Context: Experiences from Chipata, Eastern Zambia. *SUSTAINABILITY*, *14*(19). https://doi.org/10.3390/su141911901

Mugi-Ngenga, E., Mucheru-Muna, M., Mugwe, J., Ngetich, F., Mairura, F., & Mugendi, D. (2016). Household's socio-economic factors influencing the level of adaptation to climate variability in the dry zones of Eastern Kenya. *JOURNAL OF RURAL STUDIES*, *43*, 49–60. https://doi.org/10.1016/j.jrurstud.2015.11.004

Muñoz, C., & Sandoval-Díaz, J. (2023). Systematic review of risk perception of farmers in the face of drought: Influencing factors, perceived contents, adaptation strategies and related practices. *SCIENTIA AGROPECUARIA*, *14*(1), 139–152. https://doi.org/10.17268/sci.agropecu.2023.013

Murage, A. W., Pittchar, J. O., Midega, C. A. O., Onyango, C. O., & Khan, Z. R. (2015). Gender specific perceptions and adoption of the climate-smart push–pull technology in eastern Africa. *Crop Protection*, *76 pp.83–91*, 83–91. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.cropro.2015.06.014

Musinguzi, L., Natugonza, V., Efitre, J., & Ogutu-Ohwayo, R. (2018). The role of gender in improving adaptation to climate change among small-scale fishers. *Climate and Development*, *10*(6), 566–576. https://doi.org/10.1080/17565529.2017.1372262

Mutengwa, C., Mnkeni, P., & Kondwakwenda, A. (2023). Climate-Smart Agriculture and Food Security in Southern Africa: A Review of the Vulnerability of Smallholder

Agriculture and Food Security to Climate Change. *SUSTAINABILITY*, *15*(4). https://doi.org/10.3390/su15042882

Mwinkom, F., Damnyag, L., Abugre, S., & Alhassan, S. (2021). Factors influencing climate change adaptation strategies in North-Western Ghana: Evidence of farmers in the Black Volta Basin in Upper West region. *SN APPLIED SCIENCES*, *3*(5). https://doi.org/10.1007/s42452-021-04503-w

Nations, F. and A. O. of the U. (2019). *Impacts of climate change on fisheries and aquaculture: Synthesis of current knowledge, adaptation and mitigation options. FAO FISHERIES AND AQUACULTURE TECHNICAL PAPER 627*. Food & Agriculture Org. https://www.google.com/books/edition/Impacts_of_climate_change_on_fisheries_a/1jl8DwAAQBAJ?hl=en&gbpv=1&pg=PA305&printsec=frontcover

Naz, F., & Saqib, S. E. (2021). Gender-based differences in flood vulnerability among men and women in the char farming households of Bangladesh. *Natural Hazards*, *106*(1), 655–677. https://doi.org/10.1007/s11069-020-04482-y

Nchanji, E., Kabuli, H., Nyamolo, V., Cosmas, L., Chisale, V., & Matumba, A. (2022). Gender differences in climate-smart adaptation practices amongst bean-producing farmers in Malawi: The case of Linthipe Extension Planning Area. *FRONTIERS IN SUSTAINABLE FOOD SYSTEMS*, *6*. https://doi.org/10.3389/fsufs.2022.1001152

Nchanji, E., Nduwarugira, E., Ndabashinze, B., Bararyenya, A., Hakizimana, M., Nyamolo, V., & Lutomia, C. (2023). Gender norms and differences in access and use of climate-smart agricultural technology in Burundi. *FRONTIERS IN SUSTAINABLE FOOD SYSTEMS*, *7*. https://doi.org/10.3389/fsufs.2023.1040977

Nchu, I., Kimengsi, J., & Kapp, G. (2019). Diagnosing Climate Adaptation Constraints in Rural Subsistence Farming Systems in Cameroon: Gender and Institutional Perspectives. *SUSTAINABILITY*, *11*(14). https://doi.org/10.3390/su11143767

Nelson, V. (2010). *Climate Change and Gender What role for agricultural research among smallholder farmers in Africa?* (Working Document No. 222). CIAT. https://cgspace.cgiar.org/server/api/core/bitstreams/bc4297d9-03ae-4fa5-89ce-290c9cc94492/content

Ngajilo, D., Adams, S., Kincl, L., Guernsey, J., & Jeebhay, M. F. (2023). Occupational Health and Safety in Tanzanian Aquaculture – Emerging Issues. *Journal of Agromedicine*, *28*(2), 321–333. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1080/1059924X.2022.2058139

Nuhu, M., & Matsui, K. (2022). Gender Dimensions of Climate Change Adaptation Needs for Smallholder Farmers in the Upper East Region of Ghana. *SUSTAINABILITY*, *14*(16). https://doi.org/10.3390/su141610432

N-yanbini, N., Toku, A., Osumanu, I., & Sarfo, A. (2024). Exploring agro-ecological implications and gendered adaptation to climate change in Northern Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *26*(8), 20485–20505. https://doi.org/10.1007/s10668-023-03484-7

Nyantakyi-Frimpong, H. (2021). Climate change, women's workload in smallholder agriculture, and embodied political ecologies of undernutrition in northern Ghana. *HEALTH & PLACE*, *68*. https://doi.org/10.1016/j.healthplace.2021.102536

Nyantakyi-Frimpong, H., & Bezner-Kerr, R. (2015). The relative importance of climate change in the context of multiple stressors in semi-arid Ghana. *Global Environmental Change*, *32*, 40–56. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.gloenvcha.2015.03.003

Nyberg, Y., Jonsson, M., Ambjörnsson, E., Wetterlind, J., & Öborn, I. (2020). Smallholders' awareness of adaptation and coping measures to deal with rainfall variability in Western Kenya. *AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS*, *44*(10), 1280–1308. https://doi.org/10.1080/21683565.2020.1782305

Obert Jiri, Mafongoya, P. L., & Chivenge, P. (2017). Building climate change resilience through adaptation in smallholder farming systems in semi-arid Zimbabwe. *International Journal of Climate Change Strategies and Management*, *9*(2), 151–165. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-07-2016-0092

Ogra, M. V., & Badola, R. (2015). Gender and climate change in the Indian Himalayas: Global threats, local vulnerabilities, and livelihood diversification at the Nanda Devi Biosphere Reserve. *Earth System Dynamics*, *6*(2), 505–523. https://doi.org/10.5194/esd-6-505-2015

Ogundeji, A. (2022). Adaptation to Climate Change and Impact on Smallholder Farmers' Food Security in South Africa. *AGRICULTURE-BASEL*, *12*(5). https://doi.org/10.3390/agriculture12050589

Ojo, T. O., Ogundeji, A. A., & Emenike, C. U. (2022). Does Adoption of Climate Change Adaptation Strategy Improve Food Security? A Case of Rice Farmers in Ogun State, Nigeria. *Land*, *11*(11), 1875. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.3390/land11111875

Okeke-Ogbuafor, N., Atela, J., Nantongo, M., Aoko, L., Tonui, C., Rajah, E., Osamba, J., Odongo, J., Atchade, A., & Gray, T. (2024). Locally led adaptation metrics for Africa: A framework for building resilience in smallholder farming sectors. *FRONTIERS IN CLIMATE*, *6*. https://doi.org/10.3389/fclim.2024.1429462

Oluwatayo, I. B. (2019). Vulnerability and adaptive strategies of smallholder farmers to seasonal fluctuations in production and marketing in southwest Nigeria. *Climate and Development*, *11*(8 pp.659–666), 659–666. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2018.1521328

Onwutuebe, C. (2019). Patriarchy and Women Vulnerability to Adverse Climate Change in Nigeria. *SAGE OPEN*, *9*(1). https://doi.org/10.1177/2158244019825914

Onyimadu, C. (2023). Climate change adaptation and wellbeing among smallholder women farmers in Gwagwalada and Kokona, Nigeria. *FUTURES*, *153*. https://doi.org/10.1016/j.futures.2023.103238

Palosaari, M., Autio, A., Mbinga, E., Pellikka, P., & Johansson, T. (2024). The biased narrative of vulnerable women: Gender analysis of smallholder farmers' contextual vulnerability to climate change in the Taita Hills, Kenya. *Mitigation and Adaptation Strategies for Global Change*, *29*(6), 51. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s11027-024-10147-z

Partey, S. T., Dakorah, A. D., Zougmoré, R. B., Ouédraogo, M., Nyasimi, M., Nikoi, G. K., & Huyer, S. (2020). Gender and climate risk management: Evidence of climate information use in Ghana. *Climatic Change*, *158*(1), 61–75. https://doi.org/10.1007/s10584-018-2239-6

Pelage, L., Bertrand, A., Siqueira, S., Araújo, A., Avelino, K., da Silva, C., & Frédou, T. (2023). Fishers' perceptions of global change to inform coastal planning in a data-poor socio-ecological system. *MARINE POLICY*, *155*. https://doi.org/10.1016/j.marpol.2023.105784

Perez, C., Jones, E. M., Kristjanson, P., Cramer, L., Thornton, P. K., Förch, W., & Barahona, C. (2015). How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. *Global Environmental Change*, *34*, 95–107. https://doi.org/10.1016/j.gloenvcha.2015.06.003

