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Solutions Guide for Climate Change, Gender, and Health

Essential Evidence for Action

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Solutions Guide for Climate Change, Gender, and Health: Essential Evidence for Action

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Cover images: *Top row, left to right:* 1) Amanesh Hunegho, 25, Midwifery, and Tejitu Shibabaw, 21, expecting mother at the maternity waiting room in Dinkara Health Center, Agew Awi zone, Amhara region Ethiopia. Credit: Genaye Eshetu. Isaura Gomez is a 16-year-old student at the Acordos de Lusaka High School in Maxixe, Mozambique. Her school takes part in the Pathfinder-supported Junt@s program that trains students to become peer advocates (known as activists) for sexual and reproductive health. Maxixe, Mozambique. ©Dave Cooper 3) Community taxi ambulance driver Jidinda with Agnes and her baby. Jidinda gave a ride to Agnes when she became unconscious during her labor as part of M-Mama, an innovative approach to address maternal health with ambulance taxis in six districts of Tanzania's Shinyanga region. Tanzania. Credit: Sala Lewis. *Second row, left to right:* 1) Hamdiya Othman - Introduction to theatrical Show. Egypt. Credit: Medhat Saleh. 2) Sunita, Kamlesh and Sheelu Gupta live in Kanpur Nagar, Uttar Pradesh, India. Credit: Sala Lewis. 3) Tsedach Tilahun, 23, is a lab technician at Gimjabet health center, Agew Awi zone, Amhara region, Ethiopia. Credit: Genaye Eshetu *Third row, left to right:* Mr. Long'idas and family portray a model boma (household) in the Naitolia village, Tanzania. Photos taken as part of our Endangered Ecosystems of Northern Tanzania project. The project is a partnership between Pathfinder International, The Nature Conservancy, and the Northern Tanzania Rangelands Initiative. © Roshni Lodhia. 2) School girls from Knosk School in Kuje Area Council of FCT share their experiences from capacity building and advocacy on digital technology. International Day of the Girl Child 2021. Nigeria. © Rain Vedutti Photography. 3) Reena and Vijay Kumar, a newlywed couple who live in Bhadawal, are clients of Sarojni Devi. Reena works as an Asha in Bhadawal village, rural Kanpur, Uttar Pradesh. India. Credit: Sala Lewis.

This guide can be viewed and downloaded at www.pathfinder.org/climatesolutionsguide

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Dear Friends and Colleagues,

At Pathfinder we've launched climate resilience programs with teams on-the-ground in South Asia, the Middle East, and Africa. ***This is the Solutions Guide we wished we had when we started.***

That's why we are excited to offer you cutting edge research as a gateway resource to accelerate learning and advance diverse, existing solutions. This ***Solutions Guide*** prepared by Dr. Meg Brown offers a remarkable set of data, solution options and field-tested case studies in this arena.

We recognize the present-day, life-altering impacts of climate change on every dimension of life. Climate change could negate decades of progress in global health. These impacts are disproportionately felt by marginalized people and vulnerable systems. More frequent climate-induced disruptions overwhelm already strained health systems, making access to sexual and reproductive health more challenging for women and communities. Climate change makes existing power structures even more unequal, keeping important perspectives of women, girls, and other marginalized community members from the table. We need ***everyone*** to participate in the process of creating climate solutions.

From our decades of work on sexual and reproductive health and rights at Pathfinder, we know that ensuring women's and non-binary individuals' bodily autonomy and reproductive freedom is a critical step in creating equitable communities. When individuals can freely choose their pursuits, live a healthy life, and adapt well to emerging challenges, they are better able to participate as full members of our communities—to innovate, advocate for, and engage in the climate solutions we need to thrive.

It's our hope that this guide inspires you, sparks new ideas, and generates transformative action around gender, climate, and health in your own community and work.

Together, we are shaping an equitable climate future where the health and wellbeing of all is ensured. We are grateful for your ideas and collaboration.

In solidarity,

Barbara J. Merz
Managing Director, Climate

Lois Quam
Chief Executive Officer

Dr. Tabinda Sarosh
President, South Asia & MENA

Executive Summary

Climate resilience, gender equity, and health are inseparable.

Climate change poses a major threat to human health – both directly, through climate hazards like storms and extreme heat, and indirectly, through shifts in how people live and interact with the world around them. The effects of climate change exacerbate existing inequities, and gender inequities are no exception.

While climate vulnerabilities look different across contexts, structural inequities and gendered relationship norms mean that **women and girls have particular vulnerabilities to climate threats**. Intersectional aspects of identity further shape these risks: factors like living in poverty, living in rural regions, having a disability, being part of a racial or ethnic minority, gender and sexual diversity, level of education, or marital status can also shape a person's vulnerability to climate hazards as well as the resources they can draw upon as they recover from climate disasters. These individual- and community-level vulnerabilities are a response to structural and systemic policies, patterns, and norms that generate inequitable access to resources, opportunities, and systems of power. These inequities put peoples' lives at risk – and limit our collective ability to effectively respond to the urgent, existential threat of climate change. **Building a more climate resilient future means building a future that is more equitable and healthier for *all***.

Reproductive justice is at the center of climate justice.

Because gender shapes effects on health, and because in many contexts women are disproportionately at risk of experiencing the negative health effects of climate change, it is critical that climate resilience work holistically advance women's health and wellbeing. In addition to ensuring access to healthcare even amid times of crisis, this also means addressing the drivers of differential health and social risks that women face, such as constraints around their livelihoods, persistent inequities around safety and freedom of movement, and limited access to sexual and reproductive health and rights, including voluntary family planning services. Ensuring women's bodily autonomy and reproductive freedom is a critical step in creating equitable communities in which women can freely choose their pursuits and adapt well to emerging challenges and hazards.

Connected climate solutions for a healthier future.

As a global community, we are ready to meet these complex challenges.

Community is at the heart of this work. We cannot do this work alone – nor should we. Working collectively sparks creativity, fosters active learning, heals divides, and helps all of us do the work better. Collaboration is the cornerstone of this: pursuing climate resilience means learning from others, centering community voices, addressing barriers to participation, and crossing silos to bridge knowledge and skills across sectors. This work involves not only building grassroots agency, adaptive capacity, and advocacy skills, but also advancing societal transformation towards a more just and equitable world.

This Solutions Guide synthesizes the efforts of many members of the small but growing collective of individuals, organizations, and communities working across and within the climate change, gender, and health spaces. **We hope that this guide welcomes you into this community of work and supports you in your own practice of building a more resilient and just climate future within your community.**

This guide is designed to enable readers to explore specific topics of interest around climate change, gender, and health by bridging knowledge across sectors. It focuses on recent scientific evidence and thought leadership from the climate-gender-health nexus, so we recommend also exploring the foundational, sector-specific knowledge that this cutting-edge research builds upon. To support your learning, each subsection of this guide includes learning resources with additional research and tools. The bibliography serves as an additional resource for research and programmatic findings. We also recognize that this is a dynamic and rapidly expanding area of work, so we encourage you to check for recent developments as this field grows.

Ready to learn more about climate change, gender and health? Here's what you'll find in this Solutions Guide:

Chapter 1	**Evidence**	Recent evidence about the gendered health effects of key climate hazards
Chapter 2	**Solutions**	Gender-integrated and gender-transformative strategies and case studies for responding to climate hazards
Chapter 3	**Planning**	Tools for building integrated climate resilience using theories of change and frameworks
Chapter 4	**Impact**	Indicators and tools for developing and identifying representative, gender-integrated metrics
Chapter 5	**Action**	Guidance on moving forward to a more climate-resilient future

In building this Solutions Guide, we've learned a few things from our community.

Climate solutions exist...

Innovation and adaptation are already happening around the world. By sharing best practices with each other, we can learn more quickly and enhance our approaches to fostering climate resilience.

... and complex challenges require integrated solutions.

There is no singular "answer" for climate challenges. This is because of contextually specific challenges, gaps in our data about climate change, and the fact that our changing climate is producing novel effects. We're still learning about the long-term effects of climate change. But there is growing evidence around what works and what's been done on a wide range of climate-related topics, and programming and research so far suggests that what has been done in different sectors translates to integrated, cross-sectoral work. Implementing these solutions in an integrated way is especially important for ensuring that these efforts programs do not harm communities – and that they do not unjustly put the burden of resilience on those who have contributed least to drivers of climate change but are nonetheless already disproportionately experiencing climate change's effects.

Women's participation is critical at all levels of climate and health work...

From the household level to the international stage, we need *everyone's* voice. When women aren't fully engaged in climate work, programs, at best, may not meet their needs and, at worst, may put women at greater risk. Given the urgency and scale of the climate crisis, it is imperative to ensure that all people can choose to participate in developing and implementing climate solutions. People don't need empowerment: people need opportunity, resources, and the ability to exercise their autonomy.

... and gender still often gets left out of climate.

When gender *is* included in climate research, it often is oriented around binaries and isn't intersectional – so it can be difficult to discern areas of additional vulnerability such as those around race, ethnicity, economic status, or living in a rural area. Given this, it is especially important to resist stereotypes, myths, and generalizations. These can include statements like "women are more connected to the environment," "renewable energy empowers women," or "improved cookstoves reduce gender-based violence." These narratives can erase peoples' lived experiences by grouping diverse people together into singular categories. They also often bypass and fail to engage with persistent systemic inequities. However, addressing these inequities and engaging with the practical mechanisms of change is central to truly creating gender-transformative impact.

Here's how we built the Solutions Guide.

This guide uses a "critical review" methodology in its review of scientific and other literature, focusing on critically synthesizing significant, purposively identified research and programming around climate change, gender, and health (Flotemersch et al. 2019). Only English-language articles were considered. Preference was given to recent research (published within the last 5 years) focused on lower socioeconomic countries and communities, though older work and work from other geographies has also been included as necessary for coherence and robustness of the review.

To move forward effectively, we have to pay attention to gaps, limitations, and critical issues in what we know.

Existing knowledge around climate change, gender, and health faces several limitations: 1) lack of consideration of gender in climate research, 2) lack of intersectional analyses in climate research, 3) lack of clarity around key concepts like resilience and vulnerability, and 4) limited research about the consequences of adaptation. These gaps also represent an important opportunity for strengthening research and programming in this space.

These limitations shouldn't keep us from doing the work: rather, they challenge us to learn through action, to share our knowledge widely, and to be deeply committed to inclusive, collaborative efforts that transformation of inequitable relationships and structures in the pursuit of a climate-just future.

Gender's Absence in Climate Research

Climate change research and policymaking has historically neglected both health and gender (van Daalen et al. 2020). Though research on climate change and health is increasingly attentive to gendered differences in both experiences with climate change and climate-associated health outcomes, limited research exists around how vulnerabilities to and experiences of the health impacts of climate change may be shaped and differentiated along lines of sex and gender differences, gender norms, and gender roles (World Health Organization 2014). Data around climate change, gender, and health remain limited, and key health outcomes, such as mental health, remain understudied (Cianconi, Betrò, and Janiri 2020). Of all scientific work on climate change published in 2020, for example, only 6% of articles considered gender (Romanello et al. 2021). These analyses often use binary sex disaggregation, meaning that data around the health impacts of climate change are even more scarce for gender diverse and non-binary populations (Simmonds et al. 2022; van Daalen et al. 2020). This dearth of gender-disaggregated data can limit policymakers' and health practitioners' understanding of climate-related health risks, and it also makes it difficult to conclusively assess exposure thresholds for climate-related health risks (Sorensen, Murray, et al. 2018). In addition, because we are in the early years of experiencing the effects of a changing climate, we have more data about connections between short-term, proximal outcomes – for example, those around hazard-related

mortality or maternal and neonatal health outcomes – and climate hazards than we do about distal, long-term outcomes. Bridging these gaps in the data is therefore a critical aspect of work at the climate-gender-health nexus.

Gender can be defined as "the socially constructed norms, roles, attitudes, and attributes associated with people of different sex characteristics and the relations between and among these different groups" (Ide et al. 2021, 44). However, "gender" is often treated as synonymous with "women" (van Eerdewijk, Bråten, and Danielsen 2021; H. C. P. Brown 2011; Smyth 2007; Fröhlich and Gioli 2015). Alternatively, the term "gender" also frequently used in this space in a reductive way to describe differences between men and women, thus conflating sex and gender and ignoring gender diversity (Simmonds et al. 2022). Initiatives centered around gender-disparities and climate often focus on cisgender women and girls (Simmonds et al. 2022). Moreover, when those from gender diverse populations have been considered in research on the health effects of climate change, the work has focused exclusively on natural disasters and disaster relief, but has not attended to other health impacts linked to climate, such as those caused by heat or vector-borne disease, leading to critical gaps in knowledge (Simmonds et al. 2022). This can lead to research and policies that reproduce stereotypes and misconceptions around vulnerabilities, adaptive capacities, needs, and preferences (van Eerdewijk, Bråten, and Danielsen 2021).

In scientific research, women are often portrayed as especially vulnerable to climate change and as especially environmentally conscious, but this orientation can obfuscate the different struggles, lived experiences, needs, and preferences of different groups of men and women (van Eerdewijk, Bråten, and Danielsen 2021; Lau et al. 2021). Assumptions that women inherently have a "special" relationship with nature are, according to feminist political ecologists, the product of socialization (H. C. P. Brown 2011; Leach 2007; Rocheleau, Thomas-Slayter, and Wangari 1996; Fröhlich and Gioli 2015). When women are portrayed as inherently vulnerable to climate change, policies and programs can both reduce women's agency and simultaneously miss the vulnerabilities and adaptive capacities of different groups of men (Ampaire et al. 2020; van Eerdewijk, Bråten, and Danielsen 2021; Fröhlich and Gioli 2015). Thus, climate programs and policies grounded in these stereotypes may fail to create the transformative change necessary to address the root structural causes of gender inequities – and, in fact, by homogenizing women can risk worsening women's status and cementing gender roles (Huyer et al. 2020; van Eerdewijk, Bråten, and Danielsen 2021; F. F. Wong et al. 2018; Cornwall, Harrison, and Whitehead 2007).

In addition, "gender" is understood and operationalized differently across the climate change adaptation space (van Eerdewijk, Bråten, and Danielsen 2021). Within the climate-smart agriculture sector, for example, programming and research often focuses on gender roles rather than relationships, with underlying assumptions that the behaviors and

responsibilities associated with gender roles can be changed through new skills and technologies and that men and women are equally able to decide to adopt these new practices and innovations (van Eerdewijk, Bråten, and Danielsen 2021). However, focusing on gender roles often leads to an orientation towards addressing "gaps" between stereotyped "men" and "women"; this approach can miss the contextual gender dynamics that not only shape policies and interventions but also cause different experiences, outcomes, and responses to climate change (Danielsen et al. 2018; Kristjanson et al. 2017; van Eerdewijk, Bråten, and Danielsen 2021).

To address these challenges, scholars recommend 1) taking an intersectional approach and 2) viewing gender as relational (van Eerdewijk, Bråten, and Danielsen 2021). Categorization, in general, risks simplifying and homogenizing people, thus prompting programs and policies that fail to meet diverse needs (Simmonds et al. 2022). With that said, categorization remains a useful tool for assessing vulnerabilities and capacities, targeting and scaling programs, and communicating data. Thus, increased and improved use of intersectional lenses can be used to generate a more nuanced understanding of how different groups of people experience climate change, the roles and responsibilities of different groups, and how particular identities and responsibilities may shift between activities (van Eerdewijk, Bråten, and Danielsen 2021; Thompson-Hall, Carr, and Pascual 2016). Second, and relatedly, a relational approach to gender understands that gendered social positions are tethered to norms and practices around power, resources, responsibilities, and worth (van Eerdewijk, Bråten, and Danielsen 2021). Feminist political ecology approaches, which analyze dynamics between gender, power, resources, and the environment, are a useful tool here (Buechler 2016).

Given these limitations around gender representation in climate data, this report uses the language of existing research around "women" and "men." Future work should strive to move beyond these binaries and take a more intersectional approach that is attentive to a range of social differences.

Lack of Intersectional Representation in Climate Research

When climate data do include gender, this research often does not disaggregate along other intersectional aspects of identity such as age, ethnicity, socioeconomic status, disability status, or marital status (Romanello et al. 2021). Data on how climate affects different groups of men are especially scarce (Bogdan, McPherlain, and Yoon 2019). In general, individuals from marginalized groups are often excluded from or not represented in climate change research – work which shapes how programs are framed, how we evaluate "appropriate" adaptation measures, and how we conceptualize adaptive capacity and vulnerability (van Eerdewijk, Bråten, and Danielsen 2021). When programs are inappropriately framed, they may mispresent populations' vulnerability or adaptive capacity, pose ineffective or irrelevant solutions, or pursue misguided lines of research and

knowledge production (van Eerdewijk, Bråten, and Danielsen 2021). The invisibility of these unjust health risks produced by climate change are not necessarily the haphazard result of poor science or limited data: they can be structurally generated to serve particular agendas around power, responsibility, and resource allocation (Parry et al. 2019). Broad representation and deep understanding of intersectional inequities is central to developing effective, just responses to climate change (Romanello et al. 2021; van Eerdewijk, Bråten, and Danielsen 2021). Practitioners can move towards more effective programmatic framing and structural transformation by forwarding diversity through intersectional analyses, attending to varied lived experiences, and engaging with a broad range of participants (van Eerdewijk, Bråten, and Danielsen 2021).

Confusion around Resilience and Vulnerability

Resilience generally refers to the ability of social or ecological systems to respond and adapt to hazards and disturbances while overall maintaining their structure and functioning (UNDRR 2022b). However, the term "resilience" can be used very differently between policymakers, who often orient resilience to shocks and changes in the environment, and communities, where resilience often revolves around social ties, community, and a sense of place (Iniesta-Arandia et al. 2016; Nightingale 2015).

Though resilience is a popular and widely used concept, it has also been heavily critiqued for 1) focusing on a rapid return to "normal" without considering whether the pre-disturbance "normal" is something that should be returned to and 2) putting the burden of becoming resilient on those who are already most vulnerable (Haldane and Morgan 2021; Ebi and Semenza 2008; Houston 2015; K. Brown 2014). In response to these critiques, "transilience" has been introduced as a term that addresses "the need to account for issues of social vulnerability and differential access to power, knowledge, and resources" (Matin, Forrester, and Ensor 2018; Haldane and Morgan 2021, 134). Alternatively, adaptive capacity, or the "ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences," can also be used as a mechanism for measuring resilience (World Health Organization 2021; IPCC 2018). However, "resilience" remains the broadly used term across social, political, and programmatic spaces.

Vulnerability generally refers to the risk of harm faced by individuals, communities, and societies in the face of hazards; it is socio-politically situated, shaped by exposures, sensitivity and adaptive capacity (IPCC 2018; van Eerdewijk, Bråten, and Danielsen 2021). Climate change affects social vulnerabilities across several dimensions of well-being, including health, safety, food security, and displacement (Otto et al. 2017). Clear climate change vulnerability thresholds are rare, though when they exist, they are typically around age, household income, or degrees of warming; for example, children under two

experience greater long-term effects of hunger, and those below 15 and over 65 are more at risk for heat-associated mortality (Otto et al. 2017).

Resilience and vulnerability are vague and contextually specific concepts, which makes them difficult to measure and move towards. Thus, it is important for practitioners to develop clear definitions of what resilience and vulnerability mean – organizationally, locally, and programmatically – in work at the climate-gender-health nexus.

The Consequences of Adaptation

There is a significant gap in knowledge around how climate change adaptation affects people's daily lives, including risks, consequences, and stressors of adaptation as well as reproduction or exacerbation of inequalities (van Eerdewijk, Bråten, and Danielsen 2021). Some researchers have identified and explored "maladaptation" – that is, adaptive approaches that come with short- or long-term negative consequences (Magnan et al. 2016; Jacobson et al. 2019; Magnan 2014; Barnett et al. 2013; van Eerdewijk, Bråten, and Danielsen 2021). However, there remains a need to deeply consider context-specific social dynamics that shape the implementation of climate adaptation programs and aim for gender-transformative, rather than gender-aware approaches (van Eerdewijk, Bråten, and Danielsen 2021). Acknowledging programmatic failures, gaps, and inadequacies is essential to iterating practices, programs, and policies that are more equitable, inclusive, and effective at generating communal resilience.

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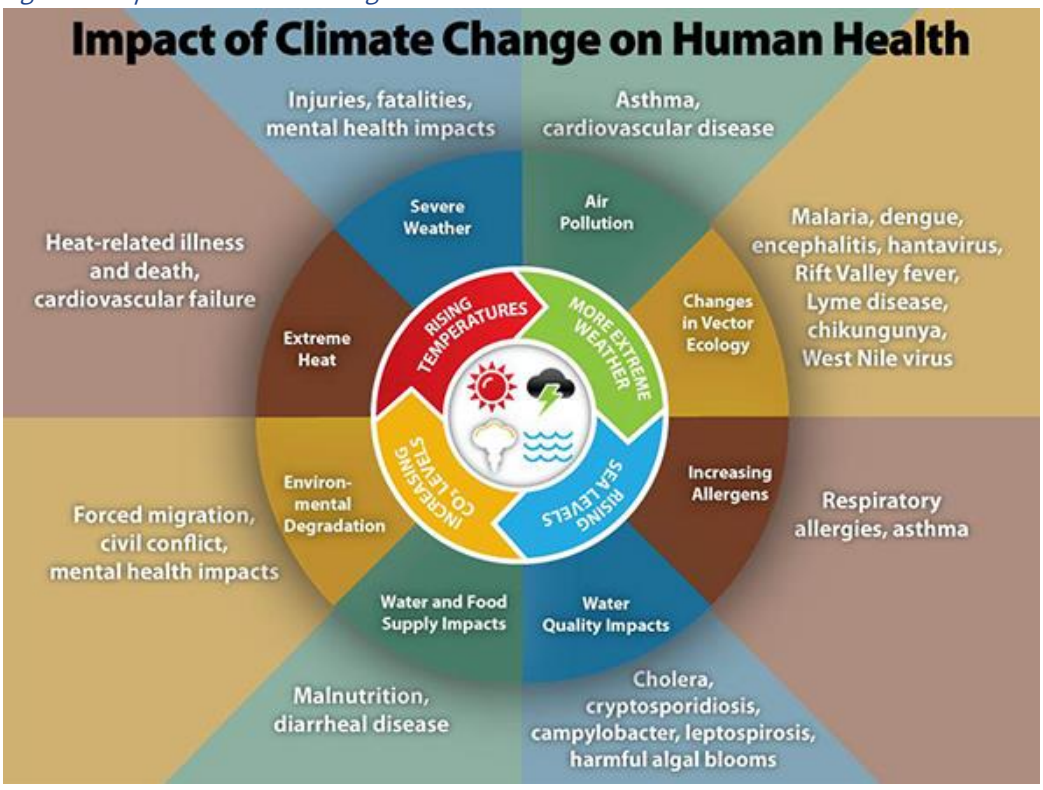
Case Studies

Chapter 1: Evidence Connecting Climate, Gender, and Health

Part 1: How A Changing Climate Affects Health

Gender, health, and climate change are deeply interlinked (Pearse 2017; Solomon and LaRocque 2019). Climate change affects health directly, through extreme weather events like storms, flooding, heat, and drought, and indirectly, through changes in migration, land use, livelihoods, and caring burdens that emerge in response to climate change (World Health Organization 2014). More than this, though climate change is a "health threat multiplier" – it has direct and indirect health effects, amplifies existing health risks, and increases existing health inequities across a spectrum of health concerns, from infectious diseases and injuries to mental health and sleep (van Daalen et al. 2020; J. Maxwell and Blashki 2016; Simmonds et al. 2022; Rifkin, Long, and Perry 2018). Climate change also has consequences for health systems and health policy, and it poses a threat to achieving universal health care (Salas and Jha 2019; van Daalen et al. 2020). These impacts are illustrated in a model the CDC developed for climate change's impacts on health (CDC 2022):

Figure 1. Impact of Climate Change on Human Health Source: CDC 2022.



These health effects are realized through complex, cross-sectoral pathways as the emissions-generating activities prompt both biophysical changes in the environment, like temperature increases and extreme weather, and ecological shifts, like biodiversity loss

and changes in human-environment relationships (Machalaba et al. 2015). Climate change's impact on health is mediated and shaped by environmental conditions, the social context, and public health capacity (K. R. Smith et al. 2014).

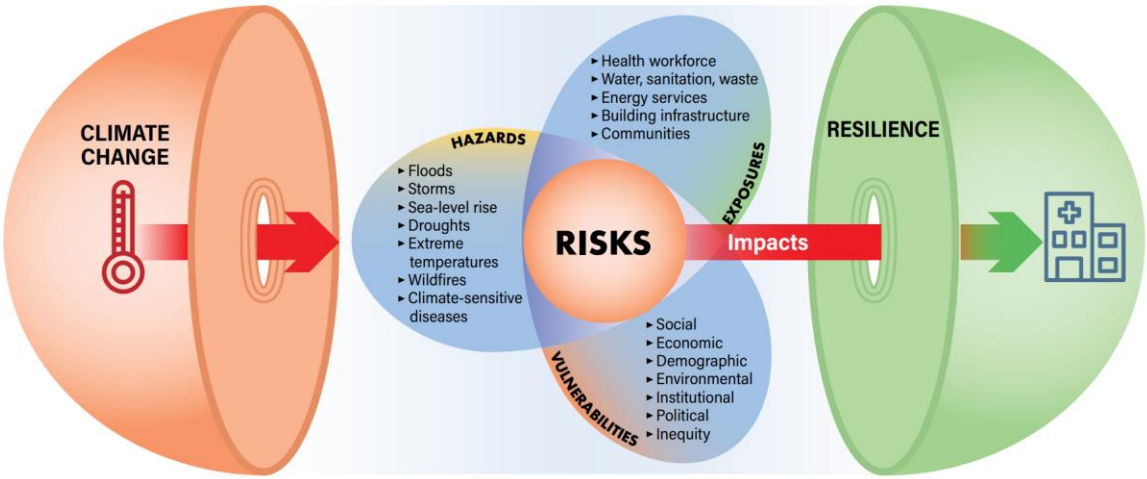
Climate change's widespread negative effects on health are not distributed evenly across genders (Watts et al. 2015; van Daalen et al. 2020). Climate change often reflects and reinforces existing gender inequalities (Eastin 2018). Gender roles, relations, norms, and inequities shape and amplify vulnerability to climate change and the health impacts of climate change, with women living in poverty from rural areas in developing countries generally thought to be among the most vulnerable to climate change (H. C. P. Brown 2011; Romanello et al. 2021; Glazebrook, Noll, and Opoku 2020).

In many places, women have increased health risks as compared to men (van Daalen et al. 2020). Women are more likely than men to experience death, injury, infectious disease, mental illness, and food insecurity associated with climate change (Sam Sellers 2016; van Eerdewijk, Bråten, and Danielsen 2021; World Health Organization 2014). Climate change reduces women's access to health services and increases risks to maternal and reproductive health (Sam Sellers 2016; Sorensen, Murray, et al. 2018). In a climate-related disaster, women are susceptible to gender-based violence, child marriage, trafficking and sexual exploitation (Chauhan 2021; van Eerdewijk, Bråten, and Danielsen 2021). Gender norms not only shape risks and vulnerabilities to climate-associated health impacts, but also shape adaptive capacity through unequal access to financial resources which can limit women's ability to adapt, restrictions around mobility which can prevent women from receiving timely access to healthcare, and allocation of food resources that puts women and girls at risk of undernutrition (van Daalen et al. 2020; van Eerdewijk, Bråten, and Danielsen 2021; Resurrección et al. 2019; Dunne 2020).

However, these trends are not universal. In some climate contexts, men are at higher risk, with unmarried men more likely than unmarried women to die in heat waves, men more likely to drown in severe weather, and men more likely to experience some forms of climate-related mental health problems such as suicide and depression (World Health Organization 2014; van Daalen et al. 2020; Ganguli 2021; Sorensen, Murray, et al. 2018; Kennedy and King 2014; Thiery et al. 2017). Those who fit outside of the gender binary are believed to be especially vulnerable to climate-related health impacts due to stigma, discrimination, and pre-existing inequities, but data to quantitatively assess these vulnerabilities is extremely limited (Simmonds et al. 2022). These gendered differences in the health impacts of climate change emerge through socioeconomic, cultural, and physiological pathways, and socially-situated gendered differences in responsibilities, access to health care, health needs, ecosystem use, livelihoods, knowledge, and living conditions play a greater role shaping these differences than physiological differences (Naswa 2021; Sorensen, Murray, et al. 2018; van Daalen et al. 2020).

These increasing health risks associated with climate change are likely to increase the burden on health systems, both through the direct effects of climate-associated weather events and through changing vector ecology that will drive outbreaks of emerging infectious diseases, both of which will require additional resources from already-strained health systems (Haldane and Morgan 2021; Curtis et al. 2017; Setoguchi et al. 2022; Watts et al. 2019). These risks to health systems emerge through direct hazards, exposures to the workforce, and vulnerabilities (WHO 2021b).

Figure 2. How climate change affects health systems' resilience Source: WHO 2021a. No changes made, A copy of the license is available here: https://apps.who.int/iris/handle/10665/340656



Climate change isn't just causing negative health outcomes: it is also holding back progress on gender equity and human rights. In Tanzania, researchers found that climate change constrained the realization of women's rights around food, water, health, decision-making, and freedom from gender-based violence (Joseph 2022). This is particularly important because of the role gender plays in shaping climate change policy and responses. Stronger climate change policy is associated with increased representation of women in government (Romanello et al. 2021; Chingarande et al. 2020).

This section uses a gendered lens to examine how specific climate-related hazards affect health. Though these hazards are often analyzed in an issue-specific manner, and this book is no exception, it is important to recognize that in reality, these issues are often deeply intertwined (Tantoh et al. 2021). This section also spotlights two specific health areas associated with climate change: reproductive health and mental health.

Box 1. Key takeaways from climate and health data Source: Authors.

Key takeaways from the data…

1. Climate hazards have profound and gendered impacts on health.
2. Climate hazards can cause direct harm, such as increased risks to mental health and maternal and infant health, and indirect harm, such as increased risk of child marriage or increased labor burdens for women.
3. Forwarding women as active participants and leaders in their communities and pursuing gender equity is critical to addressing the risks of climate change.

Learn More: Climate, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Recent scientific evidence around climate change and health**	"Chapter 7: Health, wellbeing and the changing structure of communities" in the IPCC's report *Climate Change 2022: Impacts, Adaptation and Vulnerability*	https://www.ipcc.ch/report/ar6/wg2/
		The 2022 report of the *Lancet Countdown on Climate Change and Health*	https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(22)01540-9/fulltext
	**Gender and climate across sectors**	See *Gender and Climate Change: A Closer Look at Existing Evidence* from the Global Gender and Climate Alliance	https://wedo.org/wp-content/uploads/2016/11/GGCA-RP-FINAL.pdf
	**Local examples of climate, gender, and health**	For work on gender and climate in Vietnam, see *The State of Gender Equality and Climate Change in Viet Nam* (ISPONRE 2021)	https://www.empowerforclimate.org/en/resources/t/h/e/the-state-of--gender-equality-and-climate-change-in-viet-nam
		For work on women's health and climate in Asia, see ARROW's report *Women's Health and Climate Change* (Mian 2017)	https://arrow.org.my/publication/womens-health-climate-change/
		For an example from Bangladesh, see *Health consequences of climate change in Bangladesh* (Rahman et al. 2019)	http://onlinelibrary.wiley.com/doi/abs/10.1002/wcc.601

Action Spotlight: How to Identify Local Climate Threats

This section of the book is organized around specific climate-related threats. Not sure what those are in your community? Try taking a triangulated approach that brings together community voices, high-level climate data, and research and programmatic information to generate an informed understanding of climate risks. This approach builds on several different kinds of existing knowledge to ensure a representative, robust understanding of these risks.

Figure 3. Triangulating Data to Create an Informed Understanding of Local Climate Threats Source: Authors

Community members who are already experiencing climate-related threats understand their experiences, risks, and needs best, and they often have knowledge not represented in other forms of data. However, larger-scale research and datasets can reveal important trends in the data about climate, gender, and health that might not be as apparent at a local level, and they are especially important for understanding the scope of climate risks.

When reviewing climate data and research, it's important to pay attention to the participants. For example, ask "Who is represented in the data? Who is not?" as you consider the information you find. It is also important to pay attention to the process of how that data was collected, analyzed, and interpreted. Building on the knowledge we already have is an important part of ensuring our response to climate threats are timely and well-informed.

Community Voices

Centering community voices and needs is imperative. These conversations can be informed by a review of existing climate-related data and research, but the purpose of reviewing existing data isn't to tell communities what their problems are: it's to reduce the burden on already vulnerable communities by creating a space for more focused and informed conversations. As with all participatory work, facilitators must consider who is – or is not – participating in these conversations, and how patterns of power, social norms, and biases might influence the content and direction of these conversations. One way to do this is through community risk assessments (CRAs) that explore the local socioeconomic context, evaluate climate risks, and identify key livelihood resources and needs (File and Derbile 2020). The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRISTAL) and the Participatory Assessment of Climate and Disaster Risks (PACDR) are two such tools for community-level climate risk assessment and adaptation design (IIED 2012; "Participatory Assessment of Climate and Disaster Risks (PACDR)" 2022).

High-Level Data

High-level, quantitative climate data can help identify long-term climate trends at the national level. These data are useful for understanding key overarching climate issues affecting a particular country. However, these data can sometimes be limited in their granularity – for example, they may not capture how different groups of people, like women, minority ethnic groups, or people with disabilities, might be differently affected by these climatic trends. Consider some of these resources to get you started:

- **The World Bank's Climate Change Knowledge Portal** compiles data on climate trends, vulnerabilities, and impact. This information can be explored at a country level or through a watershed view – a useful approach for understanding how climate change can transcend boundaries. https://climateknowledgeportal.worldbank.org/ They also host comprehensive climate change datasets: https://climateknowledgeportal.worldbank.org/
- **The Notre Dame Global Adaptation Index** compiles data to rank and evaluate adaptation at a country level: https://gain.nd.edu/our-work/country-index/rankings/
- **The Gender Climate Tracker** has country profiles and analyzes gender integration into climate policy, including an evaluation of Nationally Determined Contributions (NDCs) as well as links to related news, resources, and projects: https://www.genderclimatetracker.org/node/12210
- **IPCC's Atlas of Global and Regional Climate Projections** offers figures and models of climate change projections: https://www.ipcc.ch/report/ar5/wg1/atlas-of-global-and-regional-climate-projections/

- **UNDP Adaptation and Climate Promise** have country profiles and regional snapshots of climate data: https://www.adaptation-undp.org/all-countries and https://climatepromise.undp.org/
- **The World Health Organization** issues country profiles around health and climate change: https://www.who.int/teams/environment-climate-change-and-health/climate-change-and-health/evidence-monitoring/health-and-climate-change-country-profiles
- **The UNFCCC** maintains a registry of Nationally Determined Contributions under the Paris Agreement: https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx
- **The Climate and Health Alliance** has an initiative to evaluate progress towards NDCs using NDC scorecards: https://climateandhealthalliance.org/initiatives/healthy-ndcs/ndc-scorecards/
- **Country-generated datasets and climate assessments** may be available from government agencies responsible for addressing climate, such as ministries for the environment or meteorological institutes.
- **For more strengths and vulnerability assessment tools,** see that corresponding subsection of Chapter 4 in this guide.

Research and Programs

Climate-related academic publications and program reports from the area of interest can add serve as a source for more specific data about local, regional, and national climate events, risks, and projections. This information might be quantitative or qualitative; qualitative data gathered through approaches like interviews and focus groups can help capture information that might not be apparent in quantitative analyses. Just like with high-level data, they may face limitations around who is included or how the data were gathered, so it is important to pay attention to research and program methodologies.

Disasters and Extreme Weather Events

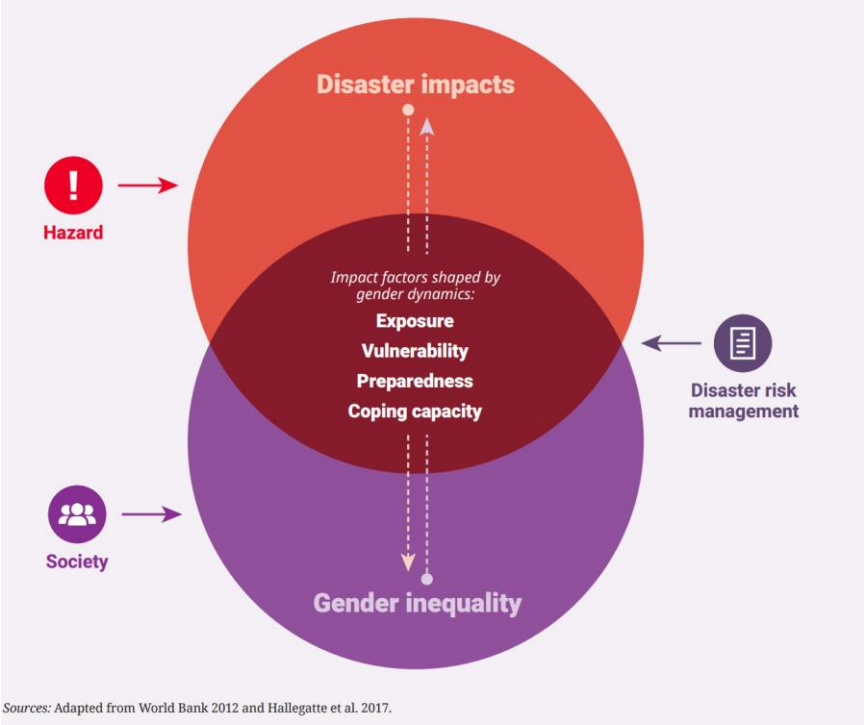
Climate change is associated with an increase in a range of extreme weather events such as windstorms, tornadoes, rising sea levels, flooding, and heavy rainfall, all of which can prompt acute disasters (World Health Organization 2014). Extreme weather disasters can have health effects including death, injury, water/sanitation issues, trauma, mental illness, and ecological grief (van Daalen et al. 2020). Disasters involving flooding can lead to microbial contamination, chemical contamination, mold exposure, and malnutrition (Hilmert et al. 2016).

Gender and Disaster-Related Morbidity and Mortality

Gender can shape health risks both during and after disasters. Overall, during disaster events, women are more likely to die than men, are at higher risk of experiencing violence, are at higher risk for mood disorders, are more likely to experience challenges with economic recovery, and face decreased life expectancy (Sorensen, Murray, et al. 2018; Norris et al. 2002; Neumayer and Plümper 2007; World Health Organization 2014; Morioka 2016; Dankelman 2016; Chauhan 2021). In general, women are more likely to experience mental health challenges than men following a disaster; however, while women more likely to experience PTSD or anxiety after a disaster, suicide is more common among men (Erman et al. 2021).

The World Bank developed a framework for understanding how disaster and gender inequality interact to shape disaster risks (Erman et al. 2021):

Figure 4. Disaster and gender inequality Source: Erman et al. 2021



However, a closer reveal of data around gender and disasters reveals a more complex picture. In sudden-onset disasters, such as earthquakes or tsunamis, mortality rates are typically higher for women than for men (Zagheni, Muttarak, and Striessnig 2016). But recent research that focused specifically on flood and storm disasters found that across the world, men are more likely to die in these types of disasters than women; this difference is greater for adults than for children or the elderly, and the gender gap in mortality risk is more pronounced in regions with lower levels of human development (Zagheni, Muttarak, and Striessnig 2016). In disasters such as floods and storms, particularly in high-income contexts, men may be more likely to die than women as they take on higher-risk tasks, while women are more likely to die in floods in lower-income countries due to restrictions around movement and clothing, lack of knowledge about how to swim, or lack of access to early warning systems (Erman et al. 2021; Morioka 2016; Doocy et al. 2013; Dankelman 2016; Chauhan 2021). Though some evidence suggests women, particularly in lower-income countries, may be more at risk of drowning than men, data on drowning is often not disaggregated by gender, separated from other injuries, or distinguished between fatal or non-fatal instances (Sindall et al. 2022).

In addition to gendered disaster-related mortality trends, morbidity outcomes following disasters can also be gendered. In Bangladesh, researchers found that women faced worse health outcomes than men following flooding because of both limited healthcare services, long distances to reach healthcare services, cost of healthcare services, and cultural norms around communicating reproductive healthcare problems (Kamal et al. 2018). In addition, women often had to stay in wet clothing, which prompted urinary tract infections (Kamal et al. 2018). Similar research from Bangladesh found that women were more likely to experience skin problems associated with floodwater exposure (Alston 2015).

Gender Equity and Coping with Disasters

Disasters can exacerbate existing gender inequities, and gender roles and responsibilities shape how people experience climate change's effects on disasters (Chauhan 2021):

Table 1. Gender roles and differentiated vulnerabilities to coastal disasters Source: Chauhan 2021

Sector	Major Gender Roles*		Climate Change Impacts	Gendered Vulnerability to that Impact
Coastal disasters	Men	• Risk taking behavior • Saving lives and property • Information updates • Insurance and recovery	Increased saltwater intrusion, flooding, and damage to infrastructure	• Loss of life • Occupational risks for fishermen • Increased migration • Increase in stress and mental health risks • Alcoholism and suicide rates can increase
	Women	• Storing household and emergency items • Household survival tasks such as water collection and cooking • Child and elderly care • Maintain dignity and cultural inhibitions		• Women and children 14 times more likely to die or be injured than men • 80% of people displaced are women • Workload of household survival tasks escalates • Health concerns due to saltwater intake • Sexual and gender-based violence increases
* The gender roles mentioned here are not fixed and need to be contexualized. These are just indicative of what the differentiated gender roles could be.				
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.				
Participatory Action Tip: You use this framework with a group to think about gender roles in your community, and how those roles are connected to climate change and climate solutions. For more guidance on this, see Exercise 6 in Module 1 of ARROW's *Training Manual on Gender and Climate Change Resilience* as well as the *Identifying Appropriate Climate Solutions* section of Chapter 3 of this resource guide.				
Note: For more on gendered impacts of climate-related shifts in livelihood and household burdens, migration, mental health, and sexual and reproductive health (including gender-based violence) see those sub-sections in Chapter 1 of this resource guide.				

A study of 149 countries found that countries with greater income inequality tend to experience higher numbers of natural disasters and experience greater damage from natural disasters (Cappelli, Costantini, and Consoli 2021). The study also found that natural disasters exacerbate inequality (Cappelli, Costantini, and Consoli 2021). In India, states with better Inequality-adjusted Human Development Index scores have fewer deaths from flooding, but this benefit is experienced more strongly by men than women, suggesting persistent inequalities even in states with higher HDI scores (Roy Chowdhury, Parida, and Agarwal Goel 2021).

Women may also face challenges in their long-term recovery as compared to men. For example, a study in Vietnam found that while men reported recovering approximately 80% of their well-being within 5 years, estimating it would take 30-57% of their annual income to compensate for their losses, women reported a lower well-being recovery rate and a higher cost of recovery, recovering 70% of their well-being and estimating it would take 41-86% of their annual income to compensate (Hudson, Pham, and Bubeck 2019).

Similarly, research suggest that individuals who are gender diverse or women with disabilities may face additional risks in disasters (Simmonds et al. 2022; Gartrell et al. 2020). For example, research around how women with disabilities in Cambodia cope with disasters demonstrated that while these women had key sources of support (including social networks, self-reliance, and NGO support), they also had important areas of vulnerability (such as reliance on agriculture, lack of governmental support, and lack of early warning systems) (Gartrell et al. 2020).

Disasters and Sexual and Reproductive Health and Rights

Access to sexual and reproductive health (SRH) services beyond maternal health care is often low-priority in disasters, and in the aftermath of disasters, lack of running water may prevent adequate menstrual hygiene, damaged infrastructure may inhibit access to SRH services, and there may be an increase in unplanned pregnancy and unsafe abortion (Naswa 2021; Mian 2017; 2018; Aguilar, Granat, and Owren 2015; Sam Sellers 2016; Castro and Hernandez 2015). For more on how disasters are associated with sexual and reproductive health outcomes, see the Sexual and Reproductive Health and Rights spotlight.

Child Marriage and Disasters

A study of gender inequities associated with extreme weather events across Asia found that extreme weather was associated with an increase in child marriage across almost all countries studied (Romanello et al. 2021). In India, the Kosi river flood was associated with earlier marriage; this effect was more pronounced for men than for women (10 months versus 4.3 months, respectively), was more common among Hindus with a strong tradition of dowry payments, and was more common among those who did not own land (Khanna and Kochhar 2020). This pattern increased male child marriage by 25% and female child

marriage by 9.5%, which, while effective at mitigating the shock for the couple's parents, has long-term consequences for the couple (Khanna and Kochhar 2020).

Maternal and Child Health in Disasters

Disasters and extreme weather events have many consequences for maternal health as a result not only of the weather event but also food insecurity, water contamination, vector-borne disease, stress and trauma, displacement, and violence (Giudice et al. 2021; Harville, Xiong, and Buekens 2010; Castañeda Carney et al. 2020; Mallett and Etzel 2018; Currie and Rossin-Slater 2013). For pregnant women, these types of events also can have important implications their infant's health.

Overall, flooding is associated with a range of poor maternal and child outcomes including low birthweight, mental health, and stillbirth (Mallett and Etzel 2018). Other work from the United States has found that proximity to a flood early in pregnancy is associated with decreased fetal growth and decreased birth weight (Hilmert et al. 2016). This work did not find an association between evacuation, financial strain, physical exertion, or stress and poor infant health outcomes, suggesting that focusing on these aspects of a disaster may not mitigate the impact of the disaster on infant health (Hilmert et al. 2016).

A study of the impact of tornadoes on infants in Bangladesh found that tornado exposure in utero was associated with a range of poor infant health outcomes such as birth weight, middle-upper arm, circumference, and fever, but that these are primarily observed among male, not female, infants (Gunnsteinsson et al. 2019). For male infants, Vitamin A supplementation can mitigate these negative health impacts (Gunnsteinsson et al. 2019).

Gender-Based Violence and Disasters

The research around connections between gender-based violence and disasters is mixed, though often suggests that disasters may be associated with an increase in gender-based violence. A systematic review of research on disasters and violence against women found that that some, though not all, studies found a positive correlation between disasters and increased violence against women, raising a call for more and better quality studies (Thurston, Stöckl, and Ranganathan 2021).

Research in Bangladesh found that cyclones both directly and indirectly contribute to gender-based violence, and that experiences of gender-based violence make women in turn more vulnerable to future cycles (Rezwana and Pain 2021). Qualitative research from the Sindh province of Pakistan also suggested that women may experience emotional, physical, and sexual violence in the aftermath of climate-linked disasters (Memon 2020). Shelters may also put women and girls at increased risk of experiencing gender-based violence, particularly if they have unlit or insecure facilities or if men and women have shared sleeping quarters (Hussain 2015). Evidence from Tanzania suggests that flooding is not associated with an increase in domestic violence (Abiona and Koppensteiner 2018).

This suggests that there may be important culturally or locally specific factors that shape the risk of different types of violence in the aftermath of different types of disasters.

Learn More: Climate Disasters, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Evidence on disasters and gender**	For more about the evidence base around disasters and gender, data gaps, and policy recommendations, see the 2021 World Bank Group report *Gender Dimensions of Disaster Risk and Resilience: Existing Evidence.*	https://openknowledge.worldbank.org/handle/10986/35202
	**Flooding's effect on pregnancy and reproductive health**	*Flooding: what is the impact on pregnancy and child health?* (Mallett and Etzel 2018)	https://onlinelibrary.wiley.com/doi/full/10.1111/disa.12256
	**Local examples of gendered impacts of disasters**	For a case study of how disasters impact abortion access, see *Another disaster: Access to abortion after Hurricane Harvey* (Leyser-Whalen, Chaleshtori, and Monteblanco 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8018709/
		For more about gender, disasters, and climate resilience in Asia, see the UN report *Action not words: Confronting Gender Inequality through Climate Change Action and Disaster Risk Reduction in Asia*, available here (Dankelman 2016)	https://asiapacific.unwomen.org/en/digital-library/publications/2017/04/action-not-words
	**Impact of disasters and climate change on health systems**	*Impact of extreme weather events and climate change for health and social care systems* (Curtis et al. 2017)	https://doi.org/10.1186/s12940-017-0324-3

Changing Temperature: Heatwaves and Coldwaves

Heat exposure is associated with a range of negative health outcomes, including mortality due to heat stress and cardiorespiratory strain, heat stress and heat stroke, increased hospital visits, increased healthcare costs, and increased incidence of adverse mental health outcomes (Ebi et al. 2021). Though much of this morbidity and mortality can be averted through preparedness and averting exposure, without investment in heat management research and infrastructure, morbidity and mortality associated with exposure to extreme heat is likely to increase in the coming decades (Ebi et al. 2021). Exposure to extreme heat also threatens progress on key sustainable development milestones: in research on extreme heat in West Africa, researchers found that a 2 °C increase in temperature would increase the prevalence of stunting such that recent progress on improving childhood nutrition would effectively be reversed (Blom, Ortiz-Bobea, and Hoddinott 2022).

Compared to other climate-related hazards, it is relatively easier to generate comprehensive and robust indicator systems linking climate change and health outcomes for heat than for other hazards (Liu et al. 2021). Studies of heat exposure, particularly on maternal and child health, have focused heavily on high- and middle-income countries, with fewer studies from lower income regions, despite research suggesting that regions in the tropics including Africa, South Asia, and South America are more likely to experience dangerous heatwaves in the coming years (Dalugoda et al. 2022; Mora et al. 2017).

Gender and Heat-Related Morbidity and Mortality

Research from heatwaves in India and Korea suggest that women are at greater risk of mortality than men during heatwaves (Azhar et al. 2014; Son et al. 2012). Though this may be in part attributable to physiological differences between males and females, social norms and livelihood patterns likely factor more strongly into these differences (Chauhan 2021; Lundgren et al. 2013). In Malawi, for example, temperature shocks severely reduced household welfare and food consumption, and these effects were felt more severely in women-headed households and in patrilineal regions where women face land tenure insecurity and reduced investment in agricultural technologies (Asfaw and Maggio 2018).

Heat exposure affects human health in many different ways. In research on heat stress in Kuala Lumpur, researchers found a range of symptoms associated with heat exposure, which they classified as physical, psychosomatic, and psychological (Aghamohammadi et al. 2021). Physical symptoms of heat can include heat exhaustion and heat stroke, cramps, itchy skin, difficulty breathing, throat irrigation, and eye problems such as irritation, poor vision, or pain (Aghamohammadi et al. 2021). Psychosomatic symptoms can include difficulty sleeping, low energy, gastrointestinal distress, pain in the body, dizziness or fainting, headache, or a racing or pounding heart (Aghamohammadi et al. 2021). Psychological symptoms are include those associated with depression or anxiety, like

feelings of nervousness, fear, worry, disinterest in activities, or hopelessness (Aghamohammadi et al. 2021).

In their study, experience of sensory organ pain was significantly associated with gender, age, ethnicity, and time spent outside, and heat-related illnesses were significantly associated with age and ethnicity (Aghamohammadi et al. 2021). Research from Canada suggests that these experiences of heat can also negatively affect workers' productivity and income (Vanos, Vecellio, and Kjellstrom 2019).

Heat exposure is also associated with negative impacts on mental health. For more on how heat exposure is associated with mental health, see the Mental Health Spotlight.

Heat and Sexual and Reproductive Health and Rights

For more on how heat exposure is associated with sexual and reproductive health outcomes, see the Sexual and Reproductive Health and Rights spotlight.

Maternal and Child Health and Heat

Heat exposure carries significant risks for maternal health, given that it is associated with hypertension, gestational diabetes, placental abruption, preeclampsia and maternal stress (Giudice et al. 2021; Dalugoda et al. 2022; Shashar et al. 2020; He et al. 2016). Broadly, heat stresses poses a risk for pregnant women through several pathways, including biological pathways around increased body weight and temperature, decreased efficacy of sweating, blood flow, dehydration, and changes in metabolism and socioenvironmental pathways around heat exposure, labor strain, infectious disease exposure, and food insecurity (Dalugoda et al. 2022; Randell, Gray, and Grace 2020; Samuels et al. 2022).

Increases in climate associated heatwaves are likely to increase the risk of adverse neonatal health outcomes in low and middle-income countries in coming years, and despite fewer studies in low- and middle-income countries, research suggests that these countries experience the highest rates of adverse outcomes (McElroy et al. 2022). Heat exposure is risky for neonatal health, increasing the risk of premature birth, low birthweight, stillbirth (Giudice et al. 2021; Kuehn and McCormick 2017; Zhang, Yu, and Wang 2017; Poursafa, Keikha, and Kelishadi 2015; Ha et al. 2017; Rylander, Odland, and Sandanger 2013; Carolan-Olah and Frankowska 2014; Bekkar et al. 2020; Dalugoda et al. 2022; He et al. 2016). One study in the United States found that these risks were higher for those who were younger, Black, Hispanic, underweight, had Medicaid, drank alcohol, smoked, or had pre-existing or gestational conditions such as hypertension, diabetes, or preeclampsia (Basu et al. 2017). This suggests that there are important social, behavioral, and demographic risk factors that can further exacerbate the risks of climate change-associated heatwaves. Heat exposure is also associated with increased risk for fetal

congenital anomalies, such as heart defects and cataracts (Zhang, Yu, and Wang 2017; Van Zutphen et al. 2012; Lin et al. 2018).

These prenatal exposures may have long-lasting effects over the course of a lifetime. Prenatal heat exposure is associated reduced height, reduced educational attainment, and reduced earnings observed in large-scale studies in the United States and China (Isen, Rossin-Slater, and Walker 2017; Hu and Li 2019). Heat exposure after birth also affects children, with heat exposure associated with an increase of both chronic and acute malnutrition in the form of wasting and stunting in children between 3 and 36 months old in West Africa (Blom, Ortiz-Bobea, and Hoddinott 2022). However, this research did not examine how these risks might differ for male and female children.

In general, these adverse effects seem to begin at exposure to temperatures above 20 °C, increasing as temperatures rise, with greater risk when temperatures rise above 30 °C (Dalugoda et al. 2022). Sudden temperature changes may pose a higher risk for women who are pregnant, and acclimatization to temperature may also play a role in mitigating the risk of risk negative pregnancy outcomes (Bekkar et al. 2020; Giudice et al. 2021; Dalugoda et al. 2022). Climate change is also reducing the diurnal temperature range – that is, the difference between the temperature during the day and the temperature at night (McElroy et al. 2022). When the diurnal temperature range is smaller, and hot days are followed by warm nights, there is a greater risk of adverse maternal health outcomes (McElroy et al. 2022). Different outcomes are associated with different susceptibility windows, with earlier heat exposure in pregnancy more strongly associated with congenital anomalies and later exposure more strongly associated with preterm birth and stillbirth (Dalugoda et al. 2022; McElroy et al. 2022).

While evidence is stronger for the effects of heatwaves than coldwaves, cold temperature may also cause adverse maternal and infant health effects (Zhang, Yu, and Wang 2017). In the United States, exposure to cold early in pregnancy was associated with an increased risk of preterm birth, while exposure to cold late in pregnancy was associated with a decreased risk of early delivery (Ha et al. 2017). This is corroborated by similar research from China that also found an increased risk of preterm birth associated with cold exposure in the last four weeks of pregnancy (He et al. 2016). Researchers found that in Japan, exposure to cold weather shocks early in life was associated with stunting for both boys and girls, with prenatal exposure having a stronger effect on boys and postnatal exposure having a stronger effect on girls – and just like with heat waves have a stronger impact on typically cooler areas, cold waves seem to have a stronger impact on typically warmer areas (Ogasawara and Yumitori 2019).

Gender-Based Violence and Heat

Heat exposure may also increase the risk of interpersonal violence (Chersich, Swift, et al. 2019). Research across Africa suggests that increased heat is associated with increased conflict between farmers and herders, and that this conflict is likely to increase with climate change-associated temperature increases (Eberle, Rohner, and Thoenig 2020). Climate change can be connected to increased violence through three pathways around direct effects, exacerbated predispositions, and group conflict (Miles-Novelo and Anderson 2019).

The effects of heat-related violence can also be gendered. Heatwaves have also been associated with an increased risk of experiencing interpersonal violence for women, with risk of police reports increasing one day after the heat wave, femicide increasing three days after, and helpline calls increasing five days after (Sanz-Barbero et al. 2018).

Learn More: Health and Extreme Temperature

	THEME	LEARNING RESOURCE	LINK
	**Health effects of heat**	For a synthesis of the literature around the health effects of heat, see *Hot weather and heat extremes: health risks* (Ebi et al. 2021)	https://www.sciencedirect.com/science/article/pii/S0140673621012083
	**How heat impacts pregnancy outcomes**	For more on the biological pathways that link heat exposure with negative pregnancy outcomes, see *Physiological mechanisms of the impact of heat during pregnancy and the clinical implications: review of the evidence from an expert group meeting* (Samuels et al. 2022)	https://link.springer.com/10.1007/s00484-022-02301-6
	**Heat in the workplace**	*The impacts of climate change on occupational heat strain in outdoor workers: A systematic review* (Habib et al. 2022)	https://www.sciencedirect.com/science/article/pii/S2212095521000018

Drought and Water Access

Though droughts – periods of time with unusually low rainfall – occur naturally, they are already increasing in duration and severity due to climate change, and they are expected to worsen (Mukherjee, Mishra, and Trenberth 2018; Ault 2020). Because drought affects food security, water availability, mental health, and farming practices, visit each of these subsections to learn more about how gender and climate affect drought and health.

At the same time, climate change is shifting water access in various ways, including driving water scarcity and poor water quality (e.g., contaminated or salinated water) (Chauhan 2021; World Health Organization 2014). Climate change and water availability are linked in complex pathways, as changes in timing and quantity of precipitation are mediated by policy, infrastructure, individual and system factors, all of which can influence health risks (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022).

Gender and Drought-Related Morbidity and Mortality

Drought's effects on health are complex and often indirect, as drought shapes water availability, food security, vector exposure, and other mediating determinants of health (Ebi and Bowen 2016; Salvador et al. 2020). For example, climatic, health, environmental, and social factors all shape how drought is experienced (Salvador et al. 2020):

A synthesis of the literature on drought suggests that a range of factors can shape vulnerability to drought hazards, with those who have livelihoods dependent on agriculture, women (particularly pregnant women), children, the elderly, those with chronic conditions, and those already living in geographic regions facing food insecurity having higher vulnerability (Salvador et al. 2020).

Reduced water availability both increases the risk of using untreated water sources – which in turn increases risk for water-associated diseases like diarrhea and cholera – and increases the labor burden on women who must walk greater distances to fetch water or fetch water more frequently (Chauhan 2021; World Health Organization 2014; Shrestha and Dhakal 2019). Fetching water over longer distances does not just affect the allocation of women's time: it can also cause damage to the spine, neck, and lower back (Chauhan 2021; World Health Organization 2014). The risks and vulnerabilities of water shortages are often not distributed evenly among women: in Burkina Faso, other indicators of difference such as ethnicity shaped women's water usage and vulnerability to water shortages (Dickin, Segnestam, and Sou Dakouré 2021).

Gender Equity and Coping with Drought and water access challenges

In addition to direct and indirect health effects, drought can also exacerbate vulnerabilities. In South Africa, female-headed households were more affected by rainfall variation than households that had both a male and female adult; women who were widows, left behind as others migrated, or never married were especially vulnerable (Flatø, Muttarak, and Pelser 2017). Male-headed households were also more vulnerable than dual-headed households, but this vulnerability was largely attributable to decreased income (Flatø, Muttarak, and Pelser 2017).

Gender roles and responsibilities also shape how people experience climate change's effects on water access and quality (Chauhan 2021):

Table 2 Gender roles and differentiated vulnerabilities to water challenges Source: Chauhan 2021

<table>
<tr><th>Sector</th><th colspan="2">Major Gender Roles*</th><th>Climate Change Impacts</th><th>Gendered Vulnerability to that Impact</th></tr>
<tr><td rowspan="2">Water</td><td>Men</td><td>• Irrigation of cash crops
• Manufacturing</td><td rowspan="2">Increased water stress due to droughts, erratic rainfall and declining ground water</td><td>• Increased conflicts over scarce water resources</td></tr>
<tr><td>Women</td><td>• Drinking and domestic use
• Irrigation of food crops</td><td>• Increase in time and distance travelled for safe water
• Diversion of water will lead to lesser water available for food crops</td></tr>
<tr><td colspan="5">* The gender roles mentioned here are not fixed and need to be contexualized. These are just indicative of what the differentiated gender roles could be.</td></tr>
<tr><td colspan="5">Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.</td></tr>
<tr><td colspan="5">Participatory Action Tip: You use this framework with a group to think about gender roles in your community, and how those roles are connected to climate change and climate solutions. For more guidance on this, see Exercise 6 in Module 1 of ARROW's Training Manual on Gender and Climate Change Resilience as well as the Identifying Appropriate Climate Solutions section of Chapter 3 of this resource guide.</td></tr>
<tr><td colspan="5">Note: for more on gendered impacts of climate-related conflict, shifts in farming, and increased livelihood and household burdens, see those sub-sections in Chapter 1, Part 2 of this resource guide.</td></tr>
</table>

Because men and women may use and fetch water differently, they are often affected by water shortages in different ways. A study of rural rice farmers in Ghana found that male- and female-headed households faced risks of water borne disease, and both men and

women fetch water from untreated sources, but for different purposes and in different ways: men fetch water for construction with bicycles and motorcycles and are less concerned about water quality, while women fetch water on foot for household tasks and require high quality water (Alhassan, Kuwornu, and Osei-Asare 2018). Men traveled further for water than women and tended to store more water (Alhassan, Kuwornu, and Osei-Asare 2018). Another similar study in a different region of Ghana found similar effects, with women affected more heavily by water shortages in part due to their limited access to resources like bicycles or motorcycles (Jeil, Abass, and Ganle 2020).