Perez, L., Rios, D. A., Giraldo, D. C., Twyman, J., Blundo-Canto, G., Prager, S. D., & Ramirez-Villegas, J. (2020). Determinants of vulnerability of bean growing households to climate variability in Colombia. *Climate and Development*, *12*(8 pp.730–742), 730–742. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2019.1685931

Phiri, A. T., Toure, H. M. A. C., Kipkogei, O., Traore, R., Afokpe, P. M. K., & Lamore, A. A. (2022). A review of gender inclusivity in agriculture and natural resources management under the changing climate in sub-Saharan Africa. *Cogent Social Sciences*, *8*(1), 2024674. https://doi.org/10.1080/23311886.2021.2024674

Poudel, S., Funakawa, S., Shinjo, H., & Mishra, B. (2020). Understanding households' livelihood vulnerability to climate change in the Lamjung district of Nepal. *Environment, Development and Sustainability*, *22*(8 pp.8159–8182), 8159–8182. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10668-019-00566-3

Pouliot, M. (2012). Contribution of "Women's Gold" to West African Livelihoods: The Case of Shea (Vitellaria paradoxa) in Burkina Faso. *Economic Botany*, *66*(3), 237–248. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s12231-012-9203-6

Queiros, A., Talbot, E., Msuya, F., Kuguru, B., Jiddawi, N., Mahongo, S., Shaghude, Y., Muhando, C., Chundu, E., Jacobs, Z., Sailley, S., Virtanen, E., Viitasalo, M., Osuka, K., Aswani, S., Coupland, J., Wilson, R., Taylor, S., Fernandes-Salvador, J., … Popova, E. (2024). A sustainable blue economy may not be possible in Tanzania without cutting emissions. *SCIENCE OF THE TOTAL ENVIRONMENT*, *947*. https://doi.org/10.1016/j.scitotenv.2024.174623

Quiros, T. E. A. L., Beck, M. W., Araw, A., Croll, D. A., & Tershy, B. (2018). Small-scale seagrass fisheries can reduce social vulnerability: A comparative case study. *Ocean & Coastal Management*, *157*, 56–67. https://doi.org/10.1016/j.ocecoaman.2018.02.003

Ravera, F., Tarrasón, D., & Siciliano, G. (2014). Rural change and multidimensional analysis of farm's vulnerability: A case study in a protected area of semi-arid northern Nicaragua. *Environment, Development and Sustainability*, *16*(4), 873–901. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10668-014-9531-z

Ribeiro, N., & Chaúque, A. (2010). *Gender and Climate change:* Heinrich Böll Stiftung. https://www.boell.de/sites/default/files/assets/boell.de/images/download_de/ecology/Mozambique.pdf

Rosengren, L., Raymond, C., Sell, M., & Vihinen, H. (2020). Identifying leverage points for strengthening adaptive capacity to climate change. *ECOSYSTEMS AND PEOPLE*, *16*(1), 427–444. https://doi.org/10.1080/26395916.2020.1857439

Sadiq, M., Kuwornu, J., Al-Hassan, R., & Alhassan, S. (2019). Assessing Maize Farmers' Adaptation Strategies to Climate Change and Variability in Ghana. *AGRICULTURE-BASEL*, *9*(5). https://doi.org/10.3390/agriculture9050090

Samoura, D., Wahab, B., Taiwo, O., Diallo, A., & Bishoge, O. (2024). Small-scale Farmers' Adoptions of Climate-smart Agricultural Practices in the Guinean Savanna's Agroecological Zones. *JOURNAL OF AGRICULTURAL SCIENCES*, *19*(1), 89–106. https://doi.org/10.4038/jas.v19i1.9588

Sanogo, K., Binam, J., Bayala, J., Villamor, G. B., Kalinganire, A., & Dodiomon, S. (2017). Farmers' perceptions of climate change impacts on ecosystem services delivery of parklands in southern Mali. *Agroforestry Systems*, *91*(2), 345–361. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10457-016-9933-z

Sekabira, H., Tepa-Yotto, G. T., Kaweesa, Y., Simbeko, G., Tamò, M., Agboton, C., Osman Damba Tahidu, & Tahirou Abdoulaye. (2023). Impact of CS-IPM on Key Social Welfare Aspects of Smallholder Farmers' Livelihoods. *Climate*, *11*(5), 97. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.3390/cli11050097

Singh, P., Tabe, T., & Martin, T. (2022). The role of women in community resilience to climate change: A case study of an Indigenous Fijian community. *Women's Studies International Forum*, *90*, 102550. https://doi.org/10.1016/j.wsif.2021.102550

Singh, R. K., Zander, K. K. https://orcid.org/0000-0002-2237-1801, Kumar, S., Singh, A., Sheoran, P., Kumar, A., Hussain, S. M., Riba, T., Rallen, O., Lego, Y. J., Padung, E., & Garnett, S. T. (2017). Perceptions of climate variability and livelihood adaptations relating to gender and wealth among the Adi community of the Eastern Indian Himalayas. *Applied Geography*, *86 pp.41–52*, 41–52. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.apgeog.2017.06.018

Siulemba, G. K., & Moodley, V. (2014). A gendered analysis of sustainable agricultural practices with changing climate in the Chankumba agricultural community, Zambia.

Agenda (Durban), *28*(3), 135–146. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/10130950.2014.932126

Sonko, E., Florkowski, W., Agodzo, S., & Antwi-Agyei, P. (2020). Subsistence farmer knowledge of strategies alleviating food insecurity in the context of climate change in the lower river region of the Gambia. *FOOD SECURITY*, *12*(3), 607–624. https://doi.org/10.1007/s12571-020-01024-z

Sreya, P. S., Parayil, C., Aswathy, N., Bonny, B. P., Aiswarya, T. P., & Nameer, P. O. (2021). Economic vulnerability of small-scale coastal households to extreme weather events in Southern India. *Marine Policy*, *131*, 104608. https://doi.org/10.1016/j.marpol.2021.104608

Steinfield, L., & Holt, D. (2020). Structures, Systems and Differences that Matter: Casting an Ecological-Intersectionality Perspective on Female Subsistence Farmers' Experiences of the Climate Crisis. *Journal of Macromarketing*, *40*(4), 563–582. https://doi.org/10.1177/0276146720951238

Sujakhu, N. M., Ranjitkar, S., He, J., Schmidt-Vogt, D., Su, Y., & Xu, J. (2019). Assessing the Livelihood Vulnerability of Rural Indigenous Households to Climate Changes in Central Nepal, Himalaya. *Sustainability*, *11*(10), Article 10. https://doi.org/10.3390/su11102977

Swai, W, O., Mbwambo, S, J., Magayane, & T, F. (2012). Gender and perception on climate change in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Journal of African Studies and Development*, *4*(9), 218–231. https://doi.org/10.5897/JASD12.038

Tandon, N. (2012). *Food Security, Women Smallholders and Climate Change in Caribbean SIDS* (Research Brief No. 33). International Policy Centre for Inclusive Growth. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=97200cecf1ca34ececeb7c0fa0fc760296391c74

Thi Hoa Sen, L., & Bond, J. (2017). Agricultural adaptation to flood in lowland rice production areas of Central Vietnam: Understanding the "regenerated rice" ratoon system. *Climate and Development*, *9*(3), 274–285. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2016.1149440

Thoai, T., Rañola, R., Camacho, L., & Simelton, E. (2018). Determinants of farmers' adaptation to climate change in agricultural production in the central region of Vietnam. *LAND USE POLICY*, *70*, 224–231. https://doi.org/10.1016/j.landusepol.2017.10.023

Upadhyay, H., Vinke, K., & Weisz, H. (2024). "We are still here" climate change, gender and immobility in highly mobile Himalayan communities. *CLIMATE AND DEVELOPMENT*, *16*(5), 443–457. https://doi.org/10.1080/17565529.2023.2230176

Van Aelst, K., & Holvoet, N. (2018). Climate change adaptation in the Morogoro Region of Tanzania: Women's decision-making participation in small-scale farm households. *CLIMATE AND DEVELOPMENT*, *10*(6), 495–508. https://doi.org/10.1080/17565529.2017.1318745

Wagner, S., Rigal, C., Liebig, T., Mremi, R., Hemp, A., Jones, M., Price, E., & Preziosi, R. (2019). Ecosystem Services and Importance of Common Tree Species in Coffee-Agroforestry Systems: Local Knowledge of Small-Scale Farmers at Mt.