Women in coastal communities face unique climate change vulnerabilities; in a study of women in coastal Nigeria, women were well-educated about climate change even as they were consistently excluded from positions of power and faced restrictions in resources or assets (Akinsemolu and Olukoya 2020).

Drought, Water, and Sexual and Reproductive Health and Rights

Climate change's impact on water quality and availability can have wide-ranging effects on sexual and reproductive health. For example, not having enough water can increase women and girls' hygiene burden, especially during menstruation (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022). Other relationships described below include those around child marriage, maternal and child health, and gender-based violence.

Child Marriage and Water Challenges

Droughts also have differential effects on child marriage trends. In sub-Saharan Africa, particularly in areas where a bride price is paid from the groom's family to the bride's family, droughts increase child marriage risk by about 3% (Corno, Hildebrandt, and Voena 2017). In India, where a dowry is paid from the bride's family to the groom's family, drought decreases child marriage by about 4% (Corno, Hildebrandt, and Voena 2017). In Sub-Saharan Africa, early marriage in a drought is associated with a 4% increase in probability of childhood pregnancy (Corno, Hildebrandt, and Voena 2017). Women who marry in droughts in sub-Saharan Africa tend to be less educated and have less decision-making power, but women who marry in droughts in India tend to be higher educated with greater decision-making power (Corno, Hildebrandt, and Voena 2017).

Maternal and Child Health in Droughts and Water Challenges

Experience of a drought can have lifelong effects. In a study of drought's health effects in South Africa, exposure to drought in infancy was associated with a 3.5-5.2% increase in disability later in life, and that males experienced the negative health effects of droughts far more strongly than females (Dinkelman 2015). This contrasts with other research in Asia that has noted greater health impacts of droughts on women, largely due to resource allocation and gender preferences (Dinkelman 2015).

In coastal Bangladesh, increased salinity is associated with increased risk of gestational hypertension and pre-eclampsia (A. E. Khan et al. 2014). A study in Bangladesh found that women often had to collect water from long distances, with over two-thirds of women reporting fetching water when they were pregnant (N. Khan 2015).

Gender-Based Violence, Drought, and Water

Data are mixed regarding whether experiencing a drought increases the risk of domestic violence. In a study in Tanzania, researchers found that drought was correlated with domestic violence, with a 15% decrease in average precipitation associated with a 13.1% increase in domestic violence (Abiona and Koppensteiner 2018). But in another study on rainfall shocks and intimate partner violence across sub-Saharan Africa, researchers found no robust relationship between domestic violence and drought (Cools, Flatø, and Kotsadam 2020). Water insufficiency also can increase women's risk of experiencing violence, interpersonal conflict, and wildlife attacks (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022).

Learn More: Drought and Health

	THEME	LEARNING RESOURCE	LINK
	**Health effects of drought**	See *Effects of droughts on health: Diagnosis, repercussion, and adaptation in vulnerable regions under climate change – Challenges for future research* (Salvador et al. 2020)	https://www.sciencedirect.com/science/article/pii/S0048969719349046
	**Water and nutrition**	For a review of how water quality and access affects nutrition, see (Miller et al. 2021)	https://academic-oup.com/advances/article/12/6/2525/6322255?login=true
	**Water and reproductive health**	For more on how water quality connects to reproductive health and rights for marginalized women, see (Mosley, Bouse, and Stidham Hall 2015)	https://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC6141208&blobtype=pdf

Ecosystem Services, Biodiversity, Disease Vectors, and Human-Wildlife Interactions

Ecological degradation can have many different effects on human health as ecosystem services functioning declines, biodiversity is lost, disease vectors change their habitat, and human-wildlife interactions increase. For example, forest loss, mangrove destruction, degradation of coral reefs, and wildfires can increase emissions, degrade water and air quality, prompt soil erosion, shift human-wildlife relationships, worsen mental health, and disrupt access to food, medicinal, and economic resources (Machalaba et al. 2021).

Gender and Environmental Change-Related Morbidity and Mortality

As temperature, hydrology, and ecosystems change in associated with climate change and the development processes that underly climate change, pathogen and vector exposures are also changing, both through novel species distributions and the emergence of new species altogether (Giudice et al. 2021). Women seem to be inequitably susceptible to climate-associated shifts in vector ecology (Giudice et al. 2021). Vector-borne diseases such as malaria, dengue, and Zika have serious adverse effects in pregnancy, and exposure to these diseases is projected to increase in the coming decades (Giudice et al. 2021; Machado et al. 2013; W. A. Khan et al. 2014; Schantz-Dunn and Nour 2009; Chibueze et al. 2017; S. J. Ryan et al. 2021; Campbell-Lendrum et al. 2015). This is especially critical given that those who are pregnant have approximately double the likelihood of attracting mosquitos compared to others (Naswa 2021). While climate change may increase exposures, it can also have complex effects, and might not necessarily mean increased rates of insect-borne disease (Mora et al. 2022; Kelman 2022).

Other forms of human-wildlife interaction may also increase as a result of expanding human or wildlife populations, in the face of climate events such as drought, or alongside landscape changes prompted by environmental degradation or conservation initiatives (Mukeka et al. 2019). These conflicts can have complex downstream effects, including retaliatory killings, zoonotic disease spread, or increases in child labor (Abrahms 2021). In some contexts, women may be more vulnerable to human-wildlife conflicts than men. For example, qualitative research around conservation programming in India in response to degradation of tiger habitat suggested that these political and ecological changes increased women's risk of attack (Doubleday 2020). In Kenya, gendered impacts of human-wildlife conflict can be both direct and indirect, as women experience associated food insecurity and fear (Khumalo and Yung 2015). The role of gender in human-wildlife conflict remains relatively understudied, however (Nyhus 2016).

Emerging infectious diseases can occur as a result of climate change, and they can also contribute to climate change or be exacerbated by climate change's effects on socioeconomic and health systems. For example, the COVID-19 pandemic both contributed to and was shaped by climate risks to health around the world: poor air quality worsened

COVID-19 risks, climate disasters made implementing COVID-19 health protocols challenging or even impossible, and slowdowns in tourism put environmental protections and progress in reducing single-use plastics at risk (Machalaba et al. 2021).

Gender Equity and Environmental Change

Habitat and biodiversity loss pose health risks through changing exposures – but they also affects food security, income, traditional medicine, and cultural practices (Kline 2021). In many rural regions of the world, women and girls fulfill traditional gender roles reliant on the availability of natural resources such as forest products and water, which means that they are disproportionately affected by the degradation of ecosystems and ecosystem services associated with climate change (Ganguli 2021; Dickin, Segnestam, and Sou Dakouré 2021; Shrestha and Dhakal 2019).

Despite gendered differences in exposures and experiences of ecosystem degradation, gender is not always integrated into this space of climate research. For example, a recent call to action oriented towards addressing land-use related zoonotic spillover called for holistic, integrated, and evidence-based approaches to policy and research oriented towards improved ecosystem connectivity and land management but did not attend to gendered differences in exposure or susceptibility (Plowright et al. 2021).

When it comes to land management – such as community forest management practices – women's knowledge of the environment is often not taken into account when women are not given decision-making power (H. C. P. Brown 2011). In the REDD+ programs, for example, women were often left out of decision-making spaces (H. C. P. Brown 2011). This is particularly important given recent research that suggests that environmental degradation is associated with increased gender-based violence (Castañeda Carney et al. 2020).

Learn More: Ecosystem Change

	THEME	LEARNING RESOURCE	LINK
	**Gender-based violence and environmental change**	*Gender-based violence and environmental linkages: The violence of inequality* (Castañeda Carney et al. 2020)	https://portals.iucn.org/library/node/48969
	**Climate change and infectious disease**	*Climate change and vector-borne diseases: what are the implications for public health research and policy?* (Campbell-Lendrum et al. 2015)	https://royalsocietypublishing.org/doi/full/10.1098/rstb.2013.0552
	**Local example of ecosystem loss and women's lives in the Pacific**	*Highlighting Women's Voices in a Climate Change and Livelihood Narrative: A Case Study in a Rural Fiji Community* (Kline 2021)	https://deepblue.lib.umich.edu/handle/2027.42/167293

Air Quality

Air pollution and climate change are deeply related, both through 1) exposures prompted by the processes that drive climate change, such as fossil fuel burning, 2) through extreme events produced by climate change, such as wildfires and flooding, and 3) through processes that may contribute to environmental degradation, such as traditional cooking practices that rely on firewood to cook indoors (Giudice et al. 2021).

Gender and Air Quality-Related Morbidity and Mortality

Women are at particular risk of adverse health outcomes associated with poor air quality because they experience greater retention of particulate matter in their lung tissue (Sorensen, Murray, et al. 2018; L. H. Chen et al. 2005).

Air Quality and Sexual and Reproductive Health and Rights

Maternal and Child Health and Air Quality

Exposure to poor air quality associated with reproductive health outcomes such as reduced fertility and maternal and neonatal health outcomes including hypertension, stillbirth, preterm birth, miscarriage, and congenital anomalies (Sorensen, Murray, et al. 2018; Giudice et al. 2021; Bekkar et al. 2020; Lamichhane et al. 2015; Koman et al. 2018; Carré et al. 2017; Mahalingaiah et al. 2016; Gaskins et al. 2018; Enkhmaa et al. 2014; Xue et al. 2019; DeFranco et al. 2016; Ha et al. 2014; Li et al. 2017). Though air quality research often comes from higher-income countries, research around associations between exposure to fine particulate matter in the air and preterm birth suggests that South Asia, East Asia, North Africa/Middle East, and West Sub-Saharan Africa have the highest burden of air quality-associated preterm birth (Malley et al. 2017).

Exposure to air pollution can also affect consecutive pregnancies (Giudice et al. 2021; Mendola et al. 2019). As with temperature, women do seem to adapt and acclimatize to air pollution exposures, with one study from California finding that women from areas with more frequent smoke exposure were at lower risk for adverse maternal and neonatal outcomes than those from regions with less frequent exposures (Heft-Neal et al. 2022). With that said, though chronic exposure lessens the severity of maternal and neonatal health risks from acute exposures as compared to those who do not experience chronic exposures, chronic exposure does not eliminate the risk of acute exposures altogether and it carries its own long-term health consequences (Heft-Neal et al. 2022).

Learn More: Air Quality and Health

	THEME	LEARNING RESOURCE	LINK
	**Climate change, air quality, and health**	*Interactions of Climate Change, Air Pollution, and Human Health* (Kinney 2018)	https://doi.org/10.1007/s40572-018-0188-x
	**Example of air and climate policy in Africa**	*Air Quality in Africa: Public Health Implications* (Abera et al. 2021)	https://doi.org/10.1146/annurev-publhealth-100119-113802

Toxic Chemicals

Climate change and toxic chemical exposures are linked and interactive: the economic drivers of climate change may emit toxic chemical exposures as part of their production process, toxic chemicals may be released in anticipation of or following extreme weather events, rising temperatures may increase toxic chemical exposures, and toxic chemical exposures can reduce physiological adaptation to climate change (Giudice et al. 2021; Schiedek et al. 2007; Noyes et al. 2009). These chemicals can include phthalates, flame retardant chemicals, and perfluorinated compounds, and have been associated with endocrine disruption and associated health problems such as obesity, diabetes, cancer, infertility, and neurodevelopmental disorders (Giudice et al. 2021; Street et al. 2018; Sirohi, Ramadhani, and Knibbs 2021; Vancamp et al. 2021; Di Renzo et al. 2015). Exposure to endocrine disrupting chemicals (EDCs) can prompt epigenetic changes with effects on fertility, obesity, metabolism, and other aspects of endocrine functioning experienced across life stages (Street et al. 2018).

Researchers from Malaysia have suggested that climate change's effects on the endocrine system may play a role in declining fertility within the country, alongside other social, economic, ecological, and health shifts (Jegasothy et al. 2021). Research on the Mahakam River in Indonesia identified a range of endocrine-disrupting chemicals in levels exceeding safe drinking water guidelines (Hadibarata, Kristanti, and Mahmoud 2019). Climate change can also increase human exposures to contaminants in soil, with uncertain effects on human health (Biswas et al. 2018). Microplastic accumulation also may be a source of toxic chemical exposure with potentially harmful health effects (Shen et al. 2020).

How humans respond to other climate threats – such as novel exposures to disease vectors like mosquitos – can also carry risks of chemical exposure. Toxicological research on the pesticide used to control mosquitos during the Zika outbreak in Brazil suggests that the pesticide could have had additional harmful effects on fetal neurodevelopment and aggravate microcephaly attributed to the virus (Vancamp et al. 2021). In the Arctic, climate change is directly and indirectly influencing exposure and accumulation of persistent organic pollutants with unclear future effects as Arctic ecosystems change (Borgå et al. 2022).

Learn More: Toxic Chemicals

	THEME	LEARNING RESOURCE	LINK
⊕	**EDCs and human health**	*Current Knowledge on Endocrine Disrupting Chemicals (EDCs) from Animal Biology to Humans, from Pregnancy to Adulthood* (Street et al. 2018)	https://www.mdpi.com/1422-0067/19/6/1647
🗺	**Local example of pollutants in the Arctic**	*The influence of global climate change on accumulation and toxicity of persistent organic pollutants and chemicals of emerging concern in Arctic food webs* (Borgå et al. 2022)	https://pubs.rsc.org/en/content/articlelanding/2022/em/d1em00469g

Ecosyndemics and Compounding Risks

Climate change is prompting widespread, interactive, concurrent shifts to weather patterns and ecosystems in both chronic and acute ways. The term *syndemics* has been used to describe synergistic health risks and patterns that are interactive and compounding, producing novel and more serious health effects (Singer 2010). The term ecosyndemics specifically refers to those syndemics associated with ecological shifts and climate change (Singer 2013).

For example, while air pollution and heat both pose serious adverse maternal and neonatal health risks, they generate synergistic – and more serious – health risks when combined (Giudice et al. 2021; Wang et al. 2020; Kwag et al. 2021). Climate-associated increases in drowning are attributable not only to flooding, but also migration, heat, and drought, which can produce riskier behavior around water and water-related activities such as fishing (Sindall et al. 2022). Extreme heat exacerbates the risks of COVID-19 for both patients and healthcare workers, exacerbating vulnerabilities for the elderly and producing competing and conflicting approaches to mitigating each hazard (Bose-O'Reilly et al. 2021). Obesity, undernutrition, and climate change have also been described as syndemics, with differential and more serious consequences for women (Dietz and Pryor 2022; Swinburn et al. 2019). Though the use of the term *syndemic* in this context was critiqued for being too all-encompassing and not sufficiently localized – and not sufficiently engaging with *how* these health conditions interact – it remains useful theoretically and politically (Mendenhall and Singer 2019).

Recent research has suggests that over half of known human pathogenic diseases can be made worse by climate change through a range of complex and interactive pathways, including increased closer proximity of pathogens to people, closer proximity of people to pathogens, strengthened pathogens, and increased human vulnerability (Mora et al. 2022). However, the complexity of these pathways, and of pathogen functioning, means that climate change does not universally or necessarily make infectious diseases, including insect-borne diseases, worse (Mora et al. 2022; Kelman 2022)

Thinking of climate-associated health risks as syndemics, and not simply as discrete, triggering events, helps illustrate how risks compound and interact to produce differential and accelerated threats over time.

Learn More: Ecosyndemics

	THEME	LEARNING RESOURCE	LINK
	**Understanding syndemics**	*Are there global syndemics?* (Singer, Bulled, and Leatherman 2022)	https://doi.org/10.1080/01459740.2021.2007907

Health Spotlight: Sexual and Reproductive Health

Climate change has serious and significant negative effects on sexual and reproductive health (Roos 2022). Climate change directly affects reproductive health issues including fertility, prenatal outcomes, mental health, sexual and reproductive health and rights, gender-based violence, and survival (Giudice et al. 2021; Roos 2022; Casey et al. 2019; Women Deliver 2021). Climate change can also affect women's ability to seek and access reproductive health care, through factors including damage to infrastructure and health systems, shifting political priorities, increased women's labor burden, and increased financial strain (Sorensen, Murray, et al. 2018; van Daalen et al. 2020; Roos 2022; Chauhan 2021; Women Deliver 2021). When a climate change-associated disaster affects a community in which reproductive healthcare access is already limited, negative sexual and reproductive health outcomes are exacerbated (Giudice et al. 2021).

HIV/AIDS and Climate Change

HIV/AIDS management offers a striking example of how climate change can negatively affect sexual and reproductive health outcomes. Lieber et al. proposed that climate change and HIV transmission are linked through four main, interconnected, pathways: increased food insecurity, increased infectious disease prevalence, increased migration, and eroded health infrastructure (Lieber et al. 2021). Guinto et al. updated Lieber et al.'s framework to forward key environmental changes, more clearly trace pathways connecting climate and HIV, highlight different HIV outcomes associated with climate vulnerability, forward social determinants of health, and emphasize how HIV can impact climate (Guinto et al. 2022).

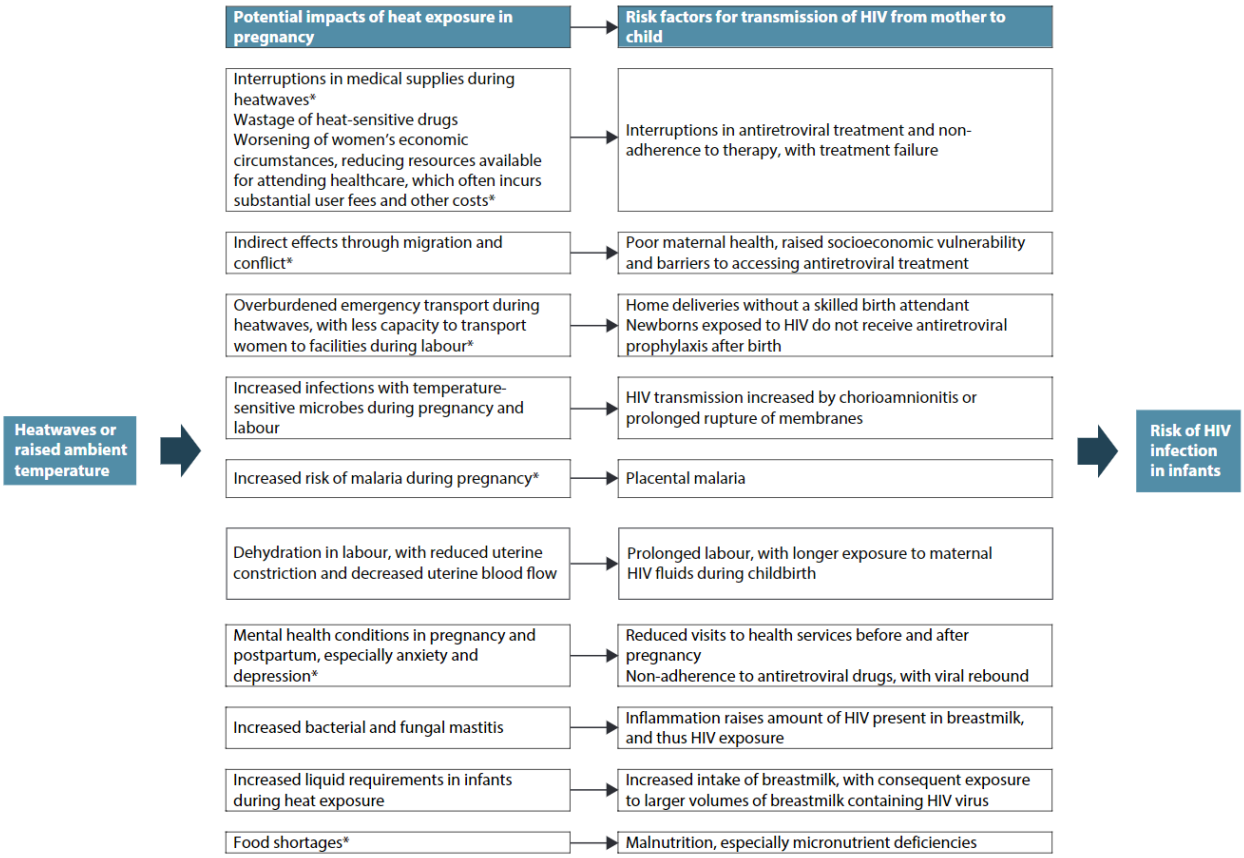
During a drought in Lesotho, adolescents living in rural areas had higher HIV prevalence, earlier sexual debut, and lower educational attainment than those not affected by drought, and migration was associated with a two-fold increase in HIV odds among young people (Low et al. 2019). Drought in Sub-Saharan Africa may also be connected with reduced adherence to antiretroviral treatment through complex shifts in social and economic situations (Orievulu et al. 2022). Drought is also associated with reduced institutional capacity to respond to HIV (Orievulu and Iwuji 2022).

Temperature models show similar trends, predicting an addition 11.6 – 16 million HIV cases in Sub-Saharan Africa by 2050, with higher temperatures associated with greater HIV prevalence across the region, especially for young people, driven by both economic and behavioral factors (Baker 2020). In the Democratic Republic of the Congo, seasonality, air pollution, and water pollution were associated with Vitamin D deficiency, and vitamin D deficiency was significantly higher among those who were HIV-positive (Madone et al. 2019).

In Botswana, seasonal variation was more strongly associated with adverse birth outcomes for women with HIV than women without HIV, raising key questions about how greater seasonal extremes might affect maternal and newborn health (Caniglia et al. 2021). Heat

exposure may also threaten progress around the prevention of mother-to-child transmission of HIV (Chersich 2019):

Figure 5. Heat exposure and prevention of mother-to-child transmission of HIV Source: Cherisch 2019



Family Planning and Other Sexual and Reproductive Health Services in a Changing Climate

Pre-existing vulnerabilities due to social inequities and gendered responsibilities exacerbate the climate-related sexual and reproductive health risks that women and those who are pregnant face (H. C. P. Brown 2011; Giudice et al. 2021; Chauhan 2021; Women Deliver 2021). In humanitarian settings – such as in the aftermath of a climate change-associated extreme weather event – sexual and reproductive health services for adolescents and young people are often especially limited (Jennings et al. 2019). Research and programming for young people in these settings often focuses more heavily on pregnancy prevention, STIs, maternal and neonatal health, and prevention of gender-based violence, but Jennings et al. did not identify any studies of other important aspects of SRH services such as abortion services, fistula, or female genital mutilation (Jennings et al. 2019). Young people who are LGBTQI or have disabilities are also neglected in research and programming in these contexts, and programming often does not target boys, especially regarding prevention of sexual and gender based violence (Jennings et al. 2019).

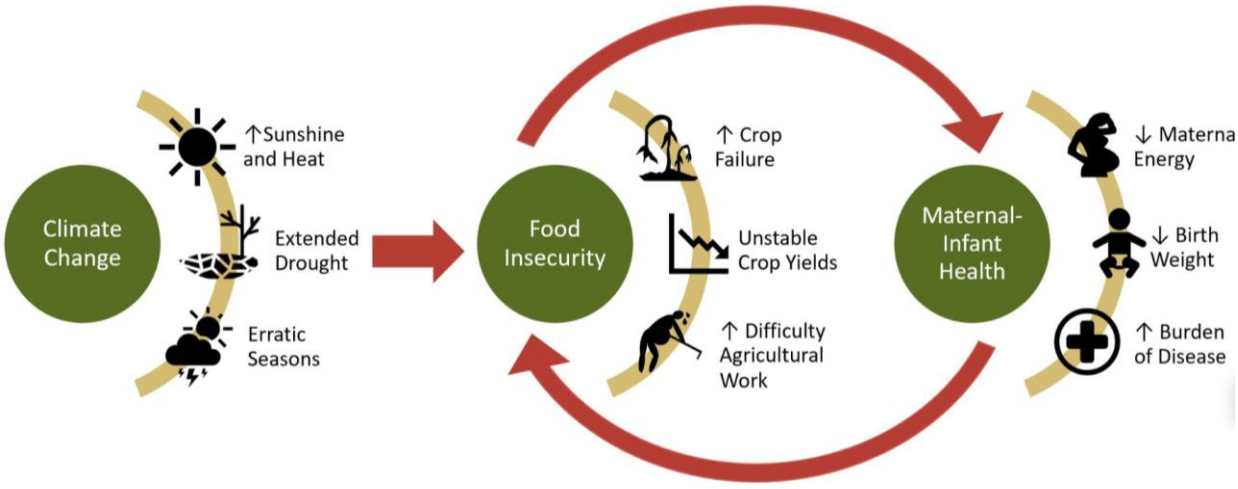
Maternal and Child Health and Climate change

As previously discussed, climate change-associated shifts in temperature, nutrition, vectors, and air quality can affect obstetric outcomes, including preeclampsia, eclampsia, and preterm birth (Sorensen, Murray, et al. 2018; van Daalen et al. 2020; Poursafa, Keikha, and Kelishadi 2015). Rising sea levels can increase saltwater intrusion into groundwater, which is associated with increased risks during pregnancy for experiencing preeclampsia and hypertension (A. E. Khan et al. 2014).

Climate affects maternal and child health outcomes through complex pathways. Recent research from Ethiopia found connections between exposure to high temperatures in utero and childhood stunting, mediated through several maternal health pathways around food security, infectious disease exposure, heat stress, and labor strain. (Randell, Gray, and Grace 2020).

These outcomes can also be considered through a food security lens. Climate-associated food insecurity also poses a serious risk to women who are pregnant, with research from Uganda suggesting that food insecurity threatens maternal and child health outcomes despite improvements in antenatal care, with the effects felt even more severely for women who are Indigenous (Bryson et al. 2021).

Figure 6. Climate change and maternal and child health outcomes Source: Bryson et al. 2021



Climate change poses urgent risks for women in the present, but also has serious intergenerational consequences attributable prenatal exposures that increase lifetime risk for conditions such as obesity, diabetes, congenital anomalies, and neurodevelopmental disorders and will, in turn, affect the next generation's capacity to adapt and survive in a changing climate (Giudice et al. 2021; Watts et al. 2019; 2021; Pacheco 2020; Rossa-Roccor, Giang, and Kershaw 2021).

For more on how disaster and extreme temperatures affect maternal and neonatal health, see those subsections of this report.

Learn More: Sexual and Reproductive Health and Climate change

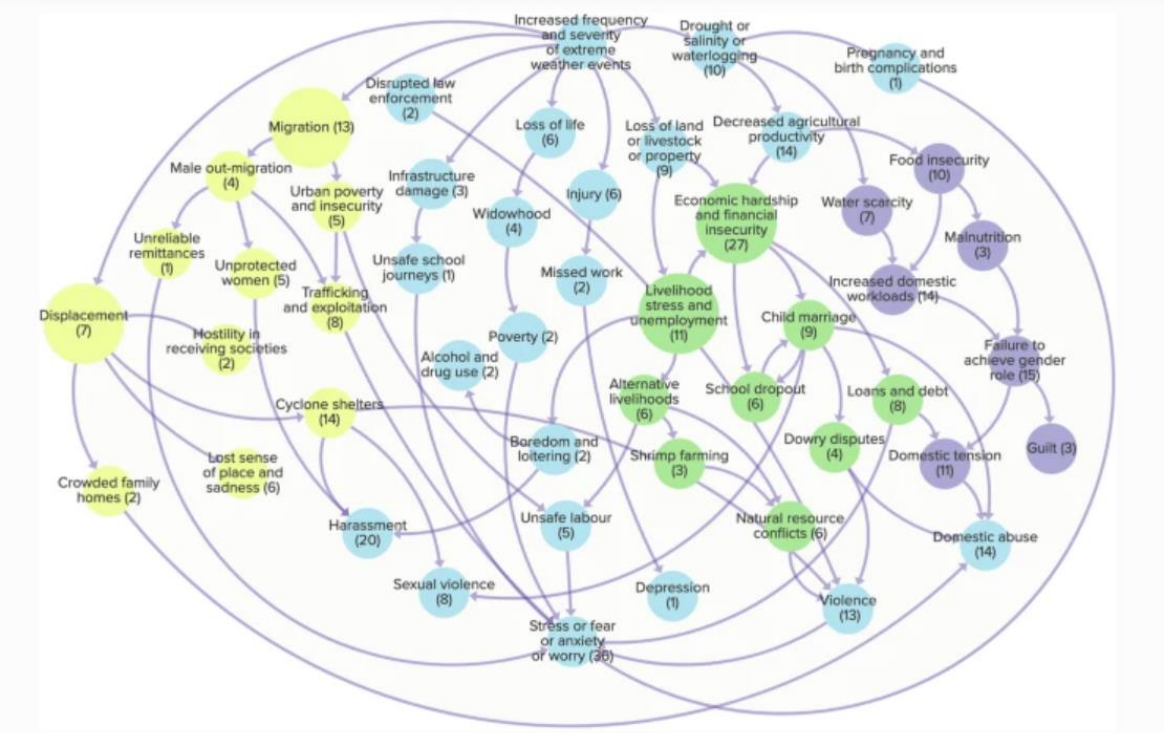
	THEME	LEARNING RESOURCE	LINK
	**Review of research on sexual and reproductive health and climate change**	For a review of recent research on sexual and reproductive health and climate change, see Women Deliver's report *The link between climate change and sexual and reproductive health and rights: An evidence review* (Women Deliver 2021)	https://womendeliver.org/wp-content/uploads/2021/02/Climate-Change-Report.pdf
		For a scoping review of women's health and climate change, see *Climate Change and Women's Health: A Scoping Review* (Desai and Zhang 2021)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8414962/
	**Climate change and HIV**	For more on how climate change and HIV transmission are related, see *The Synergistic Relationship Between Climate Change and the HIV/AIDS Epidemic: A Conceptual Framework* (Lieber et al. 2021)	https://link.springer.com/article/10.1007/s10461-020-03155-y
	**Linking reproductive justice and climate justice**	*How reproductive justice is climate justice* (Funes 2022)	https://atmos.earth/abortion-climate-justice-reproductive-justice/
	**Local case studies around reproductive health**	For research on how climate change is affecting women's reproductive health in Mozambique and Bangladesh, see *New research is in: Climate change impacts women's sexual and reproductive health* (Ipas 2022)	https://www.ipas.org/our-work/climate-justice/climate-change-impacts-womens-sexual-and-reproductive-health/
		To learn more about how climate change disasters affect women's sexual and reproductive health rights (SRHR) in Pakistan, see ARROW's 2015 scoping study of post-disaster interventions in the Sindh province of Pakistan	https://arrow.org.my/wp-content/uploads/2016/05/Climate-Change-and-SRHR-Scoping-Study_Pakistan.pdf
		ARROW and PATH's scoping study of SRHR among women fishers in the Philippines facing sea level rise	https://arrow.org.my/wp-content/uploads/2016/05/Climate-Change-and-SRHR-Scoping-Study_Philippines.pdf
		For a case study on abortion access and disaster, see *Another disaster: Access to abortion after Hurricane Harvey* (Leyser-Whalen, Chaleshtori, and Monteblanco 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8018709/

Health Spotlight: Mental Health

Climate change is already producing negative effects on mental health (Charlson et al. 2021). Because of its profound disruption of social and environmental spheres, climate change is projected to have significant mental health effects in the future (Hrabok, Delorme, and Agyapong 2020). While research on climate and mental health is increasing, there are still important gaps in scientific knowledge (Cianconi, Betrò, and Janiri 2020; Hwong et al. 2022). Ensuring that climate adaptation and resilience programming has co-benefits for mental health and social equity may help mitigate some of the negative mental health effects of a changing climate (Lawrance et al. 2021).