Kilimanjaro, Tanzania. *Forests*, *10*(11). Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.3390/f10110963

Wang, W., Zhao, X., Cao, J., Li, H., & Zhang, Q. (2020). Barriers and requirements to climate change adaptation of mountainous rural communities in developing countries: The case of the eastern Qinghai-Tibetan Plateau of China. *LAND USE POLICY*, *95*. https://doi.org/10.1016/j.landusepol.2019.104354

Weeratunge, N., Snyder, K. A., & Sze, C. P. (2010). Gleaner, fisher, trader, processor: Understanding gendered employment in fisheries and aquaculture. *Fish and Fisheries*, *11*(4), 405–420. https://doi.org/10.1111/j.1467-2979.2010.00368.x

Wood, A., Ansah, P., Rivers, L., & Ligmann-Zielinska, A. (2021). Examining climate change and food security in Ghana through an intersectional framework. *JOURNAL OF PEASANT STUDIES*, *48*(2), 329–348. https://doi.org/10.1080/03066150.2019.1655639

Wrigley-Asante, C., Owusu, K., Egyir, I. S., & Owiyo, T. M. (2019). Gender dimensions of climate change adaptation practices: The experiences of smallholder crop farmers in the transition zone of Ghana. *African Geographical Review*, *38*(2), 126–139. https://doi.org/10.1080/19376812.2017.1340168

Yessoufou, A., Kumar, S., Houessionon, P., Worou, O., Wane, A., & Whitbread, A. (2024). Vulnerability and resilience in the face of climate changes in Senegal's drylands: Measurement at the household level and determinant assessment. *FRONTIERS IN CLIMATE*, *6*. https://doi.org/10.3389/fclim.2024.1330025

Yimam, D. A., & Holvoet, N. (2024). Unpacking the invisible complex realities: Intersections of gender and marital status in determining the intrinsic vulnerability of smallholder farmers to climate change in Northwestern Ethiopia. *Climate and Development*, *16*(6), 502–513. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2023.2246038

Yiridomoh, G. Y., Appiah, D. O., Owusu, V., & Bonye, S. Z. (2021). Women smallholder farmers off-farm adaptation strategies to climate variability in rural Savannah, Ghana. *GeoJournal*, *86*(5 pp.2367–2385), 2367–2385. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10191-7

Zimmerer, K., Carrasco, M., de Haan, S., Meza, K., Jones, A., Tubbeh, R., Creed-Kanashiro, H., Nguyen, K., Tello, M., Hultquist, C., & Amaya, F. (2020). Indigenous Smallholder Struggles in Peru: Nutrition Security, Agrobiodiversity, and Food Sovereignty amid Transforming Global Systems and Climate Change. *JOURNAL OF LATIN AMERICAN GEOGRAPHY*, *19*(3), 74–111. https://doi.org/10.1353/lag.2020.0072

Ziro, J., Kichamu-Wachira, E., Ross, H., & Palaniappan, G. (2023). Adoption of climate resilient agricultural practices among the Giriama community in South East Kenya: Implications for conceptual frameworks. *FRONTIERS IN CLIMATE*, *5*. https://doi.org/10.3389/fclim.2023.1032780

Zorrilla-Miras, P., Lisboa, S., López-Gunn, E., & Giordano, R. (2024). Farmers' information sharing for climate change adaptation in Mozambique. *INFORMATION DEVELOPMENT*. https://doi.org/10.1177/02666669241227910

SURVEY METHODS AND DATA-COLLECTION METHODS RESULTS

Adzawla, W., Azumah, S. B., Anani, P. Y., & Donkoh, S. A. (2019). Gender perspectives of climate change adaptation in two selected districts of Ghana. *Heliyon*, *5*(11). https://doi.org/10.1016/j.heliyon.2019.e02854

Aiswarya, T., Parayil, C., Bonny, B., Nameer, P., Prema, A., & Sreya, P. (2023). Gendered vulnerabilities in small scale agricultural households of Southern India. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *84*. https://doi.org/10.1016/j.ijdrr.2022.103475

Alhassan, S. I., Kuwornu, J. K., & Osei-Asare, Y. B. (2019). Gender dimension of vulnerability to climate change and variability: Empirical evidence of smallholder farming households in Ghana. *International Journal of Climate Change Strategies and Management*, *11*(2), 195–214. Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-10-2016-0156

Ali, E. (2021). Farm Households' Adoption of Climate-smart Practices in Subsistence Agriculture: Evidence from Northern Togo. *Environmental Management*, *67*(5 pp.949–962), 949–962. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s00267-021-01436-3

Alpízar, F., Saborío-Rodríguez, M., Martínez-Rodríguez, M., Viguera, B., Vignola, R., Capitan, T., & Harvey, C. (2020). Determinants of food insecurity among smallholder farmer households in Central America: Recurrent versus extreme weather-driven events. *REGIONAL ENVIRONMENTAL CHANGE*, *20*(1). https://doi.org/10.1007/s10113-020-01592-y

Amadu, I., Armah, F. A., Aheto, D. W., & Adongo, C. A. (2021). A study on livelihood resilience in the small-scale fisheries of Ghana using a structural equation modelling approach. *Ocean & Coastal Management*, *215*, 105952. https://doi.org/10.1016/j.ocecoaman.2021.105952

Antwi, K. (2024). Merging adoption of natural climate solutions in agriculture with climatic and non-climatic risks within an (intra)gendered framework. *SCIENTIFIC REPORTS*, *14*(1). https://doi.org/10.1038/s41598-024-60469-w

Antwi-Agyei, P., Dougill, A. J., & Stringer, L. C. (2015). Impacts of land tenure arrangements on the adaptive capacity of marginalized groups: The case of Ghana's Ejura Sekyedumase and Bongo districts. *Land Use Policy*, *49 pp.203–212*, 203–212. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.landusepol.2015.08.007

Antwi-Agyei, P., & Nyantakyi-Frimpong, H. (2021). Evidence of Climate Change Coping and Adaptation Practices by Smallholder Farmers in Northern Ghana. *SUSTAINABILITY*, *13*(3). https://doi.org/10.3390/su13031308

Asante, F., Guodaar, L., & Arimiyaw, S. (2021). Climate change and variability awareness and livelihood adaptive strategies among smallholder farmers in semi-arid northern Ghana. *ENVIRONMENTAL DEVELOPMENT*, *39*. https://doi.org/10.1016/j.envdev.2021.100629

Asravor, R. (2018). Livelihood Diversification Strategies to Climate Change among Smallholder Farmers in Northern Ghana. *JOURNAL OF INTERNATIONAL DEVELOPMENT*, *30*(8), 1318–1338. https://doi.org/10.1002/jid.3330

Assan, E., Suvedi, M., Schmitt Olabisi, L., & Bansah, K. J. (2020). Climate change perceptions and challenges to adaptation among smallholder farmers in semi-arid Ghana: A gender analysis. *Journal of Arid Environments*, *182*, 104247. https://doi.org/10.1016/j.jaridenv.2020.104247

Awazi, N. P., Tchamba, M. N., & Avana, T. M.-L. (2019). Climate change resiliency choices of small-scale farmers in Cameroon: Determinants and policy implications. *Journal of Environmental Management*, *250 pp.109560-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.jenvman.2019.109560

Axelrod, M., Vona, M., Novak Colwell, J., Fakoya, K., Salim, S. S., Webster, D. G., & Torre-Castro, M. de la. (2022). Understanding gender intersectionality for more robust ocean science. *Earth System Governance*, *13*, 100148. https://doi.org/10.1016/j.esg.2022.100148

Ayele, E., Temesgen, D., Lemma, T., & Wordofa, M. (2024). Gender Dimensions of Determinants of Adaptation Strategies to Climate Change among Smallholder Farmers in Northeast Ethiopia. *GLOBAL SOCIAL WELFARE*. https://doi.org/10.1007/s40609-024-00364-4

Bennett, N. J., Dearden, P., & Peredo, A. M. (2015). Vulnerability to multiple stressors in coastal communities: A study of the Andaman coast of Thailand. *Climate and Development*, *7*(2), 124–141. https://doi.org/10.1080/17565529.2014.886993

Bessah, E., Raji, A. O., Taiwo, O. J., Agodzo, S. K., Ololade, O. O., Strapasson, A., & Donkor, E. (2021). Gender-based variations in the perception of climate change impact, vulnerability and adaptation strategies in the Pra River Basin of Ghana. *International Journal of Climate Change Strategies and Management*, *13*(4/5), 435–462. https://doi.org/10.1108/IJCCSM-02-2020-0018

Bhatta, G. D., Aggarwal, P. K., Poudel, S., & Belgrave, D. A. (2015). Climate-induced Migration in South Asia: Migration Decisions and the Gender Dimensions of Adverse Climatic Events. *Journal of Rural and Community Development*, *10*(4), Article 4. https://journals.brandonu.ca/jrcd/article/view/1177

Carranza, M., & Niles, M. T. (2019). Smallholder Farmers Spend Credit Primarily on Food: Gender Differences and Food Security Implications in a Changing Climate. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00056

Castro, B. (2019). Challenges, Futures and Possibilities of Land Use in Rural Areas of Cela Municipality: Risks, Climate Change Impacts, Adaptation and Links to Sustainability. In P. Castro, A. Azul, W. Filho, & U. Azeiteiro (Eds.), *CLIMATE CHANGE-RESILIENT AGRICULTURE AND AGROFORESTRY: ECOSYSTEM SERVICES AND SUSTAINABILITY* (WOS:000620171600008; pp. 115–136). https://doi.org/10.1007/978-3-319-75004-0_7

Chambon, M., Wambiji, N., Alvarez Fernandez, S., Azarian, C., Ngunu Wandiga, J., Vialard, J., Ziveri, P., & Reyes-Garcia, V. (2024). Weaving scientific and local knowledge on climate change impacts in coastal Kenya, Western Indian Ocean. *Environmental Science & Policy*, *160*, 103846. https://doi.org/10.1016/j.envsci.2024.103846

Chidakwa, P., Mabhena, C., Mucherera, B., Chikuni, J., & Mudavanhu, C. (2020). Women's Vulnerability to Climate Change: Gender-skewed Implications on Agro-based Livelihoods in Rural Zvishavane, Zimbabwe. *INDIAN JOURNAL OF GENDER STUDIES*, *27*(2), 259–281. https://doi.org/10.1177/0971521520910969

Chingala, G., Mapiye, C., Raffrenato, E., Hoffman, L., & Dzama, K. (2017). Determinants of smallholder farmers' perceptions of impact of climate change on beef production in Malawi. *Climatic Change*, *142*(1–2), 129–141. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s10584-017-1924-1

Chisale, H., Chirwa, P., & Babalola, F. (2023). Awareness, Knowledge and Perception of Forest Dependent Communities on Climate Change in Malawi: A Case of Mchinji and Phirilongwe Forest Reserves in Malawi. *JOURNAL OF SUSTAINABLE FORESTRY*, *42*(7), 728–745. https://doi.org/10.1080/10549811.2022.2123353

Ford, J. D., & Goldhar, C. (2013). Climate change vulnerability and adaptation in resource dependent communities: A case study from West Greenland. *Climate Research*, *54*(2), 181–196. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.3354/cr01118

Funk, C., Raghavan Sathyan, A., Winker, P., & Breuer, L. (2020). Changing climate—Changing livelihood: Smallholder's perceptions and adaption strategies. *Journal of Environmental Management*, *259 pp.109702-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.jenvman.2019.109702

Ge, Y., Fan, L., Li, Y., Guo, J., & Niu, H. (2023). Gender differences in smallholder farmers? Adoption of crop diversification: Evidence from Shaanxi Plain, China. *CLIMATE RISK MANAGEMENT*, *39*. https://doi.org/10.1016/j.crm.2023.100482

Goli, I., Abadi, M., Lashgarara, F., Tanaskovik, V., Chukaliev, O., Viira, A., Pour, M., Sklenicka, P., Janeckova, K., & Azadi, H. (2023). Women and climate change adaptation behaviour: What's the problem and solution? *CLIMATE AND DEVELOPMENT*, *15*(6), 535–552. https://doi.org/10.1080/17565529.2022.2121597

Henriksson, R., Vincent, K., Archer, E., & Jewitt, G. (2021). Understanding gender differences in availability, accessibility and use of climate information among smallholder farmers in Malawi. *CLIMATE AND DEVELOPMENT*, *13*(6), 503–514. https://doi.org/10.1080/17565529.2020.1806777

Huluka, A. (2022). Is there any gender difference in environmental concern? Evidence from the smallholder farmers in Oromia regional state of Ethiopia. *COGENT SOCIAL SCIENCES*, *8*(1). https://doi.org/10.1080/23311886.2022.2103284

Hussein, J., Bilotto, F., Mbui, D., Omondi, P., Harrison, M., Crane, T., & Sircely, J. (2024). Exploring smallholder farm resilience to climate change: Intended and actual adaptation. *PASTORALISM-RESEARCH POLICY AND PRACTICE*, *14*. https://doi.org/10.3389/past.2024.13424

Jennifer Twyman, Molly Green, Quinn Bernier, Patti Kristjanson, Sandra Russo, Arame Tall, Edidah Ampaire, Mary Nyasimi, Joash Mango, Sarah McKune, Caroline Mwongera, & Yacine Ndourba. (2014). *Adaptation Actions in Africa: Evidence that Gender Matters* (Working Paper No. 83; CGIAR Research Program on Climate

Change, Agriculture and Food Security (CCAFS)). CGIAR. https://cgspace.cgiar.org/server/api/core/bitstreams/af94f721-442e-42c3-9378-da63e00f67fa/content

Jha, C., & Gupta, V. (2021). Farmer's perception and factors determining the adaptation decisions to cope with climate change: An evidence from rural India. *ENVIRONMENTAL AND SUSTAINABILITY INDICATORS*, *10*. https://doi.org/10.1016/j.indic.2021.100112

Jummai Othniel Yila, & Resurreccion, B. P. (2014). Gender perspectives on agricultural adaptation to climate change in drought-prone Nguru Local Government Area in the semiarid zone of northeastern Nigeria. *International Journal of Climate Change Strategies and Management*, *6*(3), 250–271. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-12-2012-0068

Keleman, P., Sá, R., & Temudo, M. (2024). Drifting Away from the Roots: Genderfluidity as Diola's Mangrove Fishing Strategies in Three Island-Villages of Northern Guinea-Bissau. *HUMAN ECOLOGY*. https://doi.org/10.1007/s10745-024-00544-y

Khoza, S., Dewald van Niekerk, & Nemakonde, L. D. (2022). Gendered vulnerability and inequality: Understanding drivers of climate-smart agriculture dis- and nonadoption among smallholder farmers in Malawi and Zambia. *Ecology and Society*, *27*(4). Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.5751/ES-13480-270419

Khoza, S., Niekerk, D. V., & Nemakonde, L. D. (2019). Understanding gender dimensions of climate-smart agriculture adoption in disaster-prone smallholder farming communities in Malawi and Zambia. *Disaster Prevention and Management: An International Journal*, *28*(5), 530–547. https://doi.org/10.1108/DPM-10-2018-0347

Kom, Z., Nethengwe, N. S., Mpandeli, N. S., & Chikoore, H. (2022). Determinants of small-scale farmers' choice and adaptive strategies in response to climatic shocks in Vhembe District, South Africa. *GeoJournal*, *87*(2 pp.677–700), 677–700. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10272-7

Koomson, D., Davies-Vollum, K. S., & Raha, D. (2020). Characterising the vulnerability of fishing households to climate and environmental change: Insights from Ghana. *Marine Policy*, *120*, 104142. https://doi.org/10.1016/j.marpol.2020.104142

Kumasi, T., Antwi-Agyei, P., & Obiri-Danso, K. (2019). Small-holder farmers' climate change adaptation practices in the Upper East Region of Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *21*(2), 745–762. https://doi.org/10.1007/s10668-017-0062-2

Lawless, S., Cohen, P. J., Mangubhai, S., Kleiber, D., & Morrison, T. H. (2021). Gender equality is diluted in commitments made to small-scale fisheries. *World Development*, *140*, 105348. https://doi.org/10.1016/j.worlddev.2020.105348

Lawson, E. T., Alare, R. S., Salifu, A. R. Z., & Thompson-Hall, M. (2020). Dealing with climate change in semi-arid Ghana: Understanding intersectional perceptions and adaptation strategies of women farmers. *GeoJournal*, *85*(2 pp.439–452), 439–452.

Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-019-09974-4

Limuwa, M. M., & Synnevåg, G. (2018). Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate change—Insights from Malawi's small-scale fisheries. *African Journal of Food, Agriculture, Nutrition and Development*, *18*(2), Article 2. https://doi.org/10.18697/ajfand.82.17580

Lottering, S., Mafongoya, P., & Lottering, R. (2021). Assessing the social vulnerability of small-scale farmer's to drought in uMsinga, KwaZulu-Natal. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *65*. https://doi.org/10.1016/j.ijdrr.2021.102568

Maharjan, A., Kochhar, I., Chitale, V. S., ʻĀbid, Ḥusain, 1962-, & Gioli, G. (2020). Understanding rural outmigration and agricultural land use change in the Gandaki Basin, Nepal. *Applied Geography*, *124 pp.102278-*. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.apgeog.2020.102278

Maja, M. M., Idiris, A. A., Terefe, A. T., & Fashe, M. M. (2023). Gendered Vulnerability, Perception and Adaptation Options of Smallholder Farmers to Climate Change in Eastern Ethiopia. *Earth Systems and Environment*, *7*(1), 189–209. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s41748-022-00324-y

Makate, C., Mango, N., & Makate, M. (2019). Socioeconomic status connected imbalances in arable land size holding and utilization in smallholder farming in Zimbabwe:

Implications for a sustainable rural development. *Land Use Policy*, *87*, 1. Agricultural & Environmental Science Collection; PAIS Index; SciTech Premium Collection. https://doi.org/10.1016/j.landusepol.2019.104027

Maltitz, L., & Bahsta, Y. (2021). Empowerment of smallholder female livestock farmers and its potential impacts to their resilience to agricultural drought. *AIMS AGRICULTURE AND FOOD*, *6*(2), 603–630. https://doi.org/10.3934/agrfood.2021036

McKune, S., Poulsen, L., Russo, S., Devereux, T., Faas, S., McOmber, C., & Ryley, T. (2018). Reaching the end goal: Do interventions to improve climate information services lead to greater food security? *CLIMATE RISK MANAGEMENT*, *22*, 22–41. https://doi.org/10.1016/j.crm.2018.08.002

Mekuyie, M. (2021). Vulnerability of rural households to climate-induced shocks in Lokka Abaya district, Sidama zone, southern Ethiopia. *Jàmbá*, *13*(1). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.4102/jamba.v13i1.1051

Michalscheck, M., Kizito, F., Kotu, B., Avornyo, F., Timler, C., & Groot, J. (2023). Preparing for, coping with and bouncing back after shocks. A nuanced resilience assessment for smallholder farms and farmers in Northern Ghana. *INTERNATIONAL JOURNAL OF AGRICULTURAL SUSTAINABILITY*, *21*(1). https://doi.org/10.1080/14735903.2023.2241283

Molla, E., Melka, Y., & Desta, G. (2023). Determinants of farmers' adaptation strategies to climate change impacts in northwestern Ethiopia. *HELIYON*, *9*(8). https://doi.org/10.1016/j.heliyon.2023.e18514