Connections between climate change and mental health follow complex pathways. In research on mental health and climate change in Bangladesh, researchers modeled the interconnected ways climate change affects mental health (Hayward and Ayeb-Karlsson 2021):

Figure 7. Mental health effects of climate change in Bangladesh Hayward and Ayeb-Karlsson 2021. No changes made. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/



A systems diagram outlining the mental health effects of climatic changes in Bangladesh. Illustration of the linkages between climatic changes and mental wellbeing in Bangladesh. Key thematic areas are grouped by colour, while red asterisks highlight factors where gender vulnerability plays an important role in mediating risk to wellbeing. The numbers in brackets indicate the amount of publications from the systematic review that describe each and every factor (authors' own creation)

In a literature review on the mental health effects of drought, researchers found a range of characteristics that contributed to vulnerability, including living in a rural area, being dependent on farming or agriculture, being Indigenous, being in a community where mental health issues were stigmatized, lacking knowledge about mental health issues and services, previous experience of mental health issues and/or adverse life events, and exposure to extended, intense, or severe drought (Vins et al. 2015).

Gender, Mental Health, and Climate Change

As with other health effects associated with climate change, the mental health risks of climate change do not seem to be evenly distributed, and risk factors such as gender, income, and pre-existing mental health conditions may exacerbate risks (Hrabok, Delorme, and Agyapong 2020). Some research has suggested that men are more likely to experience certain forms of climate-related mental health problems such as suicide and depression (World Health Organization 2014; van Daalen et al. 2020; Ganguli 2021; Sorensen, Murray, et al. 2018; Kennedy and King 2014; Thiery et al. 2017). However, others have suggested that women may be more likely to experience mental health effects of climate change (Cianconi, Betrò, and Janiri 2020). Research on the mental health experiences of children in low and middle income countries after climate-related disasters is limited, but suggests that post-traumatic stress disorder and depression are major outcomes (Sharpe et al. 2022). Mental health research in this context also often focuses on pathological outcomes, rather than resilience or community cohesion (S. Chen et al. 2020; Eastin 2018).

Overall, each 1 °C increase in temperature is associated with a 2.2% increase in mental health-associated mortality and a 0.9% increase in mental health-associated morbidity (Liu et al. 2021). Increased temperature is associated with increased suicide rates in the U.S. and Mexico (M. Burke et al. 2018); this trend has not been studied in LMICs and Burke et al.'s study did not attend to gender, though the authors noted that in general, men commit suicide more. Other work has associated male gender, temperature, and air quality with suicide attempts (Aguglia et al. 2021). Recent research from California has suggested that increased temperatures are associated with an increased risk in emergency room visits for mental health disorders, self-injury/suicide, and intentional injury/homicide, with those who are white, Hispanic, aged 16-18, or female at higher risk compared to other groups (Basu et al. 2018). Other recent research from California has similarly suggested an association between ozone and fine particulate matter and emergency room visits for mental health, with overall higher risks for visits associated for females and those who were Asian or Hispanic (Nguyen, Malig, and Basu 2021). A third study from California also found that increases in carbon monoxide and nitrogen dioxide were associated with increases in emergency room visits for homicide/inflicted injury, which children, males, and Hispanics at elevated risk (Thilakaratne, Malig, and Basu 2020). These trends may follow

complex biological pathways, as patients experience shifts in metabolism and hydration in the face of heatwaves, and climate change seems to be increasing the severity of connections between heat and mental health (Deol 2022).

Climate-Specific Emotions

Climate-specific emotional experiences, such as climate anxiety, solastalgia, and climate grief, are also being increasingly recognized (Comtesse et al. 2021; Galway et al. 2019; Cunsolo and Ellis 2018; Cunsolo et al. 2020; Ojala et al. 2021; Walpole and Hadwen 2022). In rural India, for example, environmental changes – and the patterns of life and livelihoods that have shifted with these changes – produce emotional distress, worries, and a sense of loss (Kumar 2018). Climate-related anxiety is often higher among younger generations than older generation (Swim et al. 2022). However, it is important to recognize that in many cases, these experiences are not pathological but rather are normative, functional responses to ecological change (Comtesse et al. 2021; Cunsolo et al. 2020). Research on mental health following disasters also suggests that resilience is more prevalent than mental disorders, and that assessments of mental disorders fail to capture the process of adaptation (S. Chen et al. 2020). For psychologists, paying attention to best practices in climate communication, the diversity of climate outcomes, and the importance of both induvial and community resilience in the face of climate change and strengthen their ability to respond to clients experience climate-related distress (Mah et al. 2020).

Learn More: Mental Health and Climate Change

	THEME	LEARNING RESOURCE	LINK
	**A review of climate change and mental health knowledge**	For a review of research methods and priorities around climate and mental health, see *Climate change and mental health research methods, gaps, and priorities: a scoping review* (Hwong et al. 2022)	https://www.sciencedirect.com/science/article/pii/S2542519622000122
		The WHO's 2022 policy brief on mental health and climate change includes a summary of key relationships and recommendations for approaches to address climate-related mental health impacts	https://www.who.int/publications/i/item/9789240045125
	**Drought and mental health**	*The Mental Health Outcomes of Drought: A Systematic Review and Causal Process Diagram* (Vins et al. 2015)	https://www.mdpi.com/1660-4601/12/10/13251

	THEME	LEARNING RESOURCE	LINK
	**Heat and mental health**	*Is there an association between hot weather and poor mental health outcomes? A systematic review and meta-analysis* (Liu et al. 2021)	https://www.sciencedirect.com/science/article/pii/S0160412021001586
	**Methods, tools, and resources for mental health and climate change**	For a review of methods for measuring and studying climate change and mental health, see Quantitative methods for climate change and mental health research: current trends and future directions (Massazza et al. 2022)	https://projects.iq.harvard.edu/files/climate-smart/files/quantitative_methods_for_climate_change_and_mental_health.pdf
		For a synthesis of recent evidence on mental health and tools for translating data to action, see *The impact of climate change on mental health and emotional wellbeing: current evidence and implications for policy and practice* (Lawrance et al. 2021)	https://psychotraumanet.org/sites/default/files/documents/Lawrance%2C%20e.a.%2CThe%20impact%20of%20climate%20change%20on%20mental%20health%20and%20emotional%20wellbeing%20-%20current%20evidence%20and%20implications%20for%20policy%20and%20practice%20%281%29.pdf
		For a list of climate change and mental health resources, see Table 1 of *The Effects of Climate Change on Child and Adolescent Mental Health: Clinical Considerations* (van Nieuwenhuizen et al. 2021)	https://link.springer.com/article/10.1007/s11920-021-01296-y
	**Local case studies around mental health and climate change**	For more on gender, climate change, and mental health in Bangladesh, see *'Seeing with Empty Eyes': a systems approach to understand climate change and mental health in Bangladesh* (Hayward and Ayeb-Karlsson 2021)	http://doi.org/10.1007/s10584-021-03053-9
		For more on how indigenous people experience the mental health effects of climate change, see *Indigenous mental health in a changing climate: a systematic scoping review of the global literature*: (Middleton et al. 2020)	https://doi.org/10.1088/1748-9326/ab68a9

Part 2: How A Changing Climate Affects Social Systems

Climate change is not only generating acute and chronic changes in ecosystems and weather patterns – it is also shaping social, economic, and political systems as human societies and relations adapt and respond to both environmental shifts and the socioeconomic systems that are driving these changes. Systems and institutions that support communities may find themselves under additional strain as they cope with new and changing needs.

These changes in where people live, how people grow food and manage land, how household burdens are managed, and how adolescents and youth are affected all have long-term consequences for health. These effects are not gender neutral. Many of these effects on social systems are connected to each other: trends in one sector often affect trends in another. For example, in a study of rice farmers in rural Ghana, female-headed households were overall more vulnerable to climate change, with less livelihood diversity and greater food insecurity; male-headed households were more vulnerable to seed availability, income from crops, and health risks (Alhassan, Kuwornu, and Osei-Asare 2018). Other work, however, suggests that female-headed households may be less vulnerable to climate impacts because of factors such as lower household consumption levels, food storage, remittances, trade, choice in recovery strategies, long-term planning, or consideration of household welfare over personal welfare (Andersen, Verner, and Wiebelt 2017; van Daalen et al. 2020; Ganguli 2021; Chidakwa et al. 2020; Wrigley-Asante et al. 2019). Because vulnerability is subjective and deeply connected to gendered roles, relationships, norms, and access to resources, it is critical to think through the complexity of these relationships between climate change's effects on social systems. Understanding these relationships is an important part of understanding the scope of climate change's impact on gender and health – and designing effective, integrated approaches to address these impacts.

Conflict

Climate change-associated conflicts also factor into motivations for climate-induced migration, but gender has been relatively understudied in the climate change-conflict space (Ide et al. 2021; Fröhlich and Gioli 2015; Yoshida, Bond, and Kezie-Nwoha 2021). Research around climate change, conflict, and gender in Africa suggests that climate change-induced migration compounds existing risks (Dinkelman 2015). Moreover, the power structures that drive gender inequities are often similar to – or the same as –the power structures that drive environmental degradation and conflict (Ide et al. 2021).

When discussing gender in climate-associated conflicts, nuance is important. For example, men may carry out violence but also may experience the physical and psychological harms of patriarchal expectations. At the same time, women may advocate for peacebuilding but also may reproduce harmful norms. Gender can be a risk factor for experiencing compounding harms of conflicts, or a motivator for engaging in conflict (Ide et al. 2021). In Ethiopia, for example, climate change can increase risk of experiencing violence and conflict for both adolescent girls, who must travel further for water, and adolescent boys, who seek pasture for their cattle amid resource scarcity (Devonald et al. 2022).

Increasing household resilience may reduce endorsement of violence; a study from the Democratic Republic of the Congo found that though experience of a drought was not associated with support for violence, households that had experienced drought and had less overall resilience were more likely to endorse political violence that those with higher resilience (Uexkull, d'Errico, and Jackson 2020).

Learn More: Conflict, Climate, and Gender

	THEME	LEARNING RESOURCE	LINK
	**The impact of climate change and conflict on women and girls**	For more on how links between climate change and conflict affect women and girls, and programmatic suggestions from women and girls affected by climate-induced conflict, see the London School of Economics report *Defending the Future: Gender, Conflict, and Environmental Peace* (Yoshida, Bond, and Kezie-Nwoha 2021)	http://eprints.lse.ac.uk/110308/1/Yoshida_defending_the_future_published.pdf
		The Georgetown Institute for Women, Peace and Security's report *The Climate-Gender-Conflict Nexus: Amplifying Women's Contributions at the Grassroots* (J. M. Smith, Olosky, and Fernández 2021)	https://giwps.georgetown.edu/wp-content/uploads/2021/01/The-Climate-Gender-Conflict-Nexus.pdf
	**Framing climate change, conflict, and gender**	For more on fallacies and frameworks that shape how we think about climate change, conflict, and gender, see *Gender, Conflict, and Global Environmental Change*	https://doi.org/10.1080/10402659.2015.1037609

Shifts in Farming and Land Use

Changing temperatures, rainfall patterns, and extreme weather events associated with climate change can cause crop failures and prompt changes in farming practices. If those who make their living off the land are not able to change their practices effectively, they may be forced to seek other adaptive strategies, like migration. In Bangladesh, for example, when extensive waterlogging associated with climate change caused the loss of household vegetable gardens and domestic livestock, over half of respondents in one survey reported that family members had migrated to find alternative income (S. Khan and Hossan 2021).

The majority of smallholder farmers across the world are women, meaning that climate change's effects on agriculture have critical implications for women's livelihoods – and, in turn, their health outcomes (Sorensen, Murray, et al. 2018). Gender roles and responsibilities shape how people experience climate change's effects on farming, fishing, and livestock management (Chauhan 2021):

Table 3. Gender roles and differentiated vulnerabilities to shifts in farming and agriculture Source: Chauhan 2021

Sector	Major Gender Roles*		Climate Change Impacts	Gendered Vulnerability to that Impact
Fodder	Men	• Purchase of fodder • Free grazing	Land resource diversion, especially for bio-fuels, can lead to decreased fodder availability	• Increase in fodder costs
	Women	• Collection of fodder • Free grazing		• Time and effort spent on fodder collection increases
Crop farming	Men	• Cash crop production and marketing • Agricultural labor	Average crop yields go down, exposing millions of farmers to lower yield	• Reduced farm incomes will lead to higher migration for alternative incomes
	Women	• Food crop production and storage • Agricultural labor		• Lower availability of labor days will further reduce income • Reduced food crop yields will lead to food insecurity especially for subsistence farmers
Livestock rearing	Men	• Management of large cattle	Livestock will be adversely	• Large cattle farming could become less

		and dairy farms	affected with rising temperatures, depending on the extent of changes in feed quality, spread of diseases, and water resource availability	profitable or even non-viable
	Women	• Management of small livestock, poultry farms		• Increase in cost of managing small cattle, espeically arranging fodder and water • Increase in time spent on livestock management
Fishing	Men	• Catching of fish	Damage of ecosystems will reduce the productivity of fisheries and aquaculture, especially at low lattitudes	• More time spent at sea • Need to venture in deep sea will increase fuel costs and increase the need for more mechanized boats • Increase in costs will reduce profits from fishing
	Women	• Processing and marketing • Pond fish farming		• Higher temperatures will make fish processing and marketing more difficult
* The gender roles mentioned here are not fixed and need to be contexualized. These are just indicative of what the differentiated gender roles could be.				
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.				
Participatory Action Tip: You use this framework with a group to think about gender roles in your community, and how those roles are connected to climate change and climate solutions. For more guidance on this, see Exercise 6 in Module 1 of ARROW's *Training Manual on Gender and Climate Change Resilience* as well as the *Identifying Appropriate Climate Solutions* section of Chapter 3 of this resource guide.				
Note: For more on gendered impacts of climate-related shifts in migration and livelihood burdens, see those subsections in Chapter 1, Part 2 of this resource guide.				

Female farmers are particularly vulnerable to climate change – and may face greater challenges in recovery or adaptation – for a range of reasons including limited land tenure, limited access to agriculture extension services, type of farming, limited education, limited income, limited mobility, limited labor availability, limited climate change knowledge or access to climate resilience resources, domestic violence, and social norms (Ganguli 2021;

Jost et al. 2016; Alhassan, Kuwornu, and Osei-Asare 2018; Balikoowa et al. 2019; Tanny, Rahman, and Ali 2017; Assan et al. 2018). An individual's ability to enact different forms of agricultural adaptation is interwoven with the broader gendered context of vulnerability, well-being, and structures of power and resources (Bryan et al. 2017).

In order to change agricultural practices in response to climate change, farmers must first recognize that climate change is happening – and gender can influence whether and how climate change is recognized. Ability to perceive climate change is shaped by a range of intersectional factors like income, access to credit, access to information technology, and gender. In rural Vietnam, for example, poor farmers were less likely to perceive climate change than non-poor farmers, as were farmers who did not participate in credit programs or those who did not own information and communication technology (Hoang 2020). Men also were more likely to perceive climate change than women (Hoang 2020).

Once farmers recognize climate change, they must adjust their practices, and the use (and efficacy) of agricultural adaptation strategies can have important gendered differences. In a mixed-methods study of gender and climate resilience in sub-Saharan Africa, researchers found that female-headed households were less likely to plant improved seeds or disease-resistant species, suggesting that female farmers may face constraints around access to farming technologies such as improved seeds (Perez et al. 2015). Female-headed households had more irregular income, had fewer available resources for productivity, controlled less land and land of poorer quality, and more insecure land tenure (Perez et al. 2015). These female-headed households were less likely to use agricultural technologies (like improved seeds, fertilizers, or pest control) and had less education, less free time, and less access to extension services (Perez et al. 2015). Men, overall, were better able to access resources from governments, NGOs, and businesses, while women tended to rely on local groups within their village for insurance and risk-sharing (Perez et al. 2015). It's important to note that these local groups are not inherently disadvantageous as compared to groups men engage with, but offer different forms of support and resources (Perez et al. 2015). In a study of climate-smart agricultural practices in Uganda, Ghana, and Bangladesh, researchers found that though farmers were shifting their practices in response to climate change, women faced resource constraints that limited their adaptation, and adaptive practices often increased the labor burden for women (Jost et al. 2016).

Strong anti-woman biases in agricultural and livestock agencies put female-headed households and women farmers at greater risk of food insecurity and create challenges to shifting farming practices in the face of climate risks (Perez et al. 2015). In research on climate-smart agricultural practices in Uganda, Ghana, and Bangladesh, researchers found that women were less able to access information and extension services than men (Jost et al. 2016).

While women farmers are more vulnerable to change, their ability to cope and survive suggests that they could have an adaptive capacity similar to or better than men (Perez et al. 2015). As the outmigration of men increases women's roles and responsibilities in farming, women are increasingly engaged in agricultural decision-making practices (Chauhan 2021). Given their critical role in farming around the world, this also means that there is significant potential for women to integrate climate adaptation practices and lead change for agriculture and food security (Chauhan 2021).

Learn More: Shifts in Farming and Land Use

	THEME	LEARNING RESOURCE	LINK
	**Climate, gender, and agriculture**	For more on how gender shapes agricultural and livelihood practices – like marriage practices and cultural norms – in semi-arid regions of Africa, see *Gendered vulnerabilities to climate change: insights from the semi-arid regions of Africa and Asia* (Rao et al. 2019)	https://doi.org/10.1080/17565529.2017.1372266
	**Climate change, youth, and agriculture**	For more on how climate change is shaping youth agricultural practices in Uganda, see the CGIAR report *A Generation on the Move: Voices of Youths in the Context of Climate Change, Migration, and Livelihood Transition*	https://cgspace.cgiar.org/handle/10568/88222

Food Security

Climate change is already shifting rainfall patterns, average temperature, temperature variability and vector ecology in ways that can, in some contexts, reduce crop production and increase food insecurity (Giudice et al. 2021; Dasgupta and Robinson 2021; Deryng et al. 2014). Other extreme climate events, such as drought, wildfires, and flooding, can increase food insecurity by destroying crops, damaging infrastructure, and prompting acute financial stress for families (Chauhan 2021; Giudice et al. 2021; Aguilar, Granat, and Owren 2015). Food insecurity can increase the likelihood of migration and be a source of both physical and mental stress (Giudice et al. 2021). Research from Ethiopia suggests that rural households are more likely to experience food insecurity after temperature-associated weather shocks than urban households (Dasgupta and Robinson 2021).

Overall, climate change affects nutrition in complex pathways (Bryan et al. 2017; IFPRI 2015). Gender roles and responsibilities shape how people experience climate's impact on food security (Chauhan 2021):

Table 4. Gender roles and differentiated vulnerabilities to food security challenges Source: Chauhan 2021

Sector	Major Gender Roles*		Climate Change Impacts	Gendered Vulnerability to that Impact
Food	Men	• Money for food	Reduced food production globally and ensuing increase in food prices	• Increased poverty as share of food bill in household expenses goes up** • Increased mental stress for more income and financial management
	Women	• Food and nutrition management • Cooking	Forest conservation policies will reduce access	• Increased poverty as share of food bill in household expenses goes up** • Increased stress for food and nutrition security in family • Skewed intrahousehold distribution pattern will lead to reduced food and nutrition intake for women and girls • Indigenous and poor women dependent on forest will face more problems
* The gender roles mentioned here are not fixed and need to be contexualized. These are just indicative of what the differentiated gender roles could be. ** Households that have a higher share of food and energy in household expenditure generally fall into the lower income quadrant (poor households).				
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Participatory Action Tip: You use this framework with a group to think about gender roles in your community, and how those roles are connected to climate change and climate solutions. For more guidance on this, see Exercise 6 in Module 1 of ARROW's *Training Manual on Gender and Climate Change Resilience* as well as the *Identifying Appropriate Climate Solutions* section of Chapter 3 of this resource guide.				
Note: For more on gendered impacts of climate-related shifts in ecosystems and mental health trends, see those sub-sections in Chapter 1, Part 1 of this resource guide.				

Climate-associated increases in food insecurity exacerbate existing inequities in food security and nutrition, given that women experience higher rates of anemia and malnutrition than men, which has consequences for memory, attention, and educational outcomes (Sorensen, Murray, et al. 2018).

Around the world, women are often more sensitive to climate-associated food insecurity because of both cultural norms around resource allocation and physiological nutritional needs during menstruation and childbirth (Sorensen, Murray, et al. 2018). One study from India have found that after disasters, girls were more likely to experience stunting and be underweight than boys, and in a study of infant mortality after typhoons in the Philippines, infant mortality rose for girls but remained unchanged for boys, likely because of household resource allocation (Chauhan 2021; Datar et al. 2013; Anttila-Hughes and Hsiang 2013). Studies in India, Vietnam, and Bangladesh have found that women skip meals and eat less than men in response to environmental stressors, with twice as many women as men in one study in India reporting eating less (Chauhan 2021; Alston 2015; FAO 2018; Oxfam 2009).

In Ethiopia, female-headed households were more likely to experience food insecurity than male-headed households (Dasgupta and Robinson 2021). Female-headed households may also be more vulnerable to indirect effects of climate change's effects on food security, such as increases in food prices or lack of local demand (Flatø, Muttarak, and Pelser 2017).

Food insecurity can also affect sexual and reproductive health. In low- and middle-income countries, experiencing food insecurity during pregnancy increases the risk of maternal depression, pre-eclampsia, stillbirth, preterm birth, and low birth weight (World Health Organization 2014; Iqbal and Ali 2021). Undernutrition can cause infertility, or delay menarche, or cause amenorrhea (World Health Organization 2014).

Learn More: Gender, Food Security, and Health

	THEME	LEARNING RESOURCE	LINK
	**The Sustainable Development Goals, gender, and food security**	See *Gender equality, food security and the sustainable development goals* (Agarwal 2018)	https://www.sciencedirect.com/science/article/pii/S1877343517302415
	**Local example of climate, gender and food security in Bangladesh**	See *Gender and food security in Bangladesh: the impact of climate change* (Alston and Akhter 2016)	https://doi.org/10.1080/0966369X.2016.1204997

Migration and Displacement

Climate change-associated extreme weather events or environmental changes can prompt migration and displacement as households seek to earn additional income, find new housing, or escape conflict. In practice, migration can be a fluid strategy for coping with adversity. Research from India on gendered aspects of climate-induced migration has called for more expansive understandings of households and "local" adaptation, given the emergence of "multilocal" households that challenge binaries of female- or male-headed households or migrants and those left behind (C. Singh 2019). Migration may also erode traditional risk management systems, like borrowing goods or using common-pool resources managed through community and kinship networks (C. Singh 2019).

Gender shapes individuals' decisions to migrate by affecting how they evaluate both environmental risk and the costs, benefits, and efficacy of different adaptation approaches (Evertsen and van der Geest 2020).

Men and women often have different experiences when migrating. For example, a qualitative study of gender and climate change-induced migration in Bangladesh found that men and women had different priorities and women faced greater vulnerabilities in migration (Sams 2019). Young male migrants may relocate for precarious work with limited social protections (C. Singh 2019).

When men migrate, women may face both challenges and opportunities. One study of gender and migration in Bangladesh found that as men migrated to urban centers, women were able to develop a range of novel adaptive strategies built on social capital and trusted relationships with NGOs, countering narratives of women as passive victims (Khalil et al. 2020). In other cases, however, religious norms may make some women more vulnerable when men migrate because in these contexts, women may lose access to knowledge and resources when they do not have men to facilitate connections to networks and institutions (S. Ahmed and Eklund 2021). Work in Nepal similarly found that the presence of a non-migrating husband could mitigate some of the disempowering effects that women experience when living with in-laws, suggesting that how male migration affects women is highly context-specific (Kristjanson et al. 2017).

Women who migrate also may face large social risks that impact their physical and mental health (Ganguli 2021; Evertsen and van der Geest 2020). In Bangladesh, women often migrate in response to environmental threats, and while they see migration as a means of supporting their family, they also recognize the serious personal and social cost of migration (Evertsen and van der Geest 2020). Gendered social and financial constraints can prevent women who wish to migrate from doing so, functionally "trapping" them in vulnerable positions (Evertsen and van der Geest 2020). In other cases, however, the choice to "stay behind" does not have negative implications may be the intersectional product of

factors such as environment, social identity, labor, and education (Boas, de Pater, and Furlong 2022).

Learn More: Migration and Displacement

	THEME	LEARNING RESOURCE	LINK
	**Gender and migration**	For more on how rethinking gender and migration as processes mediated by climate risks can better illustrate risks and vulnerabilities, see *Gendered dimensions of migration in relation to climate change* (Lama, Hamza, and Wester 2021)	https://doi.org/10.1080/17565529.2020.1772708
	**Humanitarian needs and climate**	For a humanitarian lens on climate effects, see *Overlapping vulnerabilities: The impacts of climate change on humanitarian needs* (Nicoson, von Uexkull, and Houge 2019)	https://reliefweb.int/report/world/overlapping-vulnerabilities-impacts-climate-change-humanitarian-needs
	**Youth, migration, and climate**	For more on how climate change is shaping youth migration in Uganda, see the CGIAR report *A Generation on the Move: Voices of Youths in the Context of Climate Change, Migration, and Livelihood Transition*	https://cgspace.cgiar.org/handle/10568/88222
		For a synthesis of research on how climate change is shaping agriculture and migration for youth in East Africa, see *Climate change, agriculture and international migration nexus: African youth perspective* (Bezu et al. 2020)	https://cgspace.cgiar.org/handle/10568/110278

Increased Livelihood, Household, and Caring Burdens

Gender roles and responsibilities shape how people experience climate change's effects on livelihood, household, and care burdens, and these impacts can been seen across sectors (Chauhan 2021):

Table 5. Gender roles and differentiated vulnerabilities to changing livelihood and labor burdens Source: Chauhan 2021

Sector	Major Gender Roles*		Climate Change Impacts	Gendered Vulnerability to that Impact
Health	Men	• Money for medical expenses • Medical insurance	Increase in morbidity due to heat waves	• Increase in medical expenses can lead to families falling back into poverty
	Women	• Caring for the sick	Increase in vector- and water-borne diseases	• Increased burden of caring for the sick

				• 22% of women to lose wages due to absence from work for a sick child
Energy	Men	• Electricty and crude oil for machines and vehicles	Low emission energy policies will increase costs	• Increase in energy expenses • Increased poverty as share of energy bill in household expenses goes up**
	Women	• Fuel and gas for cooking • Electricity for home and work	Forest conservation policies will reduce access	• Time and effort spent on fuelwood collection increases • Increased poverty as share of energy bill in household expenses goes up**
Home-based work	Men	• Handloom and power looms	Increase in number of hot days and heat waves Increase in fluvial and coastal flooding	• Heat waves will reduce productivity
	Women	• Fuel and gas for cooking • Electricity for home and work		• Energy costs will go up • Loss of raw materials and infrastructure in floods • Loss of workplace due to disasters • No financial risk coverage/credit access could mean falling back into poverty
Transport	Men	• Private and public transport	Low emission transport policies will be put in place	• Increase in fuel and transport costs may reduce private transport usage for poorer families
	Women	• Safe public transport		• Increased pressure on public transportation will affect women's safety and access to public transport

* The gender roles mentioned here are not fixed and need to be contexualized. These are just indicative of what the differentiated gender roles could be.
** Households that have a higher share of food and energy in household expenditure generally fall into the lower income quadrant (poor households).

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Participatory Action Tip: You use this framework with a group to think about gender roles in your community, and how those roles are connected to climate change and climate solutions. For more guidance on this, see Exercise 6 in Module 1 of ARROW's *Training Manual on Gender and Climate Change Resilience* as well as the *Identifying Appropriate Climate Solutions* section of Chapter 3 of this resource guide.

Note: For more on gendered impacts of climate-related shifts in health (including disasters, heat, and ecosystem services) see Chapter 1, Part 1 of this resource guide; for more on impacts on health systems, see that subsection of Chapter 1, Part 2.

Without major shifts to traditional gendered caregiving responsibilities, as climate change increases the global disease burden, women and girls are likely to experience an increased workload at home as they care for those who are ill (Chauhan 2021; Brody, Demetriades, and Esplen 2008). In addition, women may spend more time traveling to fetch water when faced with water scarcity, and they may take on additional roles and responsibilities if men migrate to urban areas for additional income (Chidakwa et al. 2020; Jost et al. 2016).