Moore, M., & Niles, M. (2024). Gendered implications for climate change adaptation among farmers in Madagascar. *CLIMATE AND DEVELOPMENT*. https://doi.org/10.1080/17565529.2024.2363377

Mphande, E., Umar, B., & Kunda-Wamuwi, C. (2022). Gender and Legume Production in a Changing Climate Context: Experiences from Chipata, Eastern Zambia. *SUSTAINABILITY*, *14*(19). https://doi.org/10.3390/su141911901

Mugi-Ngenga, E., Mucheru-Muna, M., Mugwe, J., Ngetich, F., Mairura, F., & Mugendi, D. (2016). Household's socio-economic factors influencing the level of adaptation to climate variability in the dry zones of Eastern Kenya. *JOURNAL OF RURAL STUDIES*, *43*, 49–60. https://doi.org/10.1016/j.jrurstud.2015.11.004

Mwadzingeni, L., Mugandani, R., & Mafongoya, P. L. (2022). Socio-demographic, institutional and governance factors influencing adaptive capacity of smallholder irrigators in Zimbabwe. *PLoS One*, *17*(8). Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1371/journal.pone.0273648

Mwinkom, F., Damnyag, L., Abugre, S., & Alhassan, S. (2021). Factors influencing climate change adaptation strategies in North-Western Ghana: Evidence of farmers in the Black Volta Basin in Upper West region. *SN APPLIED SCIENCES*, *3*(5). https://doi.org/10.1007/s42452-021-04503-w

Naz, F., & Saqib, S. E. (2021). Gender-based differences in flood vulnerability among men and women in the char farming households of Bangladesh. *Natural Hazards*, *106*(1), 655–677. https://doi.org/10.1007/s11069-020-04482-y

Nchanji, E., Kabuli, H., Nyamolo, V., Cosmas, L., Chisale, V., & Matumba, A. (2022). Gender differences in climate-smart adaptation practices amongst bean-producing farmers in Malawi: The case of Linthipe Extension Planning Area. *FRONTIERS IN SUSTAINABLE FOOD SYSTEMS*, *6*. https://doi.org/10.3389/fsufs.2022.1001152

Nchanji, E., Nduwarugira, E., Ndabashinze, B., Bararyenya, A., Hakizimana, M., Nyamolo, V., & Lutomia, C. (2023). Gender norms and differences in access and use of climate-smart agricultural technology in Burundi. *FRONTIERS IN SUSTAINABLE FOOD SYSTEMS*, *7*. https://doi.org/10.3389/fsufs.2023.1040977

Nchu, I., Kimengsi, J., & Kapp, G. (2019). Diagnosing Climate Adaptation Constraints in Rural Subsistence Farming Systems in Cameroon: Gender and Institutional Perspectives. *SUSTAINABILITY*, *11*(14). https://doi.org/10.3390/su11143767

N-yanbini, N., Toku, A., Osumanu, I., & Sarfo, A. (2024). Exploring agro-ecological implications and gendered adaptation to climate change in Northern Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *26*(8), 20485–20505. https://doi.org/10.1007/s10668-023-03484-7

Nyberg, Y., Jonsson, M., Ambjörnsson, E., Wetterlind, J., & Öborn, I. (2020). Smallholders' awareness of adaptation and coping measures to deal with rainfall variability in Western Kenya. *AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS*, *44*(10), 1280–1308. https://doi.org/10.1080/21683565.2020.1782305

Oluwatayo, I. B. (2019). Vulnerability and adaptive strategies of smallholder farmers to seasonal fluctuations in production and marketing in southwest Nigeria. *Climate and Development*, *11*(8 pp.659–666), 659–666. Agricultural & Environmental Science

Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2018.1521328

Palosaari, M., Autio, A., Mbinga, E., Pellikka, P., & Johansson, T. (2024). The biased narrative of vulnerable women: Gender analysis of smallholder farmers' contextual vulnerability to climate change in the Taita Hills, Kenya. *Mitigation and Adaptation Strategies for Global Change*, *29*(6), 51. ABI/INFORM Collection; Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s11027-024-10147-z

Pelage, L., Bertrand, A., Siqueira, S., Araújo, A., Avelino, K., da Silva, C., & Frédou, T. (2023). Fishers' perceptions of global change to inform coastal planning in a data-poor socio-ecological system. *MARINE POLICY*, *155*. https://doi.org/10.1016/j.marpol.2023.105784

Poudel, S., Funakawa, S., Shinjo, H., & Mishra, B. (2020). Understanding households' livelihood vulnerability to climate change in the Lamjung district of Nepal. *Environment, Development and Sustainability*, *22*(8 pp.8159–8182), 8159–8182. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10668-019-00566-3

Pouliot, M. (2012). Contribution of "Women's Gold" to West African Livelihoods: The Case of Shea (Vitellaria paradoxa) in Burkina Faso. *Economic Botany*, *66*(3), 237–248. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s12231-012-9203-6

Ribeiro, N., & Chaúque, A. (2010). *Gender and Climate change:* Heinrich Böll Stiftung. https://www.boell.de/sites/default/files/assets/boell.de/images/download_de/ecology/Mozambique.pdf

Rosengren, L., Raymond, C., Sell, M., & Vihinen, H. (2020). Identifying leverage points for strengthening adaptive capacity to climate change. *ECOSYSTEMS AND PEOPLE*, *16*(1), 427–444. https://doi.org/10.1080/26395916.2020.1857439

Sadiq, M., Kuwornu, J., Al-Hassan, R., & Alhassan, S. (2019). Assessing Maize Farmers' Adaptation Strategies to Climate Change and Variability in Ghana. *AGRICULTURE-BASEL*, *9*(5). https://doi.org/10.3390/agriculture9050090

Samoura, D., Wahab, B., Taiwo, O., Diallo, A., & Bishoge, O. (2024). Small-scale Farmers' Adoptions of Climate-smart Agricultural Practices in the Guinean Savanna's Agroecological Zones. *JOURNAL OF AGRICULTURAL SCIENCES*, *19*(1), 89–106. https://doi.org/10.4038/jas.v19i1.9588

Sanogo, K., Binam, J., Bayala, J., Villamor, G. B., Kalinganire, A., & Dodiomon, S. (2017). Farmers' perceptions of climate change impacts on ecosystem services delivery of parklands in southern Mali. *Agroforestry Systems*, *91*(2), 345–361. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10457-016-9933-z

Singh, P., Tabe, T., & Martin, T. (2022). The role of women in community resilience to climate change: A case study of an Indigenous Fijian community. *Women's Studies International Forum*, *90*, 102550. https://doi.org/10.1016/j.wsif.2021.102550

Sonko, E., Florkowski, W., Agodzo, S., & Antwi-Agyei, P. (2020). Subsistence farmer knowledge of strategies alleviating food insecurity in the context of climate change in the lower river region of the Gambia. *FOOD SECURITY*, *12*(3), 607–624. https://doi.org/10.1007/s12571-020-01024-z

Swai, W, O., Mbwambo, S, J., Magayane, & T, F. (2012). Gender and perception on climate change in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Journal of African Studies and Development*, *4*(9), 218–231. https://doi.org/10.5897/JASD12.038

Thi Hoa Sen, L., & Bond, J. (2017). Agricultural adaptation to flood in lowland rice production areas of Central Vietnam: Understanding the "regenerated rice" ratoon system. *Climate and Development*, *9*(3), 274–285. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2016.1149440

Thorpe, A., Pouw, N., Baio, A., Sandi, R., Ndomahina, E. T., & Lebbie, T. (2014). "Fishing Na Everybody Business": Women's Work and Gender Relations in Sierra Leone's Fisheries. *Feminist Economics*, *20*(3), 53–77. https://doi.org/10.1080/13545701.2014.895403

Upadhyay, H., Vinke, K., & Weisz, H. (2024). "We are still here" climate change, gender and immobility in highly mobile Himalayan communities. *CLIMATE AND DEVELOPMENT*, *16*(5), 443–457. https://doi.org/10.1080/17565529.2023.2230176

Van Aelst, K., & Holvoet, N. (2018). Climate change adaptation in the Morogoro Region of Tanzania: Women's decision-making participation in small-scale farm households.