Research from Zimbabwe suggests that climate change disproportionately increases the amount of work women have (Dube et al. 2017). At the same time, research on women's agricultural labor suggests that in times of drought, women's workdays decrease by 11% more than men's, likely because women have fewer livelihood diversification and off-farm labor opportunities (Afridi, Mahajan, and Sangwan 2021). Research from China suggests that temperature increases are associated with a decrease in leisure time and an increase in on- and off-farm labor for both men and women, but men's time shifts from leisure to off-farm work, while women's time shifts from farm work to off-farm work (Huang et al. 2020). Overall, however, women's increased time and labor burden could have a spillover effect on household income, educational access, ability to engage in community decision-making, which has the potential to affect both long-term regional political agendas and health outcomes (Chauhan 2021).

Learn More: Livelihood, Household, and Caring Burdens

	THEME	LEARNING RESOURCE	LINK
	**Gender, labor, and adaptation**	For more on how seemingly simple adaptative practices can increase the labor burden for women, see *Home climate change mitigation practices as gendered labor* (Thoyre 2020)	https://www.sciencedirect.com/science/article/pii/S0277539518306253
	**Local example of gendered livelihood impacts in Zimbabwe**	For more on gendered labor impacts of climate change in Zimbabwe, see *The Gender-differentiated Impacts of Climate Change on Rural Livelihoods Labour Requirements in Southern Zimbabwe* (Dube et al. 2017)	https://doi.org/10.1080/09709274.2017.1316958

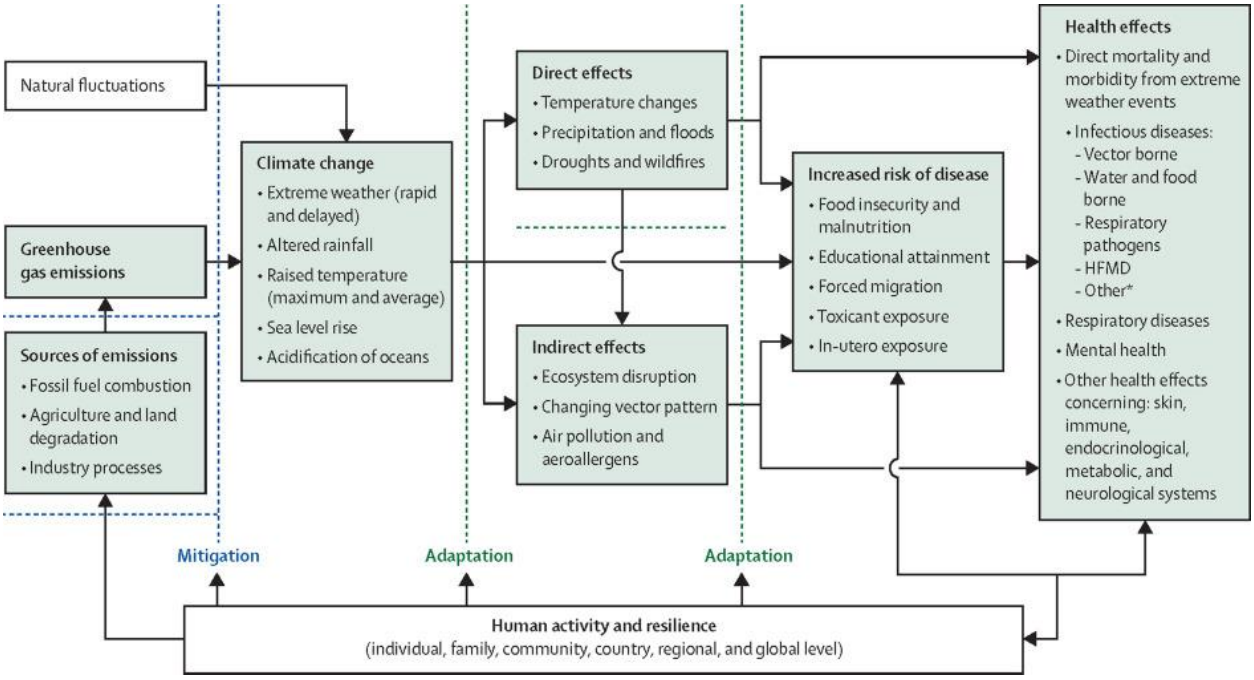
Impact Spotlight: Adolescents and Youth

When thinking about the nexus of climate change, gender, and health, it is critical to explicitly consider adolescents and youth. Based on previous work with youth in health and livelihoods programming, we know that adolescents and youth need to be specifically planned for, because when they are an afterthought, program delivery is less effective. In addition, the timescale of climate change means that adolescents and youth today will bear the sustained and compounding impacts of climate change over their lifetimes in a way that older individuals will not. Youth and climate needs also often overlap in that many of the countries with the highest current and projected climate vulnerabilities have large and growing youth populations.

Broadly, climate threats can increase risk factors for adolescents and youth while simultaneously eroding protective influences on them, with the most serious climate-related impacts felt among youth in low- and middle-income countries (Sanson et al. 2018). Because of the interactive and additive effects of climate threats on children and adolescents, investing in addressing climate risks is fundamental for both social justice and long-term developmental and mental health outcomes (Vergunst and Berry 2022). Research in East Africa suggests that, given climate change's effects on agricultural prospects, youth migration is likely to increase in coming years (Bezu et al. 2020).

As with adults, climate-related health risks for children and youth can emerge through both direct and indirect pathways (Helldén et al. 2021a):

Figure 8. Climate change and child health: an expanded framework Source: Helldén et al. 2021. No changes made. To view a copy of this license, go to: https://creativecommons.org/licenses/by-nc-nd/4.0/

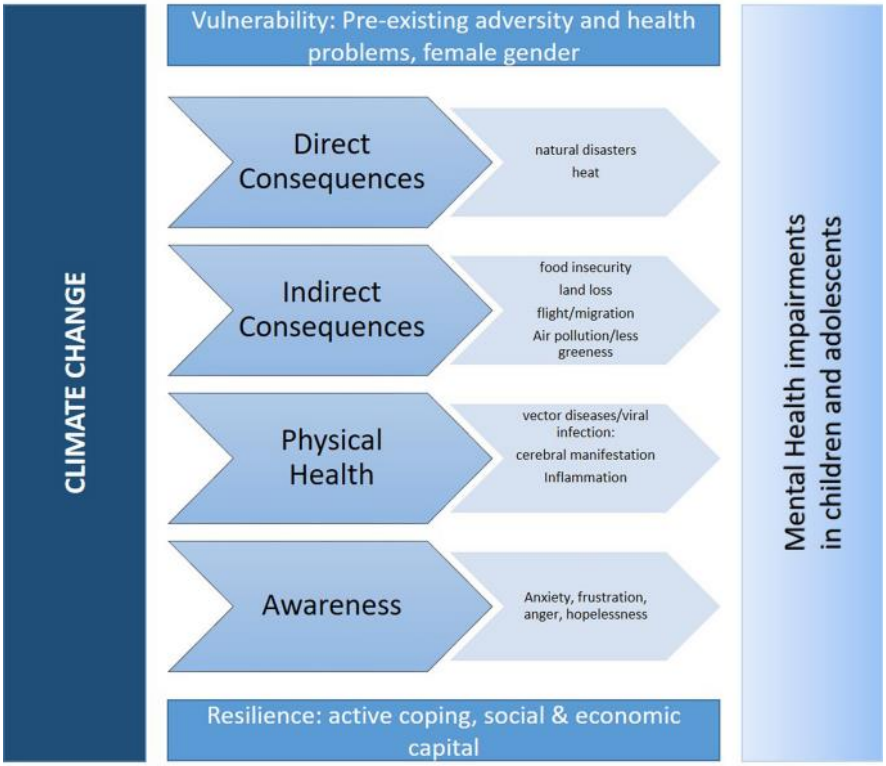


In many ways, the connections between climate and health among adolescents and youth parallel those seen in adults. As with adults, climate-related health impacts are shaped by existing inequalities and vulnerabilities, including social and ecological determinants of health, and children may be especially vulnerable (Helldén et al. 2021b; Brodie and Silberholz 2021; Gislason, Kennedy, and Witham 2021). In Pakistan, for example, students in different districts experienced different degrees of susceptibility to disasters based on psychological, physical, and educational vulnerabilities (R. Shah 2020). However, few studies on connections between climate change and child/adolescent health are sex or age disaggregated, leaving a large gap in knowledge about these connections (Helldén et al. 2021b).

Climate threats can also affect youth sexual and reproductive health outcomes and access to sexual and reproductive health services. Sexual and reproductive health services are often limited for young people in climate-affected settings (Jennings et al. 2019). For example, in some cases, increases in fertility have been observed in the aftermath of disasters, and this increase is often borne by younger women; however, connections between disaster and fertility are often quite heterogeneous (Nobles, Frankenberg, and Thomas 2015; Davis 2017; Norling 2022). For adolescent girls in Lesotho, living in a rural area affected by drought was associated with higher HIV prevalence, early sexual debut, and lower educational attainment; migration was associated with a two-fold increase in HIV odds among young people (Low et al. 2019).

Climate change also has impacts on adolescent and youth mental health (S. E. L. Burke, Sanson, and Van Hoorn 2018; Clemens, von Hirschhausen, and Fegert 2022; Helldén et al. 2021b; Majeed and Lee 2017; van Nieuwenhuizen et al. 2021; Gislason, Kennedy, and Witham 2021). Clemens et al. conceptualize the link between climate change and child mental health outcomes as occurring through four main pathways: direct effects, indirect effects, physical health, and awareness, mediated by vulnerabilities and resilience (Clemens, von Hirschhausen, and Fegert 2022):

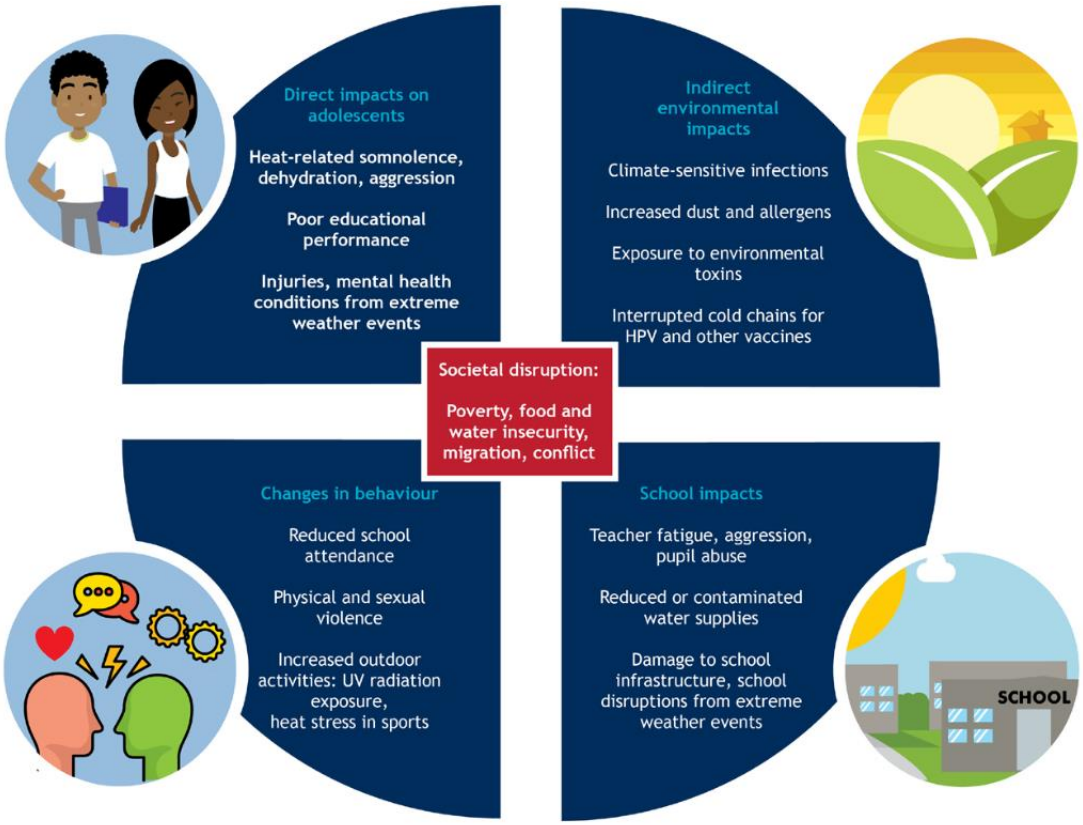
Figure 9. How climate change impacts child, adolescent, and youth mental health Source: Clemens, von Hirschhausen, and Fegert 2022. No changes made. To view a copy of this license, go to: https://creativecommons.org/licenses/by/4.0/



Overall, climate-related mental health outcomes for adolescents and youth include risks of depression, anxiety, PTSD, sleep disorders, and substance abuse, among others (S. E. L. Burke, Sanson, and Van Hoorn 2018). These mental health outcomes have serious implications for emotional regulation, learning, and behavior, and create predispositions for adverse adult mental health outcomes (S. Burke, Sanson, and Van Hoorn 2018). Similarly to trends seen among adults, climate threat-specific relationships with mental health are also observed among adolescents and youth; for example, research in the United States suggests that heat is associated with mental health crisis support-seeking behavior among young adults and adolescents (Sugg, Dixon, and Runkle 2019). Youth may also be more likely to experience climate anxiety – and its effects on mental health – than adults (Wu, Snell, and Samji 2020). Research with adolescents in Canada following wildfires found that anxiety, depression, and PTSD symptoms lasted longer and were more widespread than anticipated, persisting for several years following the fires (Pazderka et al. 2021). Findings on the gendered mental health impacts of disasters vary, with some studies suggesting more severe reactions among female youth and adolescents, and others finding no gender association; overall few studies of disasters, mental health, and youth have accounted for gender (Clemens, von Hirschhausen, and Fegert 2022; Lai et al. 2017; Rubens, Felix, and Hambrick 2018; Norris et al. 2002).

These effects of climate change on health can have a range of impacts on adolescent and youth educational performance (Chersich, Scorgie, et al. 2019).

Figure 10. Climate change's impact on youth, health, and education Source: Cherisch et al. 2019. No changes were made. The license is available here: https://creativecommons.org/licenses/by-nc-sa/4.0/



Climate-change associated disasters, disease exposures, and droughts exacerbate inequalities for girls and can limit their access to education – which can have profound long-term consequences (Roos 2022; Watts et al. 2019; Fry and Lei 2021). For example, for youth in Tanzania, being able to be exclusively in school – and not engaging in both school and paid work – was a protective factor against depressive mental health systems associated with climate-related environmental shocks (Prencipe et al. 2020). The benefits of education persist over lifetimes: in a study of how climate-associated weather shocks affected food insecurity in Ethiopia, families with a more-educated head of the household were slightly, but significantly, less likely to experience food insecurity than families with less-educated heads of household (Dasgupta and Robinson 2021).

While climate change exacerbates the vulnerabilities that girls face, boys may also face differential challenges regarding access to education in some contexts. The Kosi river flood in India was associated with a lower rate of secondary school completion for both men and women (Khanna and Kochhar 2020). A study on the gendered effects of a cyclone on children's schooling in Fiji found that school enrollment was lower for boys than girls

because of their role in farming; this effect was particularly pronounced among boys from families who did not receive early housing aid and boys who did not have an older brother or an educated father (Takasaki 2017).

Learn More: How Climate Change Impacts Adolescents and Youth

	THEME	LEARNING RESOURCE	LINK
		For data on climate and youth, see UNICEF's report *The Climate Crisis Is a Child Rights Crisis: Introducing the Children's Climate Risk Index* and accompanying interactive atlas of risks (Rees et al. 2021)	https://data.unicef.org/resources/childrens-climate-risk-index-report/
	**How climate change affects youth**	For a review of how climate change affects adolescents (e.g., migration, land loss, food insecurity, green space, disasters, heat, air pollution, climate awareness, etc.), see *Report of the intergovernmental panel on climate change* (Clemens, von Hirschhausen, and Fegert 2022)	https://link.springer.com/article/10.1007/s00787-020-01615-3#ref-CR11
		For a review of how climate affects the health of those under 18, see *Climate change and child health: a scoping review and an expanded conceptual framework* (Helldén et al. 2021b)	https://www.sciencedirect.com/science/article/pii/S2542519620302746
	Climate and youth mental health	For more on the life-long implications of climate experiences on children and adolescents with a social justice lens, see *Climate Change and Children's Mental Health: A Developmental Perspective* (Vergunst and Berry 2022)	https://journals.sagepub.com/doi/full/10.1177/21677026211040787
		*Climate Change, Air Pollution, and Children's Mental Health* (Yu and Weitzman 2021)	https://digitalcommons.library.tmc.edu/childrenatrisk/vol12/iss1/13
		Impact of Extreme Weather Events on Sub-Saharan African Child and Adolescent Mental Health: A Protocol for a Systematic Review (Rother et al. 2020)	https://www.mdpi.com/2073-4433/11/5/493/htm
	**Climate and youth migration**	For a synthesis of research on how climate change is shaping agriculture and migration for youth in East Africa, see *Climate change, agriculture and international migration nexus: African youth perspective* (Bezu et al. 2020)	https://cgspace.cgiar.org/handle/10568/110278

Chapter 2: Evidence-Based Strategies for Responding to Climate Change

How governments, communities, and individuals respond to climate change will have profound impacts not only on the degree of climate change itself, but also on the well-being of women and girls. While some adaptation approaches are projected to drastically reduce gender inequalities, others may exacerbate them (Andrijevic et al. 2020).

Women's empowerment is a critical element of climate resilience (FAO 2018). For example, a growing body of research suggests that when women and girls are included in conservation groups, resource governance and conservation outcomes improve (Leisher et al. 2016). However, it's critical that programs have a genuinely transformative approach toward gender and the environment – otherwise, just as environmental programs can be at risk of "greenwashing" if their benefit remains nominal, gender programs can be at risk of "purplewashing" or "genderwashing" (Martinez-Fierro and Garza-Veloz 2022; Fox-Kirk et al. 2020; Walters 2021).

"Solutions to the climate crisis can provide "win–win" opportunities for public health, but it is crucial that such efforts center equity and social justice." – (Mailloux et al. 2021)

Responses to climate change can generally be divided into two categories: 1) mitigation actions, which are designed to mitigate the degree to which climate change is experienced, and 2) adaptation actions, which are oriented towards managing, adjusting to, and surviving climate change. In practice, mitigation and adaptation actions are often quite synergistic, and some activities may serve both mitigation and adaptation functions (Ripple et al. 2022). Mitigation is often about "avoiding the unmanageable," while adaptation is about "managing the unavoidable" (Sovacool 2021).

When it comes to responding to climate change, knowledge gaps persist across sectors. In their review of climate change, water inaccessibility, and gender in Sub-Saharan Africa, Apatinga et al. noted that these knowledge gaps compound when greater specificity is sought: as we attempt to link climate drivers, climate consequences, gender, and coping strategies, increasing knowledge gaps appear (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022).

This trend likely translates beyond the water sector. Despite persistent knowledge gaps, however, there is a growing evidence base around mitigation actions and adaptation actions at the nexus of climate, gender, and health.

With that said, it is important to recognize that mitigation and adaptation are not universally felt or understood:

"Adaptation policies and research projects are enmeshed in matrices of difference, social relations and institutions, with contradictory effects on power, vulnerabilities and adaptive capacities. What is seen as positive and beneficial adaptation by some may be experienced as maladaptation by others (Taylor 2013; Gonda 2019). In other words, what counts as 'appropriate' climate change mitigation and adaptation is always political and contested (S. H. Eriksen, Nightingale, and Eakin 2015; C. Singh et al. 2021)." – (van Eerdewijk, Bråten, and Danielsen 2021)

Responding to climate risks in innovative, effective ways is not only about what we do, but also about how we do it. Taking participatory approaches, forwarding local knowledge, integrating methods of addressing community needs, and other ways of shifting power and changing *how* the work is done are critical parts of responding in ways that are effective and durable.

This chapter focuses primarily on climate mitigation and adaptation strategies that can be gender-integrated and enacted within communities, rather than policymaking approaches at large-scale national and international levels.

Learn More: Climate Resilience, Gender, and Health

THEME	LEARNING RESOURCE	LINK
Gender and climate resilience	For an up-to-date evaluation of scientific evidence around gender and climate resilient development, see the Cross-Chapter Box Gender: Gender, Climate Justice and Transformative Pathway in Chapter 18: Climate Resilient Development Pathways of the IPCC's Working Group II report *Climate Change 2022: Impacts, Adaptation and Vulnerability*	https://www.ipcc.ch/report/ar6/wg2/
	For approaches to mainstreaming gender in climate resilience projects, see *Leveraging co-benefits between gender equality and climate action for sustainable development: Mainstreaming gender considerations in climate change projects* from UN Women (UN Women 2016)	https://unfccc.int/files/gender_and_climate_change/application/pdf/leveraging_cobenefits.pdf
	For more on gender and climate adaptation, see the IUCN's *Roots for the Future The Landscape and Way Forward on Gender and Climate Change*	https://portals.iucn.org/library/sites/library/files/documents/2015-039.pdf

		For more on how to engage men in climate justice work, see *Men, masculinities, & climate change* (Kato-Wallace et al. 2016)	https://promundoglobal.org/wp-content/uploads/2016/04/Men-Masculinities-Climate-Change.pdf
	**Climate solutions**	The Women and Gender Constituency maintains a directory of gender just climate solutions	https://womengenderclimate.org/gender-just-climate-solutions-2/gender-just-climate-solutions/
		UNFCCC maintains resources around gender-sensitive climate adaptation tools and approaches, including reports on best practices for using indigenous and traditional practices and case studies	https://www4.unfccc.int/sites/NWPStaging/Pages/gender-page.aspx
		For case studies on gender-responsive climate solutions, see Module 4, Handout 20 of the *Training Manual on Gender and Climate Change Resilience* (page 262)	https://arrow.org.my/wp-content/uploads/2021/08/Empower-Training-Manual_GCCR-compressed.pdf
		Project Drawdown maintains a list of evidence-based climate solutions	https://www.drawdown.org/solutions/table-of-solutions
		The Handbook of Climate Change Management compiles evidence-based climate adaptation and mitigation strategies from across sectors and around the world	https://link.springer.com/referencework/10.1007/978-3-030-57281-5
	**Gender in climate policy**	For guidance on gender-inclusive climate laws and policies, see UN Women's guidance and checklists *Gender-responsive and inclusive laws and policies for disaster and climate resilience*	https://wrd.unwomen.org/practice/listing-toolbox/gender-responsive-and-inclusive-laws-and-policies-disaster-and-climate
		For guidance on a gender-inclusive National Adaptation Plan process, see *Toolkit for a gender-responsive process to formulate and implement National Adaptation Plans (NAPs)* (Dazé and Church 2019)	https://napglobalnetwork.org/resource/toolkit-for-gender-responsive-national-adaptation-plans/
		For insights from integrating gender into climate, see *The Art of Implementation: Gender Strategies Transforming National and Regional Climate Change Decision Making* (Pearl-Martinez et al. 2012)	https://portals.iucn.org/library/node/10318
	**Transforming how we do the work**	CARE's *Climate Change Advocacy Toolkit*	https://careclimatechange.org/advocacy-toolkit-sv/
		CARE's info note *Designing a Modular Approach towards Innovation*	https://careclimatechange.org/info-note-designing-a-modular-approach-towards-innovation/

Part 1: Mitigation Actions

Climate change solutions such as those identified and evaluated by Project Drawdown have numerous, wide-ranging, and substantial health co-benefits, though more research is needed outside of the context of high-income countries (Mailloux et al. 2021; Chang et al. 2017). When implemented effectively, with an eye towards social justice, climate mitigation actions can generate health benefits related to air quality, physical activity, and nutrition (Mailloux et al. 2021; Watts et al. 2021; Chang et al. 2017). In order to more comprehensively reduce vulnerability to climate threats, mitigation actions should be carried out alongside, and not instead of, adaptation efforts (Mailloux et al. 2021).

Mitigation policy is about more than just decarbonization: it can also be a tool for improving gender equity (Michael et al. 2020). To do so, researchers recommend a two-step approach where: 1) gendered points of exclusion and opportunities for participation are identified and 2) long-lasting gender-transformative capacity building and structural support activities take place (Michael et al. 2020). Climate mitigation actions could be strengthened further by taking an intersectional approach that forwards equity at every phase of implementation (Devonald et al. 2022; Markkanen and Anger-Kraavi 2019). For example, age-related vulnerabilities are often not considered in climate mitigation policy even when gender is taken into account (Devonald et al. 2022). Investing in aspects of gender equity like education can have far-reaching climate mitigation benefits: in India, cities with higher female literacy rates also had lower per-capita increases in CO2 emissions than cities with lower female literacy rates (Raparthi 2021).

UNEP promotes the “six-sector” solution, which is projected to reduce CO2 emissions by 29-32 gigatons through action in the 1) energy, 2) industry, 3) agriculture, food, and waste, 4) nature-based solutions, 5) transport, and 6) building and cities sectors (UNEP 2020). In this guide, agriculture and urban development are discussed within the adaptation space, but it’s important to know that adaptation and mitigation actions can be taken in each of these sectors.

Learn More: Climate Mitigation, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Climate mitigation research**	For the leading synthesis of scientific information regarding climate mitigation, see the IPCC's Working Group III Report *Climate Change 2022: Mitigation of Climate Change*	https://www.ipcc.ch/report/ar6/wg3/
	**Costs and benefits of climate mitigation approaches**	For a review of the co-benefits and adverse impacts of climate mitigation policies, see *Social impacts of climate change mitigation policies and their implications for inequality* (Markkanen and Anger-Kraavi 2019)	https://doi.org/10.1080/14693062.2019.1596873
		For a political ecological analysis of the costs and victims of various climate mitigation approaches, see *Who are the victims of low-carbon transitions? Towards a political ecology of climate change mitigation* (Sovacool 2021)	https://doi.org/10.1016/j.erss.2021.101916
	**Examples of gender-integrated climate mitigation approaches in India**	For case studies on gender-integration into climate mitigation policy in India, see *A two-step approach to integrating gender justice into mitigation policy: examples from India* (Michael et al. 2020)	https://www.tandfonline.com/doi/abs/10.1080/14693062.2019.1676688

Land Management and Forest Protection

Improving land management practices and forest protection are critical climate mitigation approaches, particularly because of the role the role of forests and other natural ecosystems as carbon sinks (Nnoko-Mewanu, Téllez-Chávez, and Rall 2021).

Implement Low-Emissions Agricultural Practices

For land that is already being farmed, improved agricultural practices can have a large impact on climate mitigation. In Vietnam, low-emissions agricultural practices can reduce greenhouse gas emissions by 48% and because women play such a strong role in the rice sector, advancing their participation and capacity to adapt improved agricultural practices can maximize gains around justice, equity, and income for women while contributing to climate change mitigation efforts (Farnworth et al. 2017).

Ensure Land and Forest Rights

Ensuring that women, Indigenous persons, and the rural poor have recognized land tenure and forest management rights is critical not only for protecting landscapes but also for improving livelihoods and wellbeing (Mailloux et al. 2021; Naidoo et al. 2019; Rosset and Martínez-Torres 2012; Chagutah 2013). In Ghana, women and migrants faced challenges in securing land tenure, which ultimately increased their vulnerability to climate change and its associated socioeconomic consequence by constraining possibilities for adaptation (Antwi-Agyei, Dougill, and Stringer 2015). Weak land tenure systems can exacerbate the effects of climate threats and their effects on land, crops, and livestock, in turn eroding food security and livelihood opportunities and increasing the risk of violence (Tiitmamerr, Mayai, and Mai 2017).

In Ghana, secure land tenure is also associated with use of climate adaptation strategies such as planted varietals, farming techniques, agroforestry, and planting dates (Akugre et al. 2021). Researchers in South Sudan mapped connections between climate change and different land tenure policy responses, finding that while poor land tenure arrangements can increase climate change vulnerability through displacement, conflict, and food insecurity, strong land tenure arrangements can produce climate resilience (Tiitmamerr, Mayai, and Mai 2017).

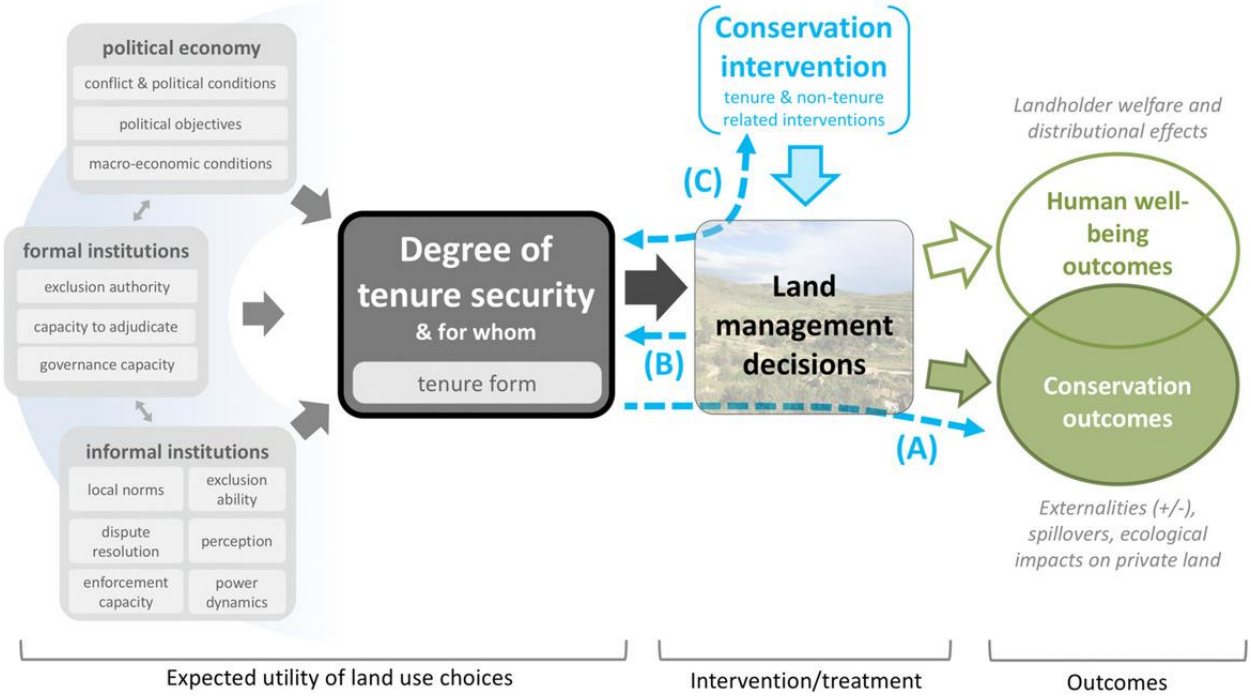
It's important to note when reviewing the literature on land tenure security that practitioners and academic researchers often characterize land tenure security differently: practitioners tend to conceptualize land tenure in legal terms, such as holding the title to land, whereas academic researchers place greater emphasis on the landholder's perception (Masuda et al. 2020).

Strengthen Conservation and Land Management

Land tenure and conservation are closely related. Because land tenure and security are not binary, but rather occur to different degrees across different scales and stakeholder

groups, the form and security of land tenure can have differential effects on conservation programming (Robinson et al. 2018). Robinson et al. developed a model for these connections (Robinson et al. 2018):

Figure 11. How land tenure affects conservation interventions and outcomes Source: Robinson et al. 2018. No changes were made. The license is available here: https://creativecommons.org/licenses/by/4.0/



Conservation and restoration efforts can reduce exposure to extremes and hazards, improve water quality, and improve mental health (Mailloux et al. 2021). Though protected areas can be critical for preserving biodiversity, natural habitat, and carbon sinks, their benefits to nearby communities can be mixed depending on specific contextual dynamics and protections. Conservation can increase conflict – for example, gendered conflicts over resource control and access – or be a tool for peacebuilding (Ajroud, Westerman, and Edmond 2015). A study of protected areas in developing countries found that households near protected areas had 17% higher wealth and 16% lower chance of poverty, and children living near protected areas had 10% higher height-for-weight scores and were 13% less likely to be stunted (Naidoo et al. 2019).

When it comes to fostering conservation activities, it is important to note that community-level benefits of protected areas do not necessarily translate to personal benefits, and personal benefits of protected areas may take more time to emerge (Tolbert et al. 2019). Engagement in simple nature activities that foster nature connectedness – like watching wildlife, taking photos of nature, or smelling flowers – is strongly associated with pro-nature conservation behavior (Richardson et al. 2020).

Though integrating gender into conservation work increases the benefits of conservation work, it is often seen as an "add-on" rather than a central element of conservation work, particularly because of perceived financial constraints from conservation practitioners (Westerman 2021). Social and cultural norms can prevent women from engaging in conservation and natural resource management processes, leading to conservation programs that do not benefit women, do not integrate women's knowledge and expertise, or perpetuate gender inequalities (James et al. 2021). Women often have different knowledge about forests than men, and when they are excluded from stakeholder discussions, policy misses out on their important and unique contributions (H. C. P. Brown 2011).

Research on protected areas in Uganda and Rwanda found that women were less likely to report personal benefits from the protected area than men, women were less likely to work in tourism than men, and that the benefits of the protected area were not distributed equitably (Tolbert et al. 2019). When equity isn't integrated into conservation programs, gender inequities and gender-based violence can increase, as was observed following tiger re-introduction in India in a complex series of gendered relationships and hidden costs in tiger conservation (Doubleday 2020).

Support Reforestation and Community Forest Management

Forests can contribute to both climate mitigation and adaptation (Pandey, Cockfield, and Maraseni 2016). Community forestry practices may also contribute to increases in local adaptive capacity because forests are often a key part of rural resilience (Pandey, Cockfield, and Maraseni 2016).

In a study of 105 community forests in Nepal, the REDD+ program increased carbon stocks in most plots and contributed to improvements in adaptation measures and livelihoods, including improved social capital, coping, community support, and income (Pandey, Cockfield, and Maraseni 2016). It was also believed to contribute to better regulated local microclimates and increased food security (Pandey, Cockfield, and Maraseni 2016).

However, relationships between the behaviors and practices of those living in and near forests can be complex. A study in Malawi found that while farmers had strongly negative attitudes towards deforestation and faced challenges to cutting down trees, they remained heavily reliant on forest resources, suggesting that forest protection efforts should be paired with poverty mitigation and livelihood diversification projects (Meijer et al. 2016a). In another study of forestry attitudes in Malawi, while attitudes towards planting trees were not associated with attitudes towards deforestation, having planted trees in the past five years *was* associated with more negative attitudes towards deforestation (Meijer et al. 2016b). This suggests that fostering pro-forest behaviors might be more powerful than simply changing attitudes alone.

Practitioners and advocacy groups have warned against false "nature-based" solutions, instead calling for advancing Indigenous and local leadership to sustainably protect and manage healthy ecosystems (APWLD et al. 2022). For example, while carbon sequestration in soil represents an interesting possibility for climate mitigation, implementing this approach also faces major social, economic, political, and scientific barriers (Amundson and Biardeau 2018). In forestry programs, though reforestation *can* be structured to incentivize planting approaches that produce higher carbon stock, these approaches likely do not have the same livelihood and adaptive capacity benefits for communities as reforestation programs oriented towards generating more diverse secondary forests (Pandey, Cockfield, and Maraseni 2016). Instead, researchers recommend planting and maintaining multiple species in forest spaces, planting multipurpose species in barren or unproductive areas, and using policy to incentivize diverse forestry rather than forestry oriented towards maximizing carbon (Pandey, Cockfield, and Maraseni 2016). Practitioners should be skeptical of nature-based solutions which achieve climate mitigation at the expense of biodiversity, implement land transformations without or against Indigenous and local voices, and claim social transformation without active engagement in shifting existing social norms, practices, and inequities.

Overall, forest management programs are most effectively carried out when they take an interdisciplinary approach that integrates forestry, social science, economic, and behavioral science research with Indigenous knowledge, local land management needs, and local coalition-building among stakeholders (Keenan 2015). When programs use a top-down approach, they may fail to consider the sociopolitical contexts of communities, may produce and reproduce marginalization, and ultimately may result in programs with unequally distributed benefits (Ashraf 2022).

Case Study: Forest conservation and sexual and reproductive health and rights

Case Study 1. Forest conservation and sexual and reproductive health and rights Source: WECF 2019

COUNTRY	**ORGANIZATION**	**KEY SECTORS**
Guatemala	FUNDAECO	Forestry, sexual and reproductive health and rights
Description	FUNDAECO breaks traditional cultural barriers to ensure the sexual and reproductive health rights of adolescent girls in more than 100 Mayan and Q'echqi communities of Guatemala, as a fundament for their involvement in forest conservation. 22 health clinics, established in Protected Areas of Izabal, have provided regular care	

	and counseling to 50,000 patients (2/3 women), significantly reducing teenage pregnancies, and strengthening women's leadership. Support provided in maternal and infant feeding and hygiene are linked to environmental protection activities, i.e., good eating habits using natural resources, or sustainable waste management. Strategies were also implemented to prevent forced migration. A scholarship and youth leadership programs contributes to end discrimination of women with formal and informal education. FUNDAECO integrated SRHR in its approach to sustainable community development and conservation efforts of the Caribbean Guatemala Protected Areas. Trainings in managing and processing non-timber forest products are offered within a program supporting more than 500 families of indigenous communities for the creation of 4,000 hectares of agroforestry systems. It includes planting rubber and fruit trees, black pepper, shade trees, and creating live wind barriers to increase the forest cover in agricultural livestock systems, regenerating the forest's biodiversity.
Gender strategy/ impact	The 22 clinics have become a vehicle for women's empowerment and mobilized the communities around family planning issues, violence against women, and sexually transmitted diseases. 10 communitarian first aid kits were developed. FUNDAECO worked with the Movement for Equity in Guatemala Association (AME) to develop training processes about human rights, SRHR, and gender based violence. Scholarship support for 48 teenage girls enabled 15 of them to graduate and access new study opportunities. Women's groups initiated new income generating activities contributing to improved livelihoods and enhanced status in their communities. From a pilot started in 2014 with 3 clinics, the project expanded to a network of 22 community-based clinics and 3 mobile ones. The success for up-scaling lies in the ability to integrate health care services, human rights, and SRHR education into environmental protection activities and policies, taking into account cultural relevance for the Mayan groups – Q'eqchi, Mam, Chuk, Q'anjobal people. The scholarship program in particular has progressively become a multiplier among communities, with empowered young girls actively promoting new models of development.
Source: Baaki et al. 2019	

Learn More: Gender, Land Management, and Forest Protection

THEME	LEARNING RESOURCE	LINK
 **Integrating gender into conservation**	For an introduction to the importance of integrating gender into conservation and climate change policy, see the editorial from *Nature Climate Change* ("Gender in Conservation and Climate Policy" 2019)	https://www.nature.com/articles/s41558-019-0448-2#article-info
	For more on integrating gender into conservation, see the Conservation International's *Guidelines for Integrating Gender and Social Equity into Conservation Programming* (Conservation International 2019)	https://www.conservation.org/docs/default-source/publication-pdfs/integrating-gender-and-social-equity-into-conservation-programming-2019.pdf?sfvrsn=6b8e5c33_2
	See also Conservation Internationals' *Lessons learned: Gender + natural resources* (Conservation International 2015)	https://www.conservation.org/docs/default-source/publication-pdfs/ci-gender-field-demonstration-projects.pdf?sfvrsn=d1a2e5e_3
	For more on the benefits and costs of integrating gender into conservation from the perspective of conservation practitioners, see *Unpacking the Perceived Benefits and Costs of Integrating Gender into Conservation Projects: Voices of Conservation Field Practitioners* (Westerman 2021)	https://cicloud.s3.amazonaws.com/docs/default-source/s3-library/publication-pdfs/unpacking-the-perceived-benefits-and-costs-of-integrating-gender-into-conservation-projects-voices-of-conservation-field-practitioners.pdf?sfvrsn=afd7bde_2
	For challenges and strategies on integrating gender into ecosystem restoration, see *Gender and ecological restoration: time to connect the dots* (Broeckhoven and Cliquet 2015)	https://onlinelibrary.wiley.com/doi/full/10.1111/rec.12270
	For an examination of what gender-equitable approaches to resource management mean in practice, see The Nature Conservancy and WorldFish's *Engaging women and men in community-based resource management processes in Solomon Islands* (Schwarz et al. 2014)	https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/223/3791_AAS-2014-33.pdf?sequence=1&isAllowed=y

	THEME	LEARNING RESOURCE	LINK
	**Gender, conflict, and conservation**	For more on responding to gender-based violence in conservation, see Conservation International's *Gender-Based Violence: Recognizing and Responding to Gender-Based Violence (GBV) in Community Conservation*, (Conservation International 2020)	https://www.conservation.org/docs/default-source/publication-pdfs/guidelines_gender-based-violence.pdf?sfvrsn=236c2593_2
		For best practices for conservation work in conflict-affected areas, see *Men and Women as Conservation Partners in Conflict Settings* (Ajroud, Westerman, and Edmond 2015)	https://doi.org/10.1080/10402659.2015.1037622
	**Participatory natural resource management**	For a review of best practices for participatory approaches to sustainable resource management and livelihoods, see the *Tools for supporting sustainable natural resource management and livelihoods* special issues of *Participatory Learning and Action* (Ashley, Kenton, and Milligan 2013)	https://pubs.iied.org/14620iied
	**Strategies and limitations in the forestry sector**	For more on adaptation and mitigation options in the forestry sector across scales, see *Climate change impacts and adaptation in forest management: a review* (Keenan 2015)	https://doi.org/10.1007/s13595-014-0446-5
		For a review of challenges and limitations of mass tree planting, see IIED's analysis of the Ten Billion Tree Tsunami program in Pakistan (Ashraf 2022)	https://pubs.iied.org/sites/default/files/pdfs/2022-06/IIED20996.pdf

Oceans and Coastal Ecosystems

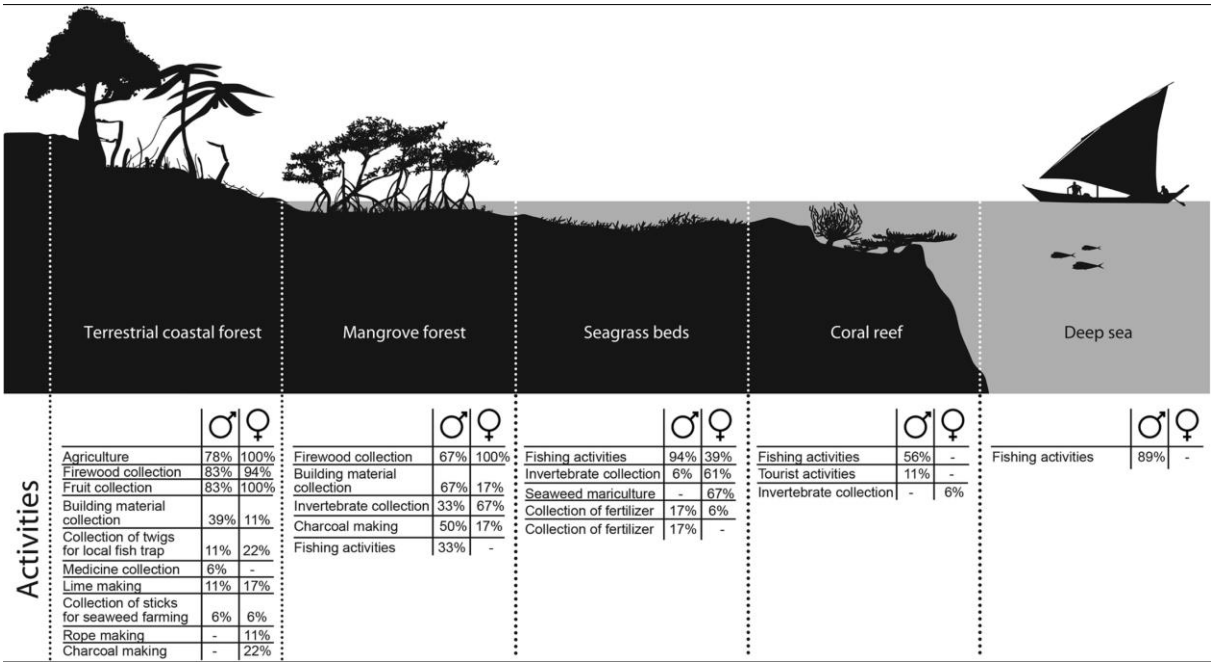
While climate mitigation actions often focus on land-based practices, a range of ocean-oriented mitigation actions are also effective and available options: ocean-based renewable energy, improved ocean transport, restoration and protection of ocean ecosystems, improved fisheries practices, and seabed carbon storage (Hoegh-Guldberg et al. 2019).

It is important to note that while research on gender in different ocean mitigation options is relatively limited, that does not mean that they are important solutions that could benefit from greater research or gender integration. Rather, this gap represents an opportunity for strengthening knowledge sharing in this space. When considering these options, it's important to note that while geoengineering climate mitigation options such as ocean iron seeding have been proposed, others have warned that techniques such as these can reproduce existing harmful gendered norms, are founded on inequitable scientific practices, and may have significant negative consequences for ecosystems and the social groups reliant upon them (Sikka 2018).

Restore and Protect Coastal Ecosystems

Restoration of coastal ecosystems is important for climate mitigation because of their role as carbon sinks, and coastal restoration can also generate health benefits by mitigating exposures to flooding and heat (Mailloux et al. 2021; Díaz et al. 2019). Integrating gender into this coastal restoration work improves its effectiveness (Hoegh-Guldberg et al. 2019). This is because gender shapes which coastal resources people value and use (de la Torre-Castro et al. 2017):

Figure 12. How gender shapes use of coastal resources Source: de la Torre-Castro et al. 2017. No changes were made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-nd/4.0/



When women are not included in design of coastal restoration programs, resources can be directed away from the resources they use. For example, in Tanzania, greater resources were directed towards aspects of coastal natural resource management that were less women-dominated, like coral reefs and deep see regions (de la Torre-Castro 2019). Fewer resources were dedicated to more equitable or women-dominated spaces, like seagrass meadows or mangrove forests (de la Torre-Castro 2019). Despite the importance of seagrass ecosystems both socially and ecologically, and the rapid global decline in seagrass habitats, seagrass restoration initiatives have received limited carbon financing support (Hejnowicz et al. 2015).

Addressing gender inequities in the fishing industry is also important for ensuring that both women and men are able to engage in protected area management and climate-responsive fishing practices. Similar gendered effects have been found in marine protected areas in the Philippines (Kleiber, Harris, and Vincent 2018). Even though both men and women fish, these areas are seen as a tool for men's fishing, rather than women's fishing (Kleiber, Harris, and Vincent 2018). Consequently, women were less likely to describe benefits from the protected are than men and less likely to participate in its management (Kleiber, Harris, and Vincent 2018). When asked why they did not attend management meetings, no man referenced their gender as a reason for not participating – but women did (Kleiber, Harris, and Vincent 2018). In other work on fisheries management in Uganda, men dominated the fishing industry and had a greater advantage in adapting to climate-associated fishing declines due to greater experience with fishing, fish species, fishing techniques, as well as greater income, despite women working longer hours, resting less, and using more income streams (Musinguzi et al. 2018).

It's important to consider gender and community voices when deciding how and where to set boundaries for protected areas. In Cambodia, the boundaries of a wetland protected area affected women differently than men, excluding women from fishing areas because of distance to travel to them, fear of violence along the way, and perceived vulnerability of women (Perry and Gillespie 2019). Because of the protected area, women must travel further to fish, fish with others, or resist common narratives of women as vulnerable and instead assert themselves as "strong" women (Perry and Gillespie 2019). In other regions, such as the South Pacific, this resistance can emerge in the form of breaking local marine management rules in response to limited engagement in management, mistrust of male leaders due to perceived mismanagement of funds, and constraints to women's fishing (Rohe, Schlüter, and Ferse 2018).

Case Study: Regional fisheries livelihoods program for South and Southeast Asia

Case Study 2. Regional fisheries livelihoods program for South and Southeast Asia (RFLP) Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
South and Southeast Asia	Food and Agriculture Organization of the United Nations (FAO)	Fisheries
Description	The RFLP was a four year project (2009-2013) for strengthening capacity among participating small-scale fishing communities and their supporting institutions in Cambodia, Indonesia, the Philippines, Sri Lanka, Timor-Leste, and Vietnam. It seeks to improve the livelihoods of fishers and their families while fostering more sustainable fisheries resources management practices. The project had six key areas of focus: • Co-management mechanisms for sustainable utilization of fishery resources • Improved safety at sea and reduced vulnerabilities for small-scale fisher communities • Improved quality of fishery products and market chains • Strengthened or diversified income opportunities for fisher families • Better access to microfinance services • Increased sharing of knowledge	
Gender strategy/ impact	The project especially focused on undertaking a gender analysis to understand the gender roles in fishing communities. This was used to provide gender trainings for men and women in fishing communities. The trainings were an opportunity for meso-level actors to be aware of "gender perceptions" and "gender stereotypes in the fisheries sector." RFLP also focused efforts on increasing the participation of women in decision-making, including their participation in co-management mechanisms, taking various roles in fisheries management interventions. In the Philippines, RFLP integrated gender into Coastal Resource and Fisheries Management Plans (CRFM) of the Local Government Units (LGUs). As a result, women will be acting as fish wardens and fishery law enforcers. RFLP is also working with the communities to set a women's managed area. In Sri Lanka, the inclusion of women representatives in co-management coordination committees was made compulsory,	

	as well as the inclusion of minimum two women directors in the Fish Finance Network Association. In Timor-Leste, women were involved as signatories of the first ever documented Tara Bandu, a traditional coastal resources management practice. Local authorities and communities were informed of the need to involve women in resource management and agreed to an RFLP request to include women as signatories of the Tara Bandu document. Women now have a role in the formalization of the traditional and community-based resources management system, albeit a mainly symbolic one, a role they did not have before the RFLP intervention. As signatories, they will now participate in all decision-making meetings. In Vietnam, the RFLP supported 16 Fisheries Associations (FAs) between the provinces of Quang Nam, Quang Tri, and Thua Thien Hue. The FAs are community-based organizations mainly for male fishers – of the 1,335 members, only 36 are women. In Vietnam, it is normal that men represent their household in most registrations. The local authorities' argument is that even if women's names do not appear in FA, they are considered FA members. RFLP worked through this to increase women's FA membership and encourage their active participation through an incentive scheme that includes: i) providing assistance for livelihood model implementation to women that are FA members only and ii) specifying that the membership fee is by household, instead of individual. This means that if both husband and wife are members, they will only need to pay one fee.

Source: Chauhan 2021, citing FAO 2012.

Learn More: Oceans and Coastal Ecosystems

	THEME	LEARNING RESOURCE	LINK
	**Gender inclusive fisheries and coastal management**	*Inclusive Management Through Gender Consideration in Small-Scale Fisheries: The Why and the How* (de la Torre-Castro 2019)	https://www.frontiersin.org/articles/10.3389/fmars.2019.00156/full#B21
		Gender analysis for better coastal management – Increasing our understanding of social-ecological seascapes (de la Torre-Castro et al. 2017)	https://www.sciencedirect.com/science/article/pii/S0308597X16308259
	**Ocean mitigation strategies in Kenyan climate policies**	*Blue Carbon Solutions in Kenya's Climate Actions* (Langat et al. 2021)	https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/60626/e49afb05-5e74-4410-9582-6d6949abe51e.pdf?sequence=1
	**Mangrove ecosystems**	For more on taking action on mangrove-related initiatives, see the Mangrove Alliance's Knowledge Hub	https://www.mangrovealliance.org/our-knowledge-hub/

Energy

Moving away from energy sources that are drivers of climate change and towards alternative and renewable forms of energy is often a core climate mitigation strategy. These projects sometimes claim benefits for education, livelihoods, and health (Kumar 2018). However, these pathways are not straightforward: they are mediated by sociocultural processes that can cause the benefits of energy access to be distributed unequally across communities (Kumar 2018). The rollout of these new energy systems can bring both benefits, such as poverty alleviation, and challenges, such as land loss or unequal distribution of benefits (Johnson et al. 2020).

A gender-responsive approach is critical at all steps of the design and decision-making process in order to ensure that energy transitions benefits all members of households and communities (Nelson and Kuriakose 2017). This is because moving towards low-carbon energy systems does not inherently produce or improve gender equity, and if energy programs are not explicitly designed to address the structures and systems that produce energy inequities, then "green" energy systems will likely replicate these same existing inequities (Johnson et al. 2020). Thus, work around energy transitions should be paired with longer-term societal shifts around promoting feminist energy jurisprudence and increasing the representation of women and girls in STEM fields to maximize its impact (S. E. Ryan 2014).

In reviewing literature on energy transitions and gender, researchers found that: 1) energy projects with negative outcomes often fail to engage the community, 2) few energy transition initiatives consider how gender might shape outcomes, 3) energy programs may not address barriers to access, and 4) "job increase" may not be an adequate indicator if this increased employment is short-term (Johnson et al. 2020). Energy research is further hampered by a tendency towards "gender blindness" and work that fails to capture the nuances of how novel energy initiatives are operationalized in everyday life (Pueyo and Maestre 2019). In India, for example, programs that focused on electric lights benefitted men more heavily than women, whereas energy access through micro-grids has the potential to have broader improved social outcomes, particularly for girls, women, and those of lower socioeconomic status (Kumar 2018).

Because of the way that gendered inequities in energy technology, access, and participation intersect, it is often more effective to conceptualize energy cross-sectorally, rather than focusing on specific siloed aspects of energy (e.g. democracy, technology, development, etc.) (Cannon and Chu 2021). Similarly, thinking about how energy interacts with other critical facets of human life – such as the food-energy-water nexus – can reveal opportunities, interdependencies, and emergent needs (Meir, Opfer, and Hernandez 2022).

Expand renewable energy access

Mitigation approaches like renewable energy may be more aligned with feminist and gender-inclusive values than other technological mitigation approaches like geoengineering (Sikka 2018). Renewable energy sources can also serve an adaptation function. For example, solar power not only reduces carbon emissions but also is also less vulnerable to storms and temperature surges than traditional power grids (Ripple et al. 2022). Indeed, energy access plays a critical role in managing climate-related disaster vulnerabilities (V. Sharma 2019). Bringing together a stronger renewable policy infrastructure, increased capacity building and mentoring for women in the renewable energy space, and strengthening financing mechanisms can facilitate the expansion of renewable energy initiatives in a gender-responsive way (Mohanty and Wallgren 2022). For example, solar power has been used to provide both energy and income for rural women in South Asia (Patel et al. 2020).

Reduce energy use in high-income contexts

Decreasing energy consumption is another important mitigation approach. However, this approach also raises important questions about justice and responsibility, and who is being asked to bear the burden of climate mitigation. A study in Bangladesh and Dhaka found that people were not optimistic about the efficacy of personal climate mitigation approaches, such as reducing energy consumption in the home or decreasing gasoline usage, although overall those who believed climate change put their lives at risk also had higher incomes, higher education, and were more likely to adopt climate mitigation actions

(Alvi, Nawaz, and Khayyam 2020). At present, inequities in residential energy access are likely to persist into the coming decades even amid economic growth (Poblete-Cazenave et al. 2021). However, modeled scenarios where climate mitigation targets are achieved demonstrate that this can be accomplished through reducing energy consumption in high-income contexts, without further curtailing energy access in regions that are already facing energy access challenges (Poblete-Cazenave et al. 2021). At a policymaking level, efforts to shift energy consumption can be integrated with other climate issues, such as air quality through integrated assessments (Klausbruckner et al. 2018).

Use improved cooking technologies

Because of the importance of food preparation in household energy consumption, cookstoves are often discussed alongside other forms of energy access. Traditional modes of cooking, which rely on solid biofuels such as wood, have significant effects not only on indoor air pollution but also on global greenhouse gases and surface temperature (Lacey et al. 2017; Gitau et al. 2019; Bensch, Jeuland, and Peters 2021). Transitioning to improved cookstoves is believed to reduce greenhouse gas emissions, improve forest conservation, reduce biodiversity loss, reduce fuel usage, and avert negative health outcomes caused by exposure to air pollution and risks of cooking on an open fire (Dissanayake et al. 2018; A. D. Beyene et al. 2015; Ochieng et al. 2021; Gitau et al. 2019; Bensch, Jeuland, and Peters 2021). The phase-out of solid fuel cooking in countries where over 5% of the population uses solid fuels could produce a cooling of the average global surface temperature of 77 mK and avert approximately 10.5 million premature deaths by 2050 (Lacey et al. 2017). Other research suggests that improved cookstoves can save approximately 634 kilograms of fuelwood annually (A. Beyene et al. 2015). Adoption of cleaner cookstoves is likely to reduce indoor air pollution exposures, improve respiratory and cardiovascular health outcomes, and reduce the labor burden on women and girls who typically do the work of gathering fuel such as wood for traditional cooking approaches (Mailloux et al. 2021; Anenberg et al. 2013; van Gemert et al. 2019). In a study in Nepal, changing to clean cookstoves is believed to have contributed in part to increased carbon stocks in local forests (Pandey, Cockfield, and Maraseni 2016).

In many communities, women and girls traditionally bear the responsibility for gathering fuelwood and cooking (Sesan et al. 2019). While improved cookstove programs are typically oriented around environmental and health benefits, they can also be an important tool for saving time and reducing labor, particularly for women. Improved cookstoves are estimated to save approximately 34 minutes per day largely through reduced burden of fuel collection, and both women and men save time with the use of this technology (Krishnapriya et al. 2021). Another study from Kenya found that time collecting fuel was reduced from 12 hours per week to 5 hours per week, even though only approximately 30% of cooking was carried out on the new stove (Jagoe et al. 2020). However, more

research is still needed around how improved cookstoves might affect women's time allocation or wellbeing (Alem 2021).

Because of their traditional responsibility for gathering fuelwood and cooking, women therefore are often assumed to have greater social capital around household energy usage (Sesan et al. 2019). Consequently, programming for adoption of improved cooking technology often focuses on women, rather than men, who often make household financial decisions, or children, who often use cooking technology currently or will use it in the future (Lindgren 2020). Though engaging women in improved cookstove enterprises has been promoted as a way to increase women's empowerment, this relationship is not inevitable (Sesan et al. 2019). A study of improved cookstove adoption in Kenya found that while women were highly motivated to acquire improved cookstoves, men had low motivation – and men also had the final say on whether households acquired improved technology (Ochieng et al. 2021). Integrating men is thus an important element of ensuring cookstove programs succeed (Ochieng et al. 2021). For example, studies have reported that men were unwilling to cut a hole in the wall to install the new stove, to build new a outdoor kitchen for the stove, to climb on the roof to clean the new chimney, or to have other men in their home to install the stove (Ochieng et al. 2021; Person et al. 2012; Sesan 2012; Catalán-Vázquez et al. 2018). However, research from Sudan suggests that focusing exclusively on men can be just as ineffective as focusing exclusively on women, and that integrated approaches attentive to context-specific gender roles and decision-making processes are more effective (Muneer and Mohamed 2003). In Mexico, a cookstove program generated health benefits, reduced greenhouse gas emissions, time savings, and money savings by integrating social networks through a training of trainers model and developing networks for cookstove dissemination, food security, and women's empowerment (Berrueta et al. 2017).

Though poverty is often the primary barrier to adopting clean cookstove technology, removing financial barriers to cookstove adoption through providing subsidies, free cookstoves, or financing does not necessarily seem to increase the rate of use or long-term adoption of the technology (Lindgren 2020; Romieu et al. 2009; Troncoso et al. 2007; Rosa et al. 2014). Overall, among options for financial incentivization, provision of free technology seems to have the most robust positive effect on adoption of improved cookstove technology (A. Beyene et al. 2015).

There may be a need for additional behavior change strategies that goes beyond simple training and information provision in order to improve the uptake of clean cookstoves, such as (Lindgren 2020):

1. Offering incentives to buy stoves
2. Airing radio announcements about the availability of stoves
3. Providing labor constructing stove infrastructure such as chimneys and hoods

4. Social support from community health workers about selection of fuels
5. Diversifying available stove options so community members have comparisons
6. Supporting self-efficacy and empowerment of women to choose a stove
7. Restrict or regulate certain fuel types

However, technological interventions like clean cookstoves have their limitations. New cookstoves technologies can be inconvenient, culturally inappropriate, or come at a high negative cost to individual households (Jeuland and Pattanayak 2012). These limitations can mean that households may not transition to sole use of the new cookstove (Rosa et al. 2014; Thomas et al. 2015; Serrano-Medrano et al. 2018). Improved cookstoves may require more tending, require fuel that is more difficult to access, or be less desirable for cooking specific traditional dishes (Rosa et al. 2014). Hesitancy around adoption of improved cookstove technology may prevent the potential benefits of this technology from being fully realized or achieving the reduction in air pollution recommended by the World Health Organization (Thomas et al. 2015). In addition, slow recovery from the COVID-19 pandemic could threaten the uptake of clean cooking technologies across Sub-Saharan Africa, Asia, and Latin America (Pachauri et al. 2021). Paying attention to the most important aspects of stove design, such as durability, fuelwood reduction, cooking time reduction, or smoke reduction, could ensure that new technologies address the desires of users (Dissanayake et al. 2018).