CLIMATE AND DEVELOPMENT, *10*(6), 495–508. https://doi.org/10.1080/17565529.2017.1318745

Wrigley-Asante, C., Owusu, K., Egyir, I. S., & Owiyo, T. M. (2019). Gender dimensions of climate change adaptation practices: The experiences of smallholder crop farmers in the transition zone of Ghana. *African Geographical Review*, *38*(2), 126–139. https://doi.org/10.1080/19376812.2017.1340168

Yessoufou, A., Kumar, S., Houessionon, P., Worou, O., Wane, A., & Whitbread, A. (2024). Vulnerability and resilience in the face of climate changes in Senegal's drylands: Measurement at the household level and determinant assessment. *FRONTIERS IN CLIMATE*, *6*. https://doi.org/10.3389/fclim.2024.1330025

Yimam, D. A., & Holvoet, N. (2024). Unpacking the invisible complex realities: Intersections of gender and marital status in determining the intrinsic vulnerability of smallholder farmers to climate change in Northwestern Ethiopia. *Climate and Development*, *16*(6), 502–513. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1080/17565529.2023.2246038

Yiridomoh, G. Y., Appiah, D. O., Owusu, V., & Bonye, S. Z. (2021). Women smallholder farmers off-farm adaptation strategies to climate variability in rural Savannah, Ghana. *GeoJournal*, *86*(5 pp.2367–2385), 2367–2385. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10191-7

Zorrilla-Miras, P., Lisboa, S., López-Gunn, E., & Giordano, R. (2024). Farmers' information sharing for climate change adaptation in Mozambique. *INFORMATION DEVELOPMENT*. https://doi.org/10.1177/02666669241227910

WOMEN'S LEADERSHIP AND PARTICIPATION IN MANAGEMENT RESULTS

Adzawla, W., Azumah, S. B., Anani, P. Y., & Donkoh, S. A. (2019). Gender perspectives of climate change adaptation in two selected districts of Ghana. *Heliyon*, *5*(11). https://doi.org/10.1016/j.heliyon.2019.e02854

Aiswarya, T., Parayil, C., Bonny, B., Nameer, P., Prema, A., & Sreya, P. (2023). Gendered vulnerabilities in small scale agricultural households of Southern India. *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, *84*. https://doi.org/10.1016/j.ijdrr.2022.103475

Alhassan, S. I., Kuwornu, J. K., & Osei-Asare, Y. B. (2019). Gender dimension of vulnerability to climate change and variability: Empirical evidence of smallholder farming households in Ghana. *International Journal of Climate Change Strategies and Management*, *11*(2), 195–214. Agricultural & Environmental Science Collection; PAIS Index; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-10-2016-0156

Antwi, K. (2024). Merging adoption of natural climate solutions in agriculture with climatic and non-climatic risks within an (intra)gendered framework. *SCIENTIFIC REPORTS*, *14*(1). https://doi.org/10.1038/s41598-024-60469-w

Antwi-Agyei, P., Dougill, A. J., & Stringer, L. C. (2015). Impacts of land tenure arrangements on the adaptive capacity of marginalized groups: The case of Ghana's Ejura Sekyedumase and Bongo districts. *Land Use Policy*, *49 pp.203–212*, 203–212.

Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1016/j.landusepol.2015.08.007

Ayele, E., Temesgen, D., Lemma, T., & Wordofa, M. (2024). Gender Dimensions of Determinants of Adaptation Strategies to Climate Change among Smallholder Farmers in Northeast Ethiopia. *GLOBAL SOCIAL WELFARE*. https://doi.org/10.1007/s40609-024-00364-4

Carranza, M., & Niles, M. T. (2019). Smallholder Farmers Spend Credit Primarily on Food: Gender Differences and Food Security Implications in a Changing Climate. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00056

Deb, A. K., Haque, C. E., & Thompson, S. (2015). 'Man can't give birth, woman can't fish': Gender dynamics in the small-scale fisheries of Bangladesh. *Gender, Place & Culture*, *22*(3), 305–324. https://doi.org/10.1080/0966369X.2013.855626

Deshar, R., & Koirala, M. (2020). *Climate Change and Gender Policy* (V. Venkatramanan, S. Shah, & R. Prasad, Eds.; WOS:000560077000015; p. 422). https://doi.org/10.1007/978-981-13-9570-3_14

Ge, Y., Fan, L., Li, Y., Guo, J., & Niu, H. (2023). Gender differences in smallholder farmers? Adoption of crop diversification: Evidence from Shaanxi Plain, China. *CLIMATE RISK MANAGEMENT*, *39*. https://doi.org/10.1016/j.crm.2023.100482

Jummai Othniel Yila, & Resurreccion, B. P. (2014). Gender perspectives on agricultural adaptation to climate change in drought-prone Nguru Local Government Area in the semiarid zone of northeastern Nigeria. *International Journal of Climate Change Strategies and Management*, *6*(3), 250–271. Agricultural & Environmental Science

Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1108/IJCCSM-12-2012-0068

Khalil, M. B., Jacobs, B. C., McKenna, K., & Kuruppu, N. (2020). Female contribution to grassroots innovation for climate change adaptation in Bangladesh. *Climate and Development*, *12*(7), 664–676. https://doi.org/10.1080/17565529.2019.1676188

Kleiber, D., Frangoudes, K., Snyder, H. T., Choudhury, A., Cole, S. M., Soejima, K., Pita, C., Santos, A., McDougall, C., Petrics, H., & Porter, M. (2017). Promoting Gender Equity and Equality Through the Small-Scale Fisheries Guidelines: Experiences from Multiple Case Studies. In S. Jentoft, R. Chuenpagdee, M. J. Barragán-Paladines, & N. Franz (Eds.), *The Small-Scale Fisheries Guidelines: Global Implementation* (pp. 737–759). Springer International Publishing. https://doi.org/10.1007/978-3-319-55074-9_35

Kumasi, T., Antwi-Agyei, P., & Obiri-Danso, K. (2019). Small-holder farmers' climate change adaptation practices in the Upper East Region of Ghana. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, *21*(2), 745–762. https://doi.org/10.1007/s10668-017-0062-2

Limuwa, M. M., & Synnevåg, G. (2018). Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate change—Insights from Malawi's small-scale fisheries. *African Journal of Food, Agriculture, Nutrition and Development*, *18*(2), Article 2. https://doi.org/10.18697/ajfand.82.17580

Maja, M. M., Idiris, A. A., Terefe, A. T., & Fashe, M. M. (2023). Gendered Vulnerability, Perception and Adaptation Options of Smallholder Farmers to Climate Change in

Eastern Ethiopia. *Earth Systems and Environment*, *7*(1), 189–209. Agricultural & Environmental Science Collection; ProQuest Central; SciTech Premium Collection. https://doi.org/10.1007/s41748-022-00324-y

Mensah, M., Vlek, P. L. G., & Fosu-Mensah, B. Y. https://orcid.org/0000-0003-3569-472X. (2022). Gender and climate change linkages in the semi-arid region of Ghana. *GeoJournal*, *87*(1 pp.363–376), 363–376. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10261-w

Mugi-Ngenga, E., Mucheru-Muna, M., Mugwe, J., Ngetich, F., Mairura, F., & Mugendi, D. (2016). Household's socio-economic factors influencing the level of adaptation to climate variability in the dry zones of Eastern Kenya. *JOURNAL OF RURAL STUDIES*, *43*, 49–60. https://doi.org/10.1016/j.jrurstud.2015.11.004

Pelage, L., Bertrand, A., Siqueira, S., Araújo, A., Avelino, K., da Silva, C., & Frédou, T. (2023). Fishers' perceptions of global change to inform coastal planning in a data-poor socio-ecological system. *MARINE POLICY*, *155*. https://doi.org/10.1016/j.marpol.2023.105784

Phiri, A. T., Toure, H. M. A. C., Kipkogei, O., Traore, R., Afokpe, P. M. K., & Lamore, A. A. (2022). A review of gender inclusivity in agriculture and natural resources management under the changing climate in sub-Saharan Africa. *Cogent Social Sciences*, *8*(1), 2024674. https://doi.org/10.1080/23311886.2021.2024674

Yiridomoh, G. Y., Appiah, D. O., Owusu, V., & Bonye, S. Z. (2021). Women smallholder farmers off-farm adaptation strategies to climate variability in rural Savannah, Ghana.

GeoJournal, *86*(5 pp.2367–2385), 2367–2385. Agricultural & Environmental Science Collection; SciTech Premium Collection. https://doi.org/10.1007/s10708-020-10191-7

REFERENCES SORTED BY KEY RESULTS

Gender of the Household Head:

Adzawla, William; Azumah, Shaibu Baanni; Anani, Paul Yao; Donkoh, Samuel A. (2019)

Ali, Essossinam (2021)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Call, Maia; Sellers, Samuel (2019)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Mugi-Ngenga, EW; Mucheru-Muna, MW; Mugwe, JN; Ngetich, FK; Mairura, FS; Mugendi, DN (2016)

Nelson, Valerie (2010)

Nyantakyi-Frimpong, Hanson; Bezner-Kerr, Rachel (2015)

Ojo, Temitope Oluwaseun; Ogundeji, Abiodun A; Emenike, Chijioke U (2022)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Education:

Abdul-Razak, M; Kruse, S (2017)

Aberman, Noora-Lisa; Ali, Snigdha; Behrman, Julia; Bryan, Elizabeth; Davis, Peter; Donnelly, Aiveen; Gathaara, Violet; Koné, Daouda; Nganga, Teresiah; Ngugi, Jane; Okoba, Barrack; Roncoli, Carla (2015)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Ali, Essossinam (2021)

Anik, AR; Rahman, S; Sarker, JR; Al Hasan, M (2021)

Antwi, K (2024)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Axelrod, Mark; Vona, Meghan; Novak Colwell, Julia; Fakoya, Kafayat; Salim, Shyam S.; Webster, D. G.; Torre-Castro, Maricela de la (2022)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Bennett, Nathan James; Dearden, Philip; Peredo, Ana María (2015)

Call, Maia; Sellers, Samuel (2019)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Chingala, Gregory; Mapiye, Cletos; Raffrenato, Emiliano; Hoffman, Louw; Dzama, Kennedy (2017)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ford, James D; Goldhar, Christina (2013)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Godden - 2013 - Gender and Declining Fisheries in Lobitos, Perú Beyond Pescador and Ama De Casa