There are also limitations to cookstoves' impact on society more broadly. Narratives that improved stoves can reduce gender based violence or that benefits measured in a laboratory will directly translate into benefits in homes may miss the impact or effectiveness of improved cookstove technology in practice (Abdelnour 2015). An orientation towards technology can put the burden of complex environmental, health, and social problems on those who are already facing disadvantages – and can make far-reaching claims that shifting to novel cooking technology will directly empower women to address issues such as climate change or deforestation (Abdelnour 2015; Abdelnour and Saeed 2014). Programs should also take care to avoid the trap of "charismatic carbon" – that is, programs that highlight feel-good marketing elements such as "empowering" women in the Global South while avoiding critical engagement with issues such as women's agency or gender relations (Lehmann 2019). Indeed, there are serious and significant gaps in empirical evidence around how transitions towards new technology practically affect women's lives (Pachauri and Rao 2013). Another key gap in knowledge is that improved cookstove research has also focused more heavily on rural households than urban households or businesses (Alem 2021).

Identifying regions or communities for improved cookstove programming is often done by examining the rate of traditional cooking techniques as well as the potential for environmental and health impact. In Mexico, a county-level spatial model was developed to

identify high-priority areas for dissemination of improved cookstoves (Serrano-Medrano et al. 2018). At a global level, Lacey et al. developed an integrated model of solid fuel use, associated health risks (premature death due to exposure to air pollution), and climate (contribution to surface temperature change due to use of solid fuel cookstoves).

Case Study: Women led agroforestry and clean cookstoves

Case Study 3. Women led agroforestry and clean cookstoves Source: Hottle 2015

COUNTRY	**ORGANIZATION**	**KEY SECTORS**
Honduras	Promoting Local Innovation (PROLINNOVA), the CGIAR Research Program on Climate Change and Food Security (CCAFS), and the Foundation for Participatory Research with Honduran Farmers (FIPAH)	Energy, agriculture, forestry
Description	This project's objects were organized around farmer-led innovation, gender equity, and low-emissions agriculture. The program used a highly participatory approach that integrated indigenous knowledge of agroforestry systems, and engaged men alongside its efforts to forward women-led initiatives. In this project, women were involved in constructing improved cookstoves, which resulted in a decrease of their firewood consumption and faster cooking. In addition, agroforestry coffee systems were planted and managed by women, with support from men, in order to improve household nutrient diversity, decrease flooding risk, and plant trees resistant to the common coffee leaf rust fungus. Youth also had greater access to agricultural training.	
Gender strategy/ impact	As a result of this project, women had greater control over land use and agricultural decision making and had increased income through more enduring income streams. In addition, there was greater collaborative experimentation between men and women through community agriculture groups.	

Source: Adapted from Hottle 2015

Learn More: Energy

THEME	LEARNING RESOURCE	LINK
Integrating gender in energy projects	*Mainstreaming gender in energy projects: A practical handbook* (Cecelski and Dutta 2011)	https://www.energia.org/publications/mainstreaming-gender-in-energy-projects-a-practical-handbook/
	Gender-responsive Renewable Energy Programmes (Mohanty and Wallgren 2022)	https://www.empowerforclimate.org/en/resources/g/e/n/gender-responsive-renewable-energy-programmes
Local case studies around energy	For more on how energy can shape both positive and maladaptive climate practices, see *Access for adaptation? Reviewing the linkages between energy, disasters, and development in India* (V. Sharma 2019)	https://www.sciencedirect.com/science/article/pii/S2214629618308521
	For a review of renewable energy options in Nepal and their potential impact on health and society, see *Role of renewable energy technologies in climate change adaptation and mitigation: A brief review from Nepal* (Suman 2021)	https://doi.org/10.1016/j.rser.2021.111524
	For infographics on renewable energy featuring women leaders from Vietnam, Bangladesh, and Cambodia, see EmPower's *Renewable Energy: Powering Equality for a Green Recovery* (EmPower 2022)	https://www.empowerforclimate.org/en/resources/i/n/f/infographics-renewable-energy-powering-equality-for-a-green-recovery
	For a case study on *Women-centered and women-led renewable energy initiatives in Bangladesh,* see page 50 of *Climate change, gender equality and human rights in Asia: Regional review and promising practices* (Pross et al. 2020)	https://asiapacific.unwomen.org/en/digital-library/publications/2021/01/climate-change-gender-equality-and-human-rights-in-asia
	For an example of an agroforestry and clean cookstoves project in Honduras, see *Women-led agroforestry and clean cookstoves in Honduras:* (Hottle 2015)	https://hdl.handle.net/10568/69448
Improved cookstoves	For a review of clean cookstove research, see the *Mitigating Climate Change through Sustainable Technology Adoption: Insights from Cookstove Interventions* working paper from the African Economic Research Consortium (Alem 2021)	http://publication.aercafricalibrary.org/bitstream/handle/123456789/2772/Working%20Paper%20Series%20CC-006.pdf?sequence=1&isAllowed=y
	For an introduction to how Dharma Life genderates change with clean cookstoves in India through cooking competitions, see their brief video. For a report on their cooking projects, see *The Kaleidoscope of Cooking* (Santosh Singh 2014)	https://www.youtube.com/watch?v=-COJvYAD6xY&ab_channel=DharmaLife https://dharmalife.in/assets/documents/Kaleidoscope-of-Cooking-India.pdf

Transportation

Improving transportation infrastructure is also a critical part of climate mitigation and adaptation, particularly given the importance of functioning infrastructure in disaster response, post-disaster healthcare, and rapid recovery. However, in many low-income contexts, climate mitigation is a co-benefit of moving towards more sustainable transportation rather than the driving force behind transportation policy shifts, which may instead be oriented around mobility and connectivity, health, energy security, or logistics (S. Bakker et al. 2019).

Research also suggests that around the world, men and women engage in transportation differently due to gendered divisions in household work. For example, women tend to travel shorter distances, stop at multiple destinations within the same trip (e.g., "chain trips"), travel more for non-work reasons, travel outside of rush hour, and choose modes of travel other than private cars (Ng and Acker 2018; Mahadevia and Advani 2016). Gender played a stronger role in mode of transportation than other factors like age or income, with researchers attributing women's preference for public and more flexible modes of transport to their more complex travel patterns (Ng and Acker 2018). In some cases, however, women's mode of transportation is forced, and not the result of choice (Mahadevia and Advani 2016). Improvements to gender equity may increase the transportation sector's contribution to greenhouse gas emissions as more women become employed outside the home and own cars, leading to increased daily travel and car use as women's level of travel approaches that of men (Holz-Rau and Scheiner 2019).

Household dynamics and structures also influence transportation patterns. In Southeast Asian cities, household size was correlated with transportation choice, with larger household size associated with traveling by alternative modes of travel such as train, taxi, or walking as compared to motorcycle or private vehicle (Ng and Acker 2018). Research from the transport sector indicates that women in different countries have more in common with each other regarding transportation choices than they do with men in the same country, suggesting that lessons learned and approaches could be readily modified and validated across contexts (Ng and Acker 2018). In the US, gendered differences in travel time to work and travel for household tasks persist for partnered women with children, regardless of whether they have breadwinner status in the household (Fan 2017). Research in Sweden suggests that transportation arrangements are negotiated within households based on both external structures and internal norms and agreements about gender roles and responsibilities, with important consequences for women's use of time and ability to access a broader space for daily activities (Gil Solá 2016). In this context, gender shaped mobility and mobility shaped gender, as women and men sharing households both reinforced and remade social rules and norms in transport negotiations (Gil Solá 2016).

Invest in transportation infrastructure and other "quick wins"

After studying transportation in Bangladesh, Ghana, India, Indonesia, Kenya, Nigeria, Rwanda, South Africa, and Uganda, researchers compiled over 100 possible measures and identified ten "quick wins" for low-carbon transportation to prioritize (K. Bakker 2010):

1. Phase out of fossil fuel subsidies
2. Implement sustainable national urban mobility plans
3. Promote electric two- and three-wheeled vehicles
4. Limit imports of secondhand trucks that are inefficient and cause pollution
5. Create low-emissions zones in cities
6. Adjust pricing on car use
7. Implement standards and incentives for vehicle fuel economy
8. Invest in infrastructure for non-motorized transit
9. Optimize freight and logistics efficiency
10. Implement quality standards for diesel

Investing in infrastructure is important because the built environment shapes both transportation needs and use of transportation (Holz-Rau and Scheiner 2019). Cycling, for example, significantly reduces lifetime CO_2 emissions (Brand et al. 2021). However, cycling is highly reliant upon built infrastructure and administrators who manage this infrastructure may resist the innovations necessary to expand cycling access (Brezina, Leth, and Lemmerer 2020). In addition, given that cycling is dominated by men and younger people, expanding and diversifying the population of cyclists requires attending to the preferences of prospective cyclists in infrastructure design (Aldred et al. 2017). For example, women tend to prefer that cycling lanes be separated from motor vehicle traffic (Aldred et al. 2017). However, by addressing aspects of safety, resources, and gender norms that can limit cycling, these programs can have a range of positive effects, including increasing rural girls' access to education (Uteng and Turner 2019; Muralidharan and Prakash 2013).

Gender mainstreaming in the transportation policy sector could be an important step forward in climate mitigation (Kronsell, Smidfelt Rosqvist, and Winslott Hiselius 2016). This is particularly important because infrastructure improvements focused on roads or smart transportation do not necessarily generate inclusivity or provide benefits for women but rather tend to benefit male users of transportation (Uteng and Turner 2019). Based on these gendered trends in transportation, researchers recommend policy changes oriented towards improved transportation safety, integration of gender analysis into transportation policy, and broader consideration of diverse needs when developing public transit schedules (Ng and Acker 2018). Attempts to maintain or reduce transportation emissions need to take care to avoid reducing or limiting women's mobility in these policies (Mahadevia and Advani 2016).

Case study: Cycling to increase secondary school enrollment for girls

Case Study 4. Cycling to increase secondary school enrollment for girls Source: Uteng and Turner 2019; Muralidharan and Prakash 2013

COUNTRY	ORGANIZATION	KEY SECTORS
India	Government of Bihar	Transportation, Youth, Education
Description	This program aimed to reduce gender gaps in secondary school enrollment in Bihar, India by providing girls continuing on to secondary school with a bicycle. Being exposed to this program increased girls' secondary school enrollment by 30% and reduced the gender gap in secondary school enrollment by 40%. Benefits were largely felt in communities where girls had to travel longer distances to schools, suggesting that bicycle provision addressed critical time and safety costs of school attendance. The program was more cost effective than conditional cash transfer programs in increasing girls' attendance.	
Gender strategy/ impact	In addition to providing a bicycle, this program also addressed gender norms that limited female mobility, education, and employment and promoted girls' safety through cycling in groups.	
Source: Adapted from Muraldihan and Prakash 2013 and Uteng and Turner 2019		

Learn More: Transportation

	THEME	LEARNING RESOURCE	LINK
	Gender and transportation	For more on gender, transport, and innovation, including how transportation affects women's health and education, see *Addressing the Linkages between Gender and Transport in Low- and Middle-Income Countries* (Uteng and Turner 2019)	https://doi.org/10.3390/su11174555
	Assessing transportation	The World Bank's report *Resilient Transport in Small Island Developing States* offers tools for assessing transportation programming, infrastructure, and operations	https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099840104262222525/p1641570ed55c3096098670e0fd1a73eb3a

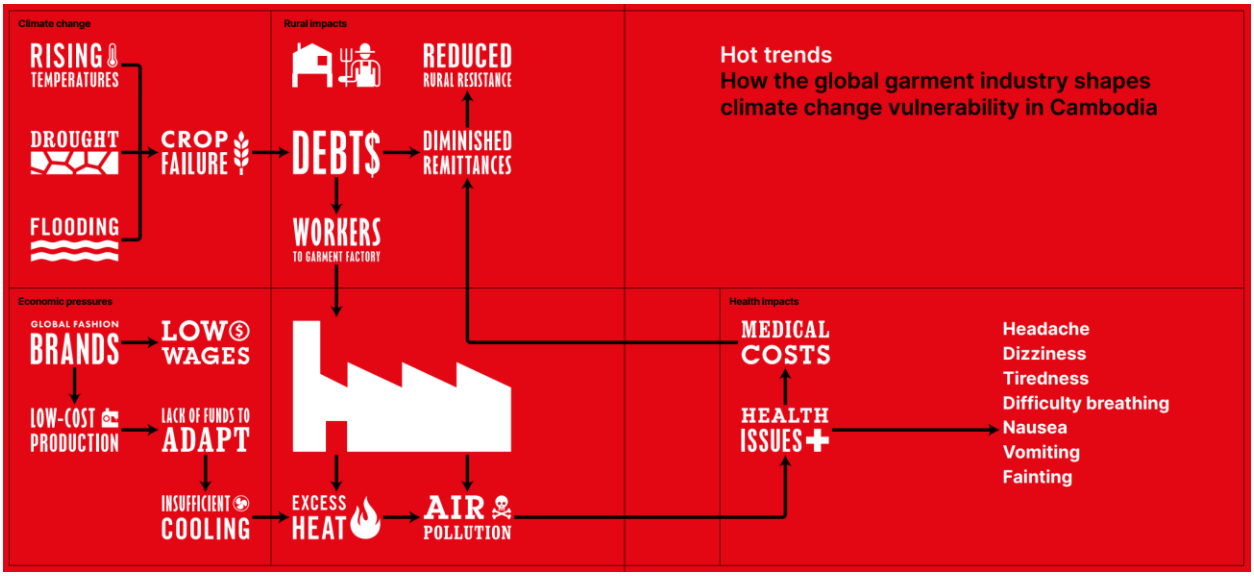
Industry

Policies like energy efficiency standards, emissions regulations, and other policies around carbon and energy use in industry could have an important impact on climate mitigation (UNEP 2020).

Implement worker and environmental protections in factories and industry

The garment industry, for example, is a major contributor to pollution and carbon emissions (Niinimäki et al. 2020). As climate-associated environmental change prompts migration to urban areas, people often seek work in these factories, where they become further exposed to other climate-associated threats such as heat and air pollution (Parsons et al. 2022):

Figure 13. How the global garment industry shapes climate change vulnerability in Cambodia Source: Parsons et al. 2022. No changes made. The license is available here: https://creativecommons.org/licenses/by-nc/3.0/



Corporate and governmental movements towards sustainability in industry are occurring at the same time as pushes from workers towards labor rights and justice (Parsons et al. 2022). Labor unions in Bangladesh have contributed greatly to reducing violence, improving working conditions, and mitigating health risks for garment workers (Uddin, Ullah, and Dipto 2021). However, workers who are already in precarious positions should not have to bear the burden and risks of organizing for fair and safe working conditions.

These effects of industry are strongly gendered. In Bangladesh, for example, garment factories tend to prefer to employ women, largely because of existing gender inequities and gender roles, but this also results in migrant women having steadier employment than migrant men (Evertsen and van der Geest 2020). Female garment workers are highly vulnerable to shifting economic conditions; for example, almost half of Bangladesh's

female garment workers lost their jobs following COVID-19 (Jalais 2021). Gender-based violence is prevalent within the garment sector and climate change may exacerbate this (Anderson Hoffner et al. 2021). However, work in this sector is often less unsafe than other forms of acceptable work for women, such as domestic labor (Evertsen and van der Geest 2020).

Other industries, like brickmaking, may also exploit rural dwellers forced to migrate as a consequence of climate change (Brickell et al. 2018). Because of this, it is critical to separate measures of economic growth from safe and fair labor, prioritize holistic climate response and occupational health efforts, and expand social protections (Brickell et al. 2018). Extractive industries such as mining, which are at the heart of transitions towards a low-carbon future, similarly pose serious threats for worker and environmental health (Addison 2018). Systemic shifts are essential to protect the rights of workers and those who dwell near industrial projects.

Leverage innovations and incentives to reduce industrial agriculture emissions

The agriculture industry is also a major contributor to greenhouse gas emissions (G. D. Sharma et al. 2021; Wollenberg et al. 2016). However, currently feasible technical mitigation options in the agriculture sector may achieve only 31-40% of the mitigation that is necessary to achieve emissions reduction targets (Wollenberg et al. 2016). Greater use of renewable energy in the agriculture industry could reduce greenhouse gas emissions and mitigate the effects of other agricultural practices, such as pesticide use, on greenhouse gas emissions (G. D. Sharma et al. 2021). However, other research suggests that the impact of renewable energy generation may vary by country, suggesting that differentiated agricultural policies may be critical in mitigating emissions (Pata 2021).

Others have suggested that taxes, rather than a focus on agricultural energy usage, would be more efficient at achieving emissions reductions in the agriculture sector (Gołasa et al. 2021). Similarly, reducing subsidies to farmers may increase emissions, but agricultural trade protections can reduce emissions (Laborde et al. 2020).

Achieving these emissions reductions without putting poverty reduction and nutrition efforts at risk is a major challenge in this sector (Laborde et al. 2020; Hellin and Fisher 2019). With that said, emissions reduction in the agriculture sector can also profoundly affect women's lives. For example, research on novel rice planting approaches in India found that direct-seeded rice and machine-transplanted rice would not only reduce greenhouse gas emissions but also dramatically reduce women's labor in rice planting (Gartaula et al. 2020). For more on gender and climate-smart agriculture approaches, see the agriculture subsection of the adaptation actions section of this book.

Case study: Producing local sustainable energy and enhancing business activities

Case Study 5. Producing local sustainable energy and enhancing business activities Source: WECF 2018

COUNTRY	ORGANIZATION	KEY SECTORS
Uganda	WECF – Women Engage for a Common Future	Energy, business and industry
Description	WECF and local partners facilitate technical trainings to integrate renewable energy solutions, such as briquette production, solar pumps, photovoltaic and biogas digesters, into the activities of agricultural cooperatives. Benefiting from improved, sustainable processing of agricultural products and diversified activities, cooperatives generate more jobs and higher incomes for their members. They also become energy hubs, providing access to clean and affordable energy to their members and the wider community. They provide technical and financial advice on sustainable energy technologies suitable for households, public entities and businesses. With a rural electrification rate of 4%, only 0.4% of the population in Uganda has access to modern cooking technologies. Almost 86% households rely on firewood for cooking, leading to high CO2 emissions and strong deforestation (losing 1% of natural forest resources every year). The project generates affordable clean energy for rural households, creating social and economic benefits for women and men, while reducing CO2 emissions and the dependence on fossil fuels. Existing community structures, such as saving groups and cooperatives, create possibilities for joint investments in energy technologies and act as multipliers. The production and use of decentralized solar energy and the recycling of organic waste promote local value chains and climate-friendly, sustainable economies. The solutions are feasible, replicable and inclusive. They transform the agricultural and energy sector, reduce poverty, create income, improve health and the communities' resilience. (continued on next page)	

Gender strategy/ impact	Gender responsive trainings on energy technologies and management are conducted to create equal ownership of business activities and installed technologies. For each technology, two cooperative members, female and male, are elected to be in charge of the technical and management issues. Cooperative members are responsible for raising awareness within their communities, particularly within women's saving groups, providing advice responding to their needs and capacities.
Source: WECF 2018	

Learn More: Industry

	THEME	LEARNING RESOURCE	LINK
	Gender, labor, and climate change	For more on labor and climate change broadly, with specific case studies of mitigation and adaptation strategies, see *Climate Change in the Global Workplace: Labour, Adaptation and Resistance* (Natarajan and Parsons 2021)	https://www.routledge.com/Climate-Change-in-the-Global-Workplace-Labour-Adaptation-and-Resistance/Natarajan-Parsons/p/book/9780367422325
		For more on how gender, climate change, and the garment industry interact, see *Gender, environment and migration in Bangladesh*	https://doi.org/10.1080/17565529.2019.1596059
	Gender and the garment industry in Bangladesh	For a case study on forwarding women through rights-based manufacturing in Bangladesh, see the case study *Rights-based manufacturing and garment industries in Bangladesh* beginning page 48 of *Climate change, gender equality and human rights in Asia: Regional review and promising practices* (Pross et al. 2020)	https://asiapacific.unwomen.org/en/digital-library/publications/2021/01/climate-change-gender-equality-and-human-rights-in-asia
	Climate mitigation in the agriculture industry	For more on policies for reducing emissions in the agriculture sector, particularly without jeopardizing poverty reduction and nutrition goals, see *Modeling the Impacts of Agricultural Support Policies on Emissions from Agriculture* (Laborde et al. 2020)	https://www.nber.org/papers/w27202

Part 2: Adaptation actions

Adaptation includes everything that individuals, communities, and institutions do to manage, adjust to, and survive climate change. The adaptation strategies that different groups choose, implement, and find effective are shaped by factors like gender and culture, and are tailored to context-specific vulnerabilities and assets (A. Ahmed et al. 2016). That is, resources, norms, values, environments, and other contextual factors can shape which strategies are implemented, how those strategies are implemented, and how effective they are as a response to climate threats.

Adaptation practices often combine both traditional practices and scientific innovations through social and ecological efforts (Mcleod et al. 2019). It's important to note that for some communities, even the best available adaptation actions will be insufficient given the magnitude of climate impacts (Mcleod et al. 2019).

Some researchers view adaptation and resilience in economic terms, such as income and livelihood diversity (Andersen, Verner, and Wiebelt 2017). Others, however, take a more holistic approach towards adaptive capacity and innovation, and will include elements such as assets, flexibility, learning, social organization, and agency (Cohen et al. 2016).

"Adaptation is, in essence, about making good decisions for the future, taking into account the implications of climate change. It involves recognizing and understanding potential future climate impacts and planning and managing for their consequences, whilst also considering the broader social, economic or other environmental changes that may impact on us, individually or collectively." – (Keenan 2015)

The ability to adapt is influenced by many factors, including gender. Systemic inequities and traditional gendered roles and responsibilities may lead to women facing many disadvantages as compared to men in terms of their ability to recover or adapt following climate-linked events, and female-headed households may experience greater climate vulnerability than male-headed households (Balikoowa et al. 2019; Ganguli 2021). However, sometimes these margins of vulnerability are very narrow, and women living in male-headed households may face their own important adaptive challenges (Balikoowa et al. 2019). Moreover, as one study from Bhutan demonstrated, while female-headed households tan tended to have lower adaptive capacity than male-headed households, other factors, like elevation and proximity to community forests, also played a role (Choden, Keenan, and Nitschke 2020). In research on climate adaptation in the Soloman Islands, capacity to innovate was associated with risk tolerance, but researchers noted gendered differences in willingness to bear risk, with women tending to be more risk averse (Cohen et al. 2016). The authors also emphasize that adaptive capacity and innovative capacity are "shaped by a range of related socio-institutional factors, in particular, pressure to conform to social norms, willingness to bear risks, need for evidence, power structures embedded in social relationships and organizations, and access

to information" and they draw attention to "trade-offs, synergies and conflicts between generic adaptive capacity and adaptive capacity for specific risks or hazard" (Cohen et al. 2016, S309). In a study of pineapple farmers in Ghana, institutional factors like quality of and access to extension services, access to climate change education, and access to credit were more influential in climate change knowledge and adaptation practices than gender, age, or marital status, highlighting the importance of addressing institutional barriers to adaptation (Antwi-Agyei et al. 2021). Researchers have called for greater integration of gender into socioecological systems research (Salgueiro-Otero and Ojea 2020). Health could similarly be forwarded explicitly.

Research like this makes it clear that we must consider intersectional, gendered patterns of both vulnerability *and* adaptive capacity to climate change as we consider how we can respond to climate threats. In their guidance for the CLARE research program on gender and climate, for example, researchers examined cross-sectoral, gendered aspects of vulnerability and adaptive capacity (van Eerdewijk, Bråten, and Danielsen 2021):

Table 6. A summary of advances in cross-sectoral knowledge on gender equity and social inclusion related climate change impacts and adaptation Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation: Cross-sectoral Knowledge	
Vulnerability /absorptive capacity	**Adaptive capacity**
• Vulnerability is a product of complex climate-society interactions and should not be reduced to questions of individual qualities. • It is linked to the extent to which people can realize their basic human rights and to the health of the ecological systems they depend on for their livelihoods and wellbeing. • Care should be taken to not generalize different groups of people's vulnerabilities to climate change. Essentialist narratives e.g., women as victims and notions of the 'universal disabled subject' – risk reproducing and reinforcing social inequalities and render the variety of vulnerabilities invisible. • People who face the highest risk and experience the most severe impacts of climate change are those who already suffer from multi-dimensional inequalities in their lives.	• Pervasive gender and social inequalities and exclusion generate or reinforce power imbalances in all institutional arenas (e.g., household, community, climate change institutions) resulting in differential adaptive capacity, including more limited climate change response options for women and girls compared to that of men and boys. • Resulting (negative) impacts tend to further restrict access to resources needed to improve capacities to adapt (e.g., access to skills and training); further impede freedom to participate and influence decisions (e.g.,); rendering needs, interests, contributions, and knowledge largely invisible (e.g., women's care work, indigenous people's ecological knowledge); and ultimately further increase differentiated vulnerability from climate change.
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Though studies around climate adaptation often focus on gender differences between men and women, other intersectional aspects of identity also shape peoples' preferences around climate adaptation strategies:

"There are geographically determined gendered preferences and adoption strategies regarding adaptation options and [...] these are influenced by the socio-ecological context and institutional dynamics. Intersecting identities, such as caste, wealth, age and gender, influence decisions and reveal power dynamics and negotiation within the household and the community, as well as barriers to adaptation among groups." (Ravera et al. 2016)

Thus, it's critical to pay attention not only to gender, but also a range of socio-ecological and structural factors that shape power, values, access to resources, and decision-making. Consider following these eleven principles for effective adaptation:

Box 2. Eleven principles for effective adaptation Source: Singh et al. 2021

"Adaptation should

1) Minimize costs, and maximize benefits
2) Support achievement of material, subjective, and relational wellbeing goals
3) Reduce vulnerability and/or increase adaptive capacity, especially of the most vulnerable and those most at risk to climate change
4) Increase resilience by building functional persistence over long timescales so that systems have the ability to bounce back from climatic shocks
5) Be economically, ecologically, and socially sustainable, explicitly looking at longer-term, cross-generational viability of adaptation actions
6) Take into account unintended negative consequences and explicitly look at the cross-scalar, long-term impacts of adaptation actions
7) Invest in ecosystem conservation management, and restoration to enhance ecosystem services, and hence reduce impacts of climate change on human systems
8) Be co-produced with communities to ensure inclusive and sustainable adaptation
9) Be oriented towards achieving transparency, accountability, and representation in governance, through multi-scalar, participatory, and inclusive processes
10) Be oriented toward socially just and equitable processes and outcomes
11) Be a process that fundamentally changes human thinking and practices in the face of climate change and overly challenge the power structures that generate vulnerability to its impacts"

Source: Singh et al. 2021

Learn More: Climate Adaptation, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Key, sector-specific messages around climate adaptation and gender**	See Module 4, Handout 19 (page 256) of the *Training Manual on Gender and Climate Change Resilience* (Chauhan 2021)	https://arrow.org.my/wp-content/uploads/2021/08/Empower-Training-Manual_GCCR-compressed.pdf
	**Guidance on climate adaptation programming**	For more on developing gender-transformative approaches to climate action, see the framework for policy outcomes at the 66th Commission on the Status of Women (CSW66) convened in March 2022, available from WEDO	https://wedo.org/toward-a-gender-transformative-agenda-for-climate-and-environmental-action/
		CARE's Orientation Guide on Gender Equality and Adaptation	https://careclimatechange.org/orientation-guide-on-gender-equality-and-adaptation/
		For a review of best practices and approaches for community based adaptation to climate change, see the *Community-Based Adaptation to Climate Change* special issue of *Participatory Learning and Action* (Ayers and Forsyth 2009)	https://pubs.iied.org/14573iied
		The World Bank Group issued guidance for designing tailored, coordinated efforts around climate resilience and adaptation programming in their report *Adaptation Principles: A Guide for Designing Strategies for Climate Change Adaptation and Resilience*	https://openknowledge.worldbank.org/handle/10986/34780
		For approaches to mainstreaming gender in climate resilience projects, see *Leveraging co-benefits between gender equality and climate action for sustainable development: Mainstreaming gender considerations in climate change projects* from UN Women (UN Women 2016)	https://unfccc.int/files/gender_and_climate_change/application/pdf/leveraging_cobenefits.pdf
	**Gender integrated climate adaptation approaches**	For more on gender-transformative climate adaptation approaches, see *Gender-transformative climate change adaptation: advancing social equity* (Resurrección et al. 2019)	https://www.sei.org/wp-content/uploads/2019/11/gender-transformative-climate-change-adaptation.pdf

	For case studies on specific gender-responsive climate solutions, see Module 4, Handout 20 of the *Training Manual on Gender and Climate Change Resilience* (page 262)	https://arrow.org.my/wp-content/uploads/2021/08/Empower-Training-Manual_GCCR-compressed.pdf
	For examples of technical, non-technical, and transformational climate solutions that aim for gender justice, see the Women and Gender Constituency's repository *Gender Just Climate Solutions*	https://womengenderclimate.org/gender-just-climate-solutions-2/gender-just-climate-solutions/
Engaging men in climate adaptation	For more on how to engage men in climate justice work, see *Men, masculinities, & climate change* (Kato-Wallace et al. 2016)	https://promundoglobal.org/wp-content/uploads/2016/04/Men-Masculinities-Climate-Change.pdf

Sexual and Reproductive Health and Rights and Climate Adaptation

Sexual and reproductive health and rights are at the center of many cross-cutting thematic issues in climate adaptation and should be recognized as a key element of climate adaptation (McMullen et al. 2021; IPPF 2021). All work around sexual and reproductive health and rights, especially as it relates to climate resilience, must be grounded in human rights and equity (Starrs et al. 2018). Securing sexual and reproductive health and rights contributes to climate adaptation and resilience first and foremost by reducing climate vulnerabilities through its contribution to addressing gender inequality and marginalization; strengthening gender equity increases the capacity of women and girls to participate in developing and implementing climate change solutions (IPCC 2014; IPPF 2021; UNHRC 2019). When women and girls can participate in creating climate solutions, these solutions are more fair, effective, and sustainable (IPPF 2021; UNHRC 2019).