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Guodaar, L; Bardsley, DK (2024)

Jerneck, Anne (2018)

Kerr, RB; Nyantakyi-Frimpong, H; Dakishoni, L; Lupafya, E; Shumba, L; Luginaah, I; Snapp, SS (2018)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Kom, Zongho; Nethengwe, N S; Mpandeli, N S; Chikoore, H (2022)

Kumasi, TC; Antwi-Agyei, P; Obiri-Danso, K (2019)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Maharjan, Amina; Kochhar, Ishaan; Chitale, Vishwas Sudhir; ʻĀbid, Ḥusain, 1962-; Gioli, Giovanna (2020)

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Mangheni, MN; Tufan, HA; Nkengla, L; Aman, BO; Boonabaana, B (2019)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Mugi-Ngenga, EW; Mucheru-Muna, MW; Mugwe, JN; Ngetich, FK; Mairura, FS; Mugendi, DN (2016)

Murage, A W; Pittchar, J O; Midega, C.A.O.; Onyango, C O; Khan, Z R (2015)

Nelson, Valerie (2010)

Ngajilo, Dorothy; Adams, Shahieda; Kincl, Laurel; Guernsey, Judith; Jeebhay, Mohamed F (2023)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Nyantakyi-Frimpong, H (2021)

Onyimadu, CO (2023)

Pelage, L; Bertrand, A; Siqueira, SCW; Araújo, ACAP; Avelino, KVA; da Silva, CL; Frédou, T (2023)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Van Aelst, K; Holvoet, N (2018)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Technology:

Abdul-Razak, M; Kruse, S (2017)

Aberman, Noora-Lisa; Ali, Snigdha; Behrman, Julia; Bryan, Elizabeth; Davis, Peter; Donnelly, Aiveen; Gathaara, Violet; Koné, Daouda; Nganga, Teresiah; Ngugi, Jane; Okoba, Barrack; Roncoli, Carla (2015)

Adam, R.; Amani, A.; Kuijpers, R.; Smits, E.; Kruijssen, F. (2022)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Ali, Essossinam (2021)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Chingala, Gregory; Mapiye, Cletos; Raffrenato, Emiliano; Hoffman, Louw; Dzama, Kennedy (2017)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Jerneck, Anne (2018)

Kawarazuka, N.; Locke, C.; McDougall, C.; Kantor, P.; Morgan, M. (2016)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Kom, Zongho; Nethengwe, N S; Mpandeli, N S; Chikoore, H (2022)

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Mangheni, MN; Tufan, HA; Nkengla, L; Aman, BO; Boonabaana, B (2019)

Mugi-Ngenga, EW; Mucheru-Muna, MW; Mugwe, JN; Ngetich, FK; Mairura, FS; Mugendi, DN (2016)

Murage, A W; Pittchar, J O; Midega, C.A.O.; Onyango, C O; Khan, Z R (2015)

Nelson, Valerie (2010)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Onyimadu, CO (2023)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Van Aelst, K; Holvoet, N (2018)

Zorrilla-Miras, P; Lisboa, SN; López-Gunn, E; Giordano, R (2024)

<u>Decision Making:</u>

Aberman, Noora-Lisa; Ali, Snigdha; Behrman, Julia; Bryan, Elizabeth; Davis, Peter; Donnelly, Aiveen; Gathaara, Violet; Koné, Daouda; Nganga, Teresiah; Ngugi, Jane; Okoba, Barrack; Roncoli, Carla (2015)

Adam, R.; Amani, A.; Kuijpers, R.; Smits, E.; Kruijssen, F. (2022)

Adzawla, William; Azumah, Shaibu Baanni; Anani, Paul Yao; Donkoh, Samuel A. (2019)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Anik, AR; Rahman, S; Sarker, JR; Al Hasan, M (2021)

Antwi, K (2024)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Axelrod, Mark; Vona, Meghan; Novak Colwell, Julia; Fakoya, Kafayat; Salim, Shyam S.; Webster, D. G.; Torre-Castro, Maricela de la (2022)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Carvalho, Danielle Almeida de; Amaral, Silvana; Alves, Lincoln Muniz (2023)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

de la Torre-Castro, Maricela (2019)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Godden - 2013 - Gender and Declining Fisheries in Lobitos, Perú Beyond Pescador and Ama De Casa

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Jellason, NP; Conway, JS; Baines, RN (2023)

Jerneck, Anne (2018)

Keleman, PJ; Sá, RM; Temudo, MP (2024)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Mangheni, MN; Tufan, HA; Nkengla, L; Aman, BO; Boonabaana, B (2019)

Nelson, Valerie (2010)

Nyantakyi-Frimpong, H (2021)

Ogundeji, AA (2022)

Onyimadu, CO (2023)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Pelage, L; Bertrand, A; Siqueira, SCW; Araújo, ACAP; Avelino, KVA; da Silva, CL; Frédou, T (2023)

Quiros, T. E. Angela L.; Beck, Michael W.; Araw, Alexis; Croll, Donald A.; Tershy, Bernie (2018)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Van Aelst, K; Holvoet, N (2018)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Household Duties, Partners, and Communities:

Adzawla, William; Azumah, Shaibu Baanni; Anani, Paul Yao; Donkoh, Samuel A. (2019)
Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Antwi, K (2024)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Axelrod, Mark; Vona, Meghan; Novak Colwell, Julia; Fakoya, Kafayat; Salim, Shyam S.; Webster, D. G.; Torre-Castro, Maricela de la (2022)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)
Carvalho, Danielle Almeida de; Amaral, Silvana; Alves, Lincoln Muniz (2023)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Godden - 2013 - Gender and Declining Fisheries in Lobitos, Perú Beyond Pescador and Ama De Casa

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Hidayati, I.; Putri, I. A. P.; Ghani, M. W.; Situmorang, A.; Widayatun (2021)

Jellason, NP; Conway, JS; Baines, RN (2023)

Keleman, PJ; Sá, RM; Temudo, MP (2024)

Kerr, RB; Nyantakyi-Frimpong, H; Dakishoni, L; Lupafya, E; Shumba, L; Luginaah, I; Snapp, SS (2018)

Khoza, Sizwile; Dewald van Niekerk; Nemakonde, Livhuwani D (2022)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Kumasi, TC; Antwi-Agyei, P; Obiri-Danso, K (2019)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Nelson, Valerie (2010)

Nyantakyi-Frimpong, H (2021)

Ojo, Temitope Oluwaseun; Ogundeji, Abiodun A; Emenike, Chijioke U (2022)

Onyimadu, CO (2023)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Singh, Priyatma; Tabe, Tammy; Martin, Tess (2022)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Van Aelst, K; Holvoet, N (2018)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

<u>Income, Wealth, Credit & Diversification of Income:</u>

Abdul-Razak, M; Kruse, S (2017)

Adam, R.; Amani, A.; Kuijpers, R.; Smits, E.; Kruijssen, F. (2022)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Ali, Essossinam (2021)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Chingala, Gregory; Mapiye, Cletos; Raffrenato, Emiliano; Hoffman, Louw; Dzama, Kennedy (2017)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Godden - 2013 - Gender and Declining Fisheries in Lobitos, Perú Beyond Pescador and Ama De Casa

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Jerneck, Anne (2018)

Kawarazuka, N.; Locke, C.; McDougall, C.; Kantor, P.; Morgan, M. (2016)

Kom, Zongho; Nethengwe, N S; Mpandeli, N S; Chikoore, H (2022)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Nelson, Valerie (2010)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Onyimadu, CO (2023)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Singh, Priyatma; Tabe, Tammy; Martin, Tess (2022)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Van Aelst, K; Holvoet, N (2018)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Extension Services:

Abdul-Razak, M; Kruse, S (2017)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Ali, Essossinam (2021)

Anik, AR; Rahman, S; Sarker, JR; Al Hasan, M (2021)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Kerr, RB; Nyantakyi-Frimpong, H; Dakishoni, L; Lupafya, E; Shumba, L; Luginaah, I; Snapp, SS (2018)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Mangheni, MN; Tufan, HA; Nkengla, L; Aman, BO; Boonabaana, B (2019)

Murage, A W; Pittchar, J O; Midega, C.A.O.; Onyango, C O; Khan, Z R (2015)

Nelson, Valerie (2010)

Quiros, T. E. Angela L.; Beck, Michael W.; Araw, Alexis; Croll, Donald A.; Tershy, Bernie (2018)

Van Aelst, K; Holvoet, N (2018)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Zorrilla-Miras, P; Lisboa, SN; López-Gunn, E; Giordano, R (2024)

Tenure:

Antwi, K (2024)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Antwi-agyei, Philip; Quinn, Claire Helen; Adiku, Samuel Godfried; Kwasi; Codjoe, Samuel Nii; Ardey; Dougill, Andrew John; Lamboll, Richard; Dovie, Delali Benjamin; Komla (2017)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Kumasi, TC; Antwi-Agyei, P; Obiri-Danso, K (2019)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Nelson, Valerie (2010)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Van Aelst, K; Holvoet, N (2018)

Migration:

Adam, R.; Amani, A.; Kuijpers, R.; Smits, E.; Kruijssen, F. (2022)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Bennett, Nathan James; Dearden, Philip; Peredo, Ana María (2015)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ford, James D; Goldhar, Christina (2013)

Jørstad, Hanne; Webersik, Christian (2016)

Kom, Zongho; Nethengwe, N S; Mpandeli, N S; Chikoore, H (2022)

Kumasi, TC; Antwi-Agyei, P; Obiri-Danso, K (2019)

Lauria, Valentina; Das, Isha; Hazra, Sugata; Cazcarro, Ignacio Ofori-Danson, Patrick; Ahmed, Munir; Hossain, Mostafa (2018)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maharjan, Amina; Kochhar, Ishaan; Chitale, Vishwas Sudhir; ʻĀbid, Ḥusain, 1962-; Gioli, Giovanna (2020)

Nelson, Valerie (2010)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Nyantakyi-Frimpong, H (2021)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Poverty:

Abdul-Razak, M; Kruse, S (2017)

Adzawla, William; Azumah, Shaibu Baanni; Anani, Paul Yao; Donkoh, Samuel A. (2019)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Anik, AR; Rahman, S; Sarker, JR; Al Hasan, M (2021)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Axelrod, Mark; Vona, Meghan; Novak Colwell, Julia; Fakoya, Kafayat; Salim, Shyam S.; Webster, D. G.; Torre-Castro, Maricela de la (2022)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ford, James D; Goldhar, Christina (2013)

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Jerneck, Anne (2018)

Jørstad, Hanne; Webersik, Christian (2016)

Keleman, PJ; Sá, RM; Temudo, MP (2024)

Kerr, RB; Nyantakyi-Frimpong, H; Dakishoni, L; Lupafya, E; Shumba, L; Luginaah, I; Snapp, SS (2018)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Nelson, Valerie (2010)

Ngajilo, Dorothy; Adams, Shahieda; Kincl, Laurel; Guernsey, Judith; Jeebhay, Mohamed F (2023)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Nyantakyi-Frimpong, H (2021)

Ogundeji, AA (2022)

Onyimadu, CO (2023)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Swai; W, O.; Mbwambo; S, J.; Magayane; T, F. (2012)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

Yiridomoh, Gordon Yenglier; Appiah, Divine Odame; Owusu, Victor; Bonye, Samuel Ziem (2021)

Cultural Norms and Beliefs

Abdul-Razak, M; Kruse, S (2017)

Aberman, Noora-Lisa; Ali, Snigdha; Behrman, Julia; Bryan, Elizabeth; Davis, Peter; Donnelly, Aiveen; Gathaara, Violet; Koné, Daouda; Nganga, Teresiah; Ngugi, Jane; Okoba, Barrack; Roncoli, Carla (2015)

Adam, R.; Amani, A.; Kuijpers, R.; Smits, E.; Kruijssen, F. (2022)

Adzawla, William; Azumah, Shaibu Baanni; Anani, Paul Yao; Donkoh, Samuel A. (2019)

Agarwal, Tripti; Prarthna Agarwal Goel; Hom Gartaula; Rai, Munmum; Bijarniya, Deepak; Rahut, Dil Bahadur; Jat, M L (2022)

Akinsemolu, Adenike A.; Olukoya, Obafemi A. P. (2020)

Ali, Essossinam (2021)

Anik, AR; Rahman, S; Sarker, JR; Al Hasan, M (2021)

Antwi-Agyei, Philip; Dougill, Andrew J; Stringer, Lindsay C (2015)

Axelrod, Mark; Vona, Meghan; Novak Colwell, Julia; Fakoya, Kafayat; Salim, Shyam S.; Webster, D. G.; Torre-Castro, Maricela de la (2022)

Ayele, E; Temesgen, D; Lemma, T; Wordofa, MG (2024)

Azong, Matilda N.; Kelso, Clare J. (2021)

Call, Maia; Sellers, Samuel (2019)

Carvalho, Danielle Almeida de; Amaral, Silvana; Alves, Lincoln Muniz (2023)

Chidakwa, P; Mabhena, C; Mucherera, B; Chikuni, J; Mudavanhu, C (2020)

Dah-gbeto, Afiavi P; Villamor, Grace B (2016)

Dilshad, Tanzina; Mallick, Dwijen; Udas, Pranita B.; Goodrich, Chanda G.; Prakash, Anjal; Gorti, Ganesh; Bhadwal, Suruchi; Anwar, Muhammad Zubair; Khandekar, Neha; Hassan, S. M. Tanvir; Habib, Nusrat; Abbasi, Saqib Shakeel; Syed, Md. Abu; Rahman, Atiq (2019)

Ford, James D; Goldhar, Christina (2013)

Ge, YH; Fan, LX; Li, YB; Guo, J; Niu, HP (2023)

Graziano, Kathryn; Pollnac, Richard; Christie, Patrick (2018)

Guodaar, L; Bardsley, DK (2024)

Jellason, NP; Conway, JS; Baines, RN (2023)

Jerneck, Anne (2018)

Jørstad, Hanne; Webersik, Christian (2016)

Kawarazuka, N.; Locke, C.; McDougall, C.; Kantor, P.; Morgan, M. (2016)

Keleman, PJ; Sá, RM; Temudo, MP (2024)

Kerr, RB; Nyantakyi-Frimpong, H; Dakishoni, L; Lupafya, E; Shumba, L; Luginaah, I; Snapp, SS (2018)

Khoza, Sizwile; Dewald van Niekerk; Nemakonde, Livhuwani D (2022)

Khoza, Sizwile; Niekerk, Dewald Van; Nemakonde, Livhuwani David (2019)

Lebel, Louis; Lebel, Phimphakan; Lebel, Boripat (2014)

Limuwa and Synnevåg - 2018 - Gendered perspective on the fish value chain, livelihood patterns and coping strategies under climate

Maharjan, Amina; Kochhar, Ishaan; Chitale, Vishwas Sudhir; ʻĀbid, Ḥusain, 1962-; Gioli, Giovanna (2020)

Maja, Mengistu M.; Idiris, Abdurahim A.; Terefe, Aemro T.; Fashe, Muluneh M. (2023)

Mangheni, MN; Tufan, HA; Nkengla, L; Aman, BO; Boonabaana, B (2019)

Molua, Ernest L; Sonwa, Denis; Bele, Youssoufa; Foahom, Bernard; Jean Pierre Mate Mweru; Salomon Mampeta Wa Bassa; Gapia, Martial; Ngana, Felix; Assoua Eyong Joe; Masumbuko, Emile Mulotwa (2023)

Mugi-Ngenga, EW; Mucheru-Muna, MW; Mugwe, JN; Ngetich, FK; Mairura, FS; Mugendi, DN (2016)

Murage, A W; Pittchar, J O; Midega, C.A.O.; Onyango, C O; Khan, Z R (2015)

Nelson, Valerie (2010)

Ngajilo, Dorothy; Adams, Shahieda; Kincl, Laurel; Guernsey, Judith; Jeebhay, Mohamed F (2023)

N-yanbini, NN; Toku, A; Osumanu, IK; Sarfo, AK (2024)

Nyantakyi-Frimpong, H (2021)

Nyantakyi-Frimpong, Hanson; Bezner-Kerr, Rachel (2015)

Onyimadu, CO (2023)

Palosaari, Maiju; Autio, Antti; Mbinga, Elizabeth; Pellikka, Petri; Johansson, Tino (2024)

Pelage, L; Bertrand, A; Siqueira, SCW; Araújo, ACAP; Avelino, KVA; da Silva, CL; Frédou, T (2023)

Poudel, Shobha; Funakawa, Shinya; Shinjo, Hitoshi; Mishra, Bhogendra (2020)

Quiros, T. E. Angela L.; Beck, Michael W.; Araw, Alexis; Croll, Donald A.; Tershy, Bernie (2018)

Singh, Priyatma; Tabe, Tammy; Martin, Tess (2022)

Sreya, P. S.; Parayil, Chitra; Aswathy, N.; Bonny, Binoo P.; Aiswarya, T. P.; Nameer, P. O. (2021)

Swai; W, O.; Mbwambo; S, J.; Magayane; T, F. (2012)

Van Aelst, K; Holvoet, N (2018)

Weeratunge, Nireka; Snyder, Katherine A; Sze, Choo Poh (2010)

ACKNOWLEDGEMENTS

The research team would like to acknowledge the following individuals for their help:

Jenna Strawbridge, Duke University Libraries Librarian for Nicholas School of the Environment & Chemistry, for literature review and search methods.

Kerry Ossi-Lupo, Duke University Nicholas School of the Environment Lecturing Fellow in Communications, for guidance in writing and presenting this master's project.

Elizabeth Albright, Ph.D, Duke University Nicholas School of the Environment Dan and Bunny Gabel Associate Professor of the Practice of Environmental Ethics and Sustainable Environmental Management, Chair, Environmental Economics and Policy, Dan and Bunny Gabel Chair of Environmental Ethics and Sustainable Environmental Management, for project presentation feedback and support (along with the Environmental Economics and Policy cohort).

Xavier Basurto, Ph.D, Stanford University Doerr School of Sustainability, Professor of Environmental Social Sciences, for guidance and advice.

Ben Siegelman, Rare, for project guidance and feedback (along with Rare's Gender Equity and Social Inclusion team).

John Virdin, Ph.D, Duke University Assistant Professor of the Practice in the Division of Marine Science and Conservation and Director, Ocean and Coastal Policy Program, Nicholas Institute for Environmental Policy Solutions for project guidance and advising.