> *"The convergence of promoting sexual and reproductive health and rights, improving access and quality of education, and developing climate solutions provides an opportunity to improve the lives of women and girls while simultaneously unleashing cascading benefits for combatting climate change." – (Mailloux et al. 2021)*

Integrate sexual and reproductive health services with adaptation programming

Given the connections between climate change and reproductive health, integrated voluntary, rights-based family planning with other environmental and resilience programming can be an effective strategy for reducing vulnerability to climate change (Mian 2018; Chauhan 2021; D'agnes et al. 2010; Engelman and Johnson 2019). When family planning projects are integrated with cross-sectoral work, outcomes are better than with single-sector work (Engelman and Johnson 2019; Hardee et al. 2018; Robson et al. 2017). Enabling women to choose whether and when to expand their families also has implications for other aspects of health and climate resilience (Dasgupta and Robinson 2021). For example, voluntary family planning can provide important health, economic, and equity benefits, can support resilience and planetary health, and can reduce vulnerability to climate-associated hazards like flood, drought, water shortages, or food insecurity (Mailloux et al. 2021; Starrs et al. 2018; Hardee et al. 2018; Dodson et al. 2020; Dasgupta and Robinson 2021).

Resist framing sexual and reproductive health as climate mitigation

Given the positive impact that women in positions of political authority can have on carbon emissions and environmental policies, ensuring sexual and reproductive rights and increasing the availability of voluntary family planning services also has the potential to reduce future climate outcomes (UNHRC 2019; Engelman and Johnson 2019; Sam Sellers 2016). Some conservationists and scientists have also called attention to the pressure that increasing populations place on biodiversity and hydrology (Hawken 2017; Engelman and Johnson 2019; Ahmadalipour et al. 2019). However, women's empowerment and sexual and reproductive rights *must* remain at the heart of work around SRHR and climate, with a focus on climate adaptation and resilience instead of climate mitigation. See Box 3 for more on the dangers of contraception as climate mitigation and IPPF's framing of this issue.

As activists and organizers put it in their policy framework for the 66th Conference on the Status of Women: "Avoid and decry approaches that position contraception as a climate change mitigation strategy, and abandon the patriarchal, eugenicist and racist framing of population control" (APWLD et al. 2022).

Given this, IPPF recommends that climate adaptation measures that incorporate SRHR should address a broad suite of SRHR services, instead of focusing only on narrow aspects of SRH, such as contraception (IPPF 2021). For example, in addition to contraception services, these efforts can also include HIV, AIDS, and other STI care; sexuality education; gender-based violence prevention; infertility treatment; cervical cancer treatment; maternal and newborn care; other forms of care for sexual health and well-being; and efforts to address structural barriers to SRHR (IPPF 2021).

Box 3. Contraception as a strategy for climate change mitigation Source: IPPF 2021

"Different stakeholders have pointed to contraception as an important intervention for climate change mitigation. Project Drawdown, for example, includes family planning alongside girls' education among the top 10 of its climate solutions.[1] The argument is that contraception will reduce fertility, which will lower population growth, which in turn will lead to decreased levels of greenhouse gas emissions. The predominant focus of such narratives – explicitly or implied – is women and girls in lower income countries, where rates of fertility are comparatively high.[2]

Rhetoric and actions suggesting curbs on the fertility off women and girls as a solution for social and environmental ills have a long and dangerous history and still manifest today. Policies and practices driven by a desire to stem population growth have lead to countless human rights violations.[3] The International Conference on Population and Development in 1994 marked an important shift away from population-focused objectives to a broader sexual and reproductive health and rights agenda, grounded in individual human rights.[3] The urgency of the climate crisis must not serve as justification for harmful and coercive population control narratives, policies, and practices.

Mitigation of climate change requires addressing unsustainable patterns of consumption and production, particularly in high-income countries, where per capita levels of greenhouse gas emissions far exceed those in lower income groups.[4] Promotion of contraception as a solution for climate change instrumentalizes women's and girls' bodies and places emphasis and responsibility for tackling the climate crisis on those least responsible for contributing to it but most severely affected by its impacts. It's a deeply unjust and harmful distraction from countries' responsibilities to address the structural drivers of the climate crisis."

Source: IPPF 2021, citing:

(1) See Project Drawdown (2020) The Drawdown Review 2020 – Climate Solutions for a New Decade. Available at: https://drawdown.org/drawdown-review; see also Project Drawdown website, Solutions, Health and Education: https://www.drawdown.org/solutions/ health-and-education.

(2) See United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019: Highlights. Available at: https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf. See further Vollset, SE et al (2020) Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. The Lancet 2020; 396, 10258, pp. 1285–1306. Available at: https://doi.org/10.1016/S0140-6736(20)30677-2.

(3) See Pizzarossa, LB (2018) Here to Stay: The Evolution of Sexual and Reproductive Health and Rights in International Human Rights Law.

(4) See World Bank data on CO2 emissions (metric tons per capita). Available at: https://data.worldbank.org/indicator/EN.ATM.CO2E.PC.

Case Study: Population, health, and environment (PHE) approach in climate change policies

Case Study 6. Population, health, and environment (PHE) approach in climate change policies Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
Philippines	PATH Foundation Philippines, Inc.	Fisheries, Water, Policy Sexual and reproductive health and rights
Description	PATH Foundation Philippines, Inc. (PFPI) implemented the Population, Health and Environment and Climate Change Project in the Philippines' Verde Island Passage. Verde Island is a key marine biodiversity area threatened by overfishing, pollution, and climate change. The goal of the project is to mainstream sexual and reproductive health and rights (SRHR) into climate change policy and practice. The project applied a developmental approach (PHE) that forges multisectoral collaboration and partnership, and employs multiple interventions to address SRHR needs (family planning), biodiversity loss, poor health and food insecurity to foster climate-resilient communities. Women play a critical role in achieving climate change resilience. PFPI's scoping study results show that women are central to conceiving and implementing solutions. Planning their families, managing the resources, and being pro-health and pro-environment advocates in their own communities will help build resilience to climate change. All of these will contribute to a better future for their children. The women also highlighted that collaboration and agreements between communities will create synergy in community actions and results.	
Gender strategy/ impact	At the core of the population, health, environment, and climate change nexus is the "burden on the woman." Fishing communities in the Verde Islands experience declining fish catch, depleting potable water, and poor health. Lack of livelihood options, loss of family income, and food insecurity drive women to engage in multiple jobs and to work longer hours to supplement the family's income. The project addresses women's needs and rights as well as family planning in a participatory approach, helping them identify coping strategies.	
Source: Chauhan 2021, citing (WECF 2016)		
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.		

Case Study: Menstrual hygiene, strengthened livelihoods, and waste management

Case Study 7. Combating menstrual hygiene poverty while reducing waste Source: WECF 2019

COUNTRY	ORGANIZATION	KEY SECTORS
India	Praveen Lata Sansthan	Sexual and reproductive health and rights, waste, livelihoods
Description	This project addresses the interconnected challenges of plastic waste, extreme poverty, unhygienic practices during menstruation, and sustainable livelihoods. It enables adolescent girls and community women to lead healthy lives by breaking myths and taboos surrounding menstruation and creating awareness about health practices. More than 6,500 Mera Pads – reusable cloth pads made from bamboo – have been distributed. Their production and sales have created new jobs for 25 women, improving the livelihoods of their families. Over 7,500 women and girls have been trained in menstrual hygiene through 92 workshops in 30 villages across 8 districts of Rajasthan. Awareness raising programs were also organized for boys and men to break the cycle of menstrual discrimination. Disposable sanitary pads result in the unsustainable discharge of millions of tons of plastic waste all over the world, which are nearly non-biodegradable. One woman using disposable pads and tampons for menstrual hygiene will generate around 150 kg of plastic waste during her entire life, with an estimated carbon footprint of 900 kg CO2. This project has thus far supported 1,626 women with 6,504 reusable cloth pads, saving 31,219 kg of plastic waste and substantially reducing carbon emissions.	
Gender strategy/ impact	Access to safe menstrual hygiene can be a matter of life and death. Patriarchal discrimination of menstruating women still prevails in India. With affordable, sustainable alternative pads, this project has created jobs, improved the life of 1,626 women, and raised the capacity of 7,500 girls and women on menstrual hygiene management. Programs to sensitive boys and men break gender taboos. Pragati Sakhis – environmental ambassadors – are selected to educate and empower women in the communities on environment and health. Started in one village in 2015, Spotless Dame has already been replicated in 30 locations from 8 districts. Pragati Sakhis – environmental ambassadors -endorse the role of multiplicators and ensure up-scaling. The business model based on a sustainable production with local materials and local people is easy to replicate. By 2030, the non-profit organization aims to provide 1 million women with Mera Pads, creating sustainable jobs for at least 1,000 women.	
Source: WECF 2019		

Case Study: Reproductive health care in emergency response

Case Study 8. Reproductive health care in emergency response Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
Philippines	UNFPA	Coastal disaster management, sexual and reproductive health and rights, youth
Description	After Typhoon Haiyan, United Nations Population Fund (UNFPA) estimated that there were 230,000 pregnant women in affected areas, with 835 women giving birth every day with very limited access to emergency obstetric care. UNFPA and its partners provided lifesaving maternal health services through 80 temporary maternity wards, two emergency obstetric theaters in containers, and 34 ambulances, including motorbikes. Women and girls of reproductive age were also provided access to basic hygiene items, such as sanitary pads, underwear, and soap, through the distribution of 105,000 dignity kits in evacuation centers. An additional 110,000 kits were for pregnant and lactating women. UNFPA also focused on ensuring that 4,000 women every week have access to reproductive health care services by providing equipment and repairing infrastructure in all eight affected provinces. In the aftermath of the storm, UNFPA also paid special attention to the needs of young people affected by the disaster. With their direct involvement and the help of local partners, UNFPA set up "Youth-Friendly Spaces" that offer peer education training for volunteers and various activities for local youth, including information sessions about life skills and responsible sexual behavior. More than 20,000 young people across hard-hit areas attended UNFPA-supported health information sessions to address issues of gender-based violence. UNFPA established 17 women-friendly spaces across four provinces. The spaces serve as primary venues for raising awareness on gender-based violence, anti-trafficking, and psychosocial support with referrals to services for survivors. It also has linkages to cash-for-work programs. In addition, 2,400 services providers were oriented on handling gender-based violence cases during emergencies.	
Gender strategy/ impact	As needs intensified after Typhoon Haiyan, UNFPA began working with the Government of the Philippines to ensure that women affected by the typhoon are not cut off from life-saving reproductive health care, wherever they are located.	
Source: Chauhan 2021, citing UNFPA 2018		

Learn More: Sexual and Reproductive Health and Rights and Climate Adaptation

	THEME	LEARNING RESOURCE	LINK
	**Sexual and reproductive health and rights and climate**	For more on addressing SRHR amidst the climate crisis, see *The climate crisis and sexual and reproductive health and rights* (IPPF 2021)	https://www.ippf.org/sites/default/files/2021-03/IPPF%20position%20paper%20The%20climate%20crisis%20and%20sexual%20and%20reproductive%20health%20and%20rights_Jan2021.pdf
	**Reproductive justice and climate justice**	For approachable resources on the connections between reproductive justice and climate justice, see the Ipas blog post *Why we need to make reproductive justice part of our climate conservation and climate action plan* (Matine and Cisse 2021)	https://www.ipas.org/news/why-we-need-to-make-reproductive-justice-part-of-the-climate-conversation-and-our-climate-action-plan/
	**Family planning and conservation**	For more on how family planning fits in with conservation goals, see *Removing Barriers to Family Planning, Empowering Sustainable Environmental Conservation: A Background Paper and Call for Action*	https://margaretpyke.org/wp-content/uploads/2021/01/C1-Removing-Barriers.pdf

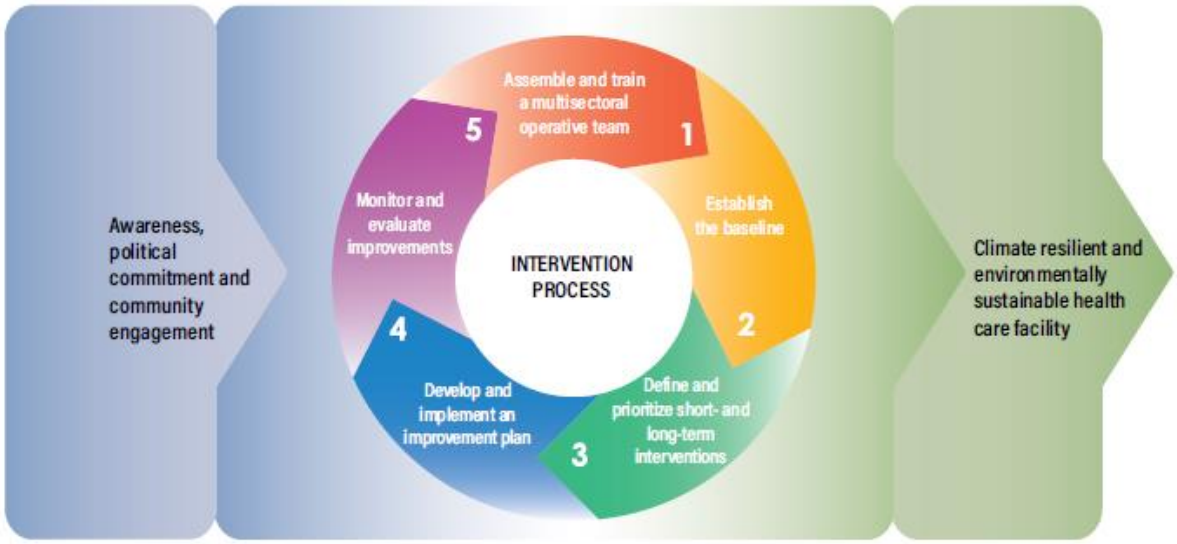
Health Systems

Climate change has serious consequences for health systems and policy, and it poses a threat to achieving universal health care (Salas and Jha 2019; van Daalen et al. 2020). Within the health sector, overall strengthening of the health system, integration of women's groups into health programming, and providing health care through rural community health workers can help bridge gender gaps in healthcare access and health status (H. C. P. Brown 2011; Banerjee and Maharaj 2020; van Daalen et al. 2020; World Health Organization 2014). Ensuring that health systems' are adapting to climate change can also better enable them to provide care and respond to other emergent issues (Romanello et al. 2022).

Health financing can also be an important part of strengthening the climate resilience of health systems (Hanefeld et al. 2018). However, funding remains a major barrier to implementing national health and climate change plans; for example, less than 28% of low and lower-middle income countries are receiving international funds for their climate and health activities (WHO 2021a). Securing funding for these improvements is an important part of strengthening the resilience of health care systems (WHO 2020).

Moving towards more climate resilient health facilities can take place in an iterative intervention process where implemented actions are developed in response to baseline needs and goals, and are adapted through monitoring and evaluation as well as training of multisectoral teams (WHO 2020):

Figure 14. Process for increasing climate resilience and environmental sustainability in health care facilities
Source: WHO 2020. No changes made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/deed.en



Strengthen health system supply chains and infrastructure

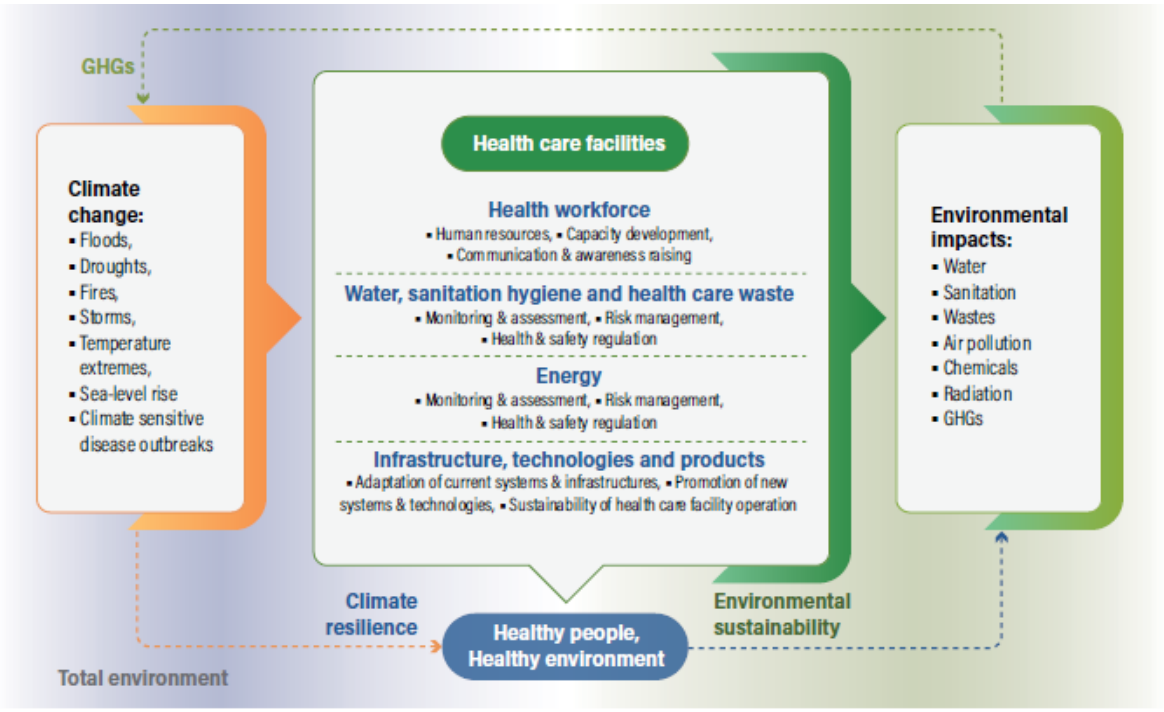
Extreme weather associated with climate change can have cascading impacts on health systems as challenges compound (Romanello et al. 2022). Given this, strengthening health infrastructure and functioning in emergencies is an important part of ensuring that health systems are ablet to continue providing care amid climate-related challenges.

Strengthening the functioning of the health care system therefore often entails emergency planning. For example, it can include creating systems for managing safety, emergency needs, transportation, evacuation, water supplies and other disaster risk reduction measures (WHO 2020). Following emergencies, plans for rapid clean up can also be an important part of avoiding air quality and related problems, like those from mold (WHO 2020). Plans for water storge and monitoring of water systems and sewers are also important (WHO 2020). Health systems can also ensure that they have sufficient medicine, supplies, and facilities for emergency demand or in case the facility is cut off from supply chains (WHO 2020).

It can also involve developing more robust health infrastructure (Ossebaard and Lachman 2021). Within existing buildings, this can entail permanent movement of equipment away from flooding areas or a plan to move that equipment in emergencies (WHO 2020). Facility staff can also check to ensure energy use can continue in extreme weather, including for lighting, communications, refrigeration, and sterilization, by checking backup generators and coverage of emergency back-ups (WHO 2020). Strengthening resilience can also entail retrofitting infrastructure for extreme weather, considering future risks in building new infrastructure, and designing buildings responsive to locally specific hazards (WHO 2020).

Finally, shifting towards climate-resilient health systems can include activities like reducing greenhouse gas emissions from the health sector (Ossebaard and Lachman 2021). This can also include the implementation of systems for saving energy, recycling, reducing water waste (WHO 2020). Improved insulation, use of renewable energy, and moving towards a culture of saving energy can also support the reduction of emissions (WHO 2020). For example, changing the staff culture towards a preference for stairs and ramps over elevators can help reduce energy usage (WHO 2020). Reducing waste and the carbon footprint of the health care sector, through changing the packaging of waste and materials, moving away from waste incineration, recycling, and reducing plastic water bottle use, can also help (WHO 2020). Bicycle storage and public transportation discounts for staff can also enable more climate resilient modes of transportation (WHO 2020).

Figure 15. Framework for building climate-resilient and environmentally sustainable health care facilities
Source: WHO 2020. No changes made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/deed.en



Improve surveillance systems

Investing in health information systems is an important part of strengthening health systems' climate resilience (Hanefeld et al. 2018). In particular, systems for monitoring morbidity and mortality associated with climate hazards are a useful tool for understanding regional risks and trends (WHO 2020). Identifying these climate-associated health risks is an important first step in developing contextually-specific responses that can strengthen health systems (Romanello et al. 2022).

In addition to monitoring outcomes broadly, these surveillance systems should also monitor outcomes for healthcare workers and vulnerable populations in emergencies (WHO 2020). Rolling out these systems should also include training on climate-related surveillance for staff (WHO 2020).

These health surveillance systems for climate-related disease can be built to include weather and climate information but currently, less than 40% of countries do this (WHO 2021a). In addition, they can incorporate GIS or other mapping technologies in the process of regularly mapping risks to the facility and region (WHO 2020).

In addition, early warning systems and extreme weather alerts can ensure health facilities are prepared for climate emergencies (WHO 2020).

This health and environmental surveillance data should be used to inform decisions, such as considering the temperature when planning activities and physical labor or adjusting air conditioning use based on temperature (WHO 2020). The data can also be used to guide early health intervention (WHO 2020). Moreover, emergency plans should be updated plans as new information about risks becomes available (WHO 2020).

Part of strengthening health surveillance systems also involves collecting data with greater degrees of disaggregation so policymakers, health professionals, and community members can appropriately understand and respond to risks in the community.

Build capacity of health care workers

Supporting the health workforce is also an important part of strengthening the climate resilience of health systems (Hanefeld et al. 2018). For example, investing in training around addressing climate risks, such as those related to WASH, chemical, and energy related hazards, can improve health care workers' ability to recognize and respond to climate-related crises (WHO 2020; Ossebaard and Lachman 2021). Staff can also be trained to recognize health conditions that are made worse by climate change (WHO 2020).

In addition, efforts can be made to improve the capacity of health care workers to effectively respond in times of crisis. This can include infection prevention training for crises and training around areas where there may be increased demand following climate

events, in addition to general training around early warning systems, contingency plans, disaster response, emergency preparedness (WHO 2020). Safety training around water, waste, chemical, and electrical safety can also be useful (WHO 2020). Training to help staff recognize signs of PTSD in each other can also help support the workforce in times of crisis (WHO 2020).

Ongoing learning opportunities are an important part of ensuring staff knowledge is maintained (WHO 2020). Training can also be oriented towards cultural shifts, such as training around reduced energy use or the health co-benefits of sustainability (WHO 2020).

This can also include activities to strengthen health care human resources, such as systems to provide additional workers in emergencies, systems to protect worker safety, and mutual aid and psychosocial support for healthcare workers (WHO 2020).

Capacity building efforts should be done in a gender-sensitive way, attuned to the needs of different health care workers and the gendered effects of climate both on the health system and in the community more broadly.

Reach broader populations through innovative approaches that address systemic inequities

Feminist investment in in building climate-resilient health systems is a critical aspect of moving towards systemic change that does not just respond to inequitable vulnerabilities but rather strives to eradicate them (APWLD et al. 2022; Banwell et al. 2018; Downey et al. 2021). Developing more accessible health infrastructure responsive to these inequities is a key part of building climate-resilient health systems (Ossebaard and Lachman 2021).

One way to do this is through community health workers and community groups (World Health Organization 2014; van Daalen et al. 2020). Prevention and education programming can reduce the disease burden on health care systems (WHO 2020). This can include awareness raising among patients, visitors and communities about climate risks and prevention measures (WHO 2020). Healthcare workers can be involved in community health programs and disaster planning (WHO 2020). In addition, health care facilities can partner with local authorities to reduce climate vulnerability (WHO 2020).

Understanding intersectional vulnerabilities and adaptive capacities around health can inform equitable approaches to health system strengthening and generate more climate resilient health systems (van Eerdewijk, Bråten, and Danielsen 2021):

Table 7. A summary of advances in health sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity ans social inclusion related climate change impacts and adaptation: Health and disability	
Vulnerability /absorptive capacity	
Groups particularly vulnerable to climate change	Women often face disproportionate high health risks from the impacts of climate change when compared to men. People with disability experience multidimensional inequalities and due to their exclusion from adaptation efforts
Examples of different, and more severe, experiences of climate change effects for different groups of people in different social positions	Climate change acts as a health threat multiplier due to multiple direct (e.g., extreme heat) and indirect factors (e.g., reduced access to health care), and at the same time exacerbates existing health inequalities and exclusion from health and other services.
Adaptive capacity	
Gender/ social differences in ability to respond to climate change	Climate change related gender-based health disparities are associated with unequal access to and control over resources between women and men such as financial assets that can help prevent, reduce and react to shocks and related illness or disability.
How gender and social relations mediate climate change response options	Gender norms and power dynamics might influence adaptive capacity such as when norms restrict women's mobility and prevent them from leaving home to seek timely medical help.
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Case Study: Strengthening health systems with a digital app for adolescent reproductive health

Case Study 9. Strengthening health systems with a digital app for adolescent reproductive health Source: YLabs 2022

COUNTRY	ORGANIZATION	KEY SECTORS
Rwanda	YLabs	Health systems, sexual and reproductive health and rights, youth, digital health
Description	The CyberRwanda platform supports adolescents' reproductive health access with interactive health education, mobile-friendly contraceptive product ordering, and streamlined linkage to clinic-based services. The project is led by YLabs in partnership with the Society for Family Health - Rwanda, and is implemented with guidance from the Ministry of Health, Rwanda Biomedical Center, and the Rwanda Education Board. The app was co-designed with over 800 youth and 200 parents, teachers, and health care providers. It can be accessed on phones and in schools, and the app includes on offline mode so youth can still access content even without Internet connection. The app is also being adapted to include a "Crisis Flows" feature to address urgent or emergency situations when youth may need immediate support. The program uses a "digital self-care" approach to provide anonymous information about taboo topics and strengthen continuity of care with trusted providers. The app includes three key features. First, it has narrative content in the form of web-comic stories on themes ranging from career planning and goal setting to contraception, gender-based violence, and relationships. Second, it has a frequently asked questions page and directory for local pharmacies and health facilities. Third, it lets youth order and purchase sexual and reproductive health items such as condoms, contraceptive pills, pads, etc. for pickup at a pharmacy or health post of their choice.	
Gender strategy/ impact	Though the project's original demographic was adolescent girls, early design research sessions revealed that adolescent boys also had limited access to information about family planning and reproductive health. Moreover, these adolescent boys were often very influential in girls' sexual and reproductive health decision-making. Given this, the project adjusted to include the voices and address the needs of both adolescent girls and boys. Platform features and educational information provided are adapted based on gender and sex of the user. Data from the program will be age and gender disaggregated. CyberRwanda is being evaluated through a multi-arm randomized control trial led by University of California Berkeley.	
Source: YLabs 2022b; Nolan et al. 2020; Ippoliti et al. 2021; Hémono et al. 2022		

Learn More: Health Systems

	THEME	LEARNING RESOURCE	LINK
	**Women leaders in health**	For examples of women leaders in the health sector, see *Women Who Lead: Successes and Challenges of Five Health Leaders* (Javadi et al. 2016)	https://doi.org/10.1080/23288604.2016.1225471
	**Guidance on climate and health systems**	In their report *Climate Change and Health: Vulnerability and Adaptation Assessment,* the WHO developed an Operational Framework for Building Climate-resilient Health Systems. In it, the WHO assesses climate resilience across a range of domains, including leadership and governance, the health workforce, health information systems, essential medical products, service delivery, and financing (World Health Organization 2021)	https://www.who.int/publications/i/item/9789240036383
		The WHO issued guidance on capacity building for climate resilience in health care facilities in their report *WHO Guidance for Climate Resilient and Environmentally Sustainable Health Care Facilities.* Chapter 4 includes interventions for strengthening climate resilience.	https://www.who.int/publications/i/item/climate-resilient-and-environmentally-sustainable-health-care-facilities
		The World Bank Group also issued guidance on developing climate-smart healthcare systems in their report *Climate Smart Healthcare: Low-Carbon and Resilience Strategies for the Health Sector*	https://openknowledge.worldbank.org/handle/10986/27809
		The *Compendium of WHO and other UN guidance on health and environment* offers systematically compiles guidance on all areas of health and the environment from the WHO and other UN organizations	https://www.who.int/publications/i/item/WHO-HEP-ECH-EHD-22.01
	**Comparing toolkits for climate resilient heath care system**	To learn more about toolkits for climate resilient healthcare systems, see the review of three toolkits for climate resilient healthcare systems from PAHO, Canada, and the United States in *Enhancing the sustainability and climate resiliency of health care facilities: a comparison of initiatives and toolkits* (Balbus et al. 2016)	https://www.scielosp.org/article/rpsp/2016.v40n3/174-180/en/

THEME	LEARNING RESOURCE	LINK
Evaluating climate vulnerabilities and resilience in the health sector	The WHO *Checklists to Assess Vulnerabilities in Health Care Facilities in the Context of Climate Change* is designed to accompany their *Guidance for Climate Resilient and Environmentally Sustainable Health Care Facilities* report	https://www.who.int/publications/i/item/9789240022904
	The World Bank Group provided guidance on evaluating climate-smart health systems in their report *Methodological Guidance: Climate Change and Health Diagnostic - A Country-Based Approach for Assessing Risks and Investing in Climate-Smart Health Systems* (World Bank 2018)	https://documents1.worldbank.org/curated/en/552631515568426482/pdf/122328-WP-PUBLIC-WorldBankClimateChangeandHealthDiagnosticMethodologyJan.pdf
Data on climate vulnerabilities and adaptation in the health sector	The WHO *Health and Climate Change Survey report,* completed every three years, includes national level data around leadership and governance, national vulnerability and adaptation assessments, emergency preparedness, disease surveillance, adaptation and resilience measures, climate and health finance, and mitigation in the health sector	https://www.who.int/publications/i/item/9789240038509

Gender Equity

Inequities in social determinants of health affect the impacts of climate change, and climate change (and efforts to mitigate or adapt to it) affect social determinants of health (Saunders et al. 2017). Addressing pre-existing inequities is a critical element of reducing gendered vulnerabilities to climate change and ensuring that all people have the tools, resources, and capacity to adapt to variable impacts of climate change.

It is important to note that reducing gender inequity is not inherently a climate adaptation or mitigation strategy. For example, while increased women's leadership in government and level of education reduces the carbon-intensity of well-being (the ratio of CO_2 emissions per year of life expectancy), women's increased participation in the labor market increases carbon-intensity of well-being (Ergas et al. 2021). Thus, it is critical to integrate climate adaptation approaches alongside gender-transformative and health initiatives to ensure that improvements in one sector do not come at a cost of harm in another.

Strengthen equity in social networks and community groups

In some cases, this addressing gender inequities requires paying attention to how gender shapes social networks and social engagements. For example, women and men may have different social networks, which allow them access to different resources or forms of social support (Perez et al. 2015; Balikoowa et al. 2019). While participation in social groups can be an important element of climate change adaptation, in one study from Uganda, female-headed households did not demonstrate the same social network participation of men, likely because of limited time to participate or concerns that they could not offer reciprocity to other group members (Balikoowa et al. 2019).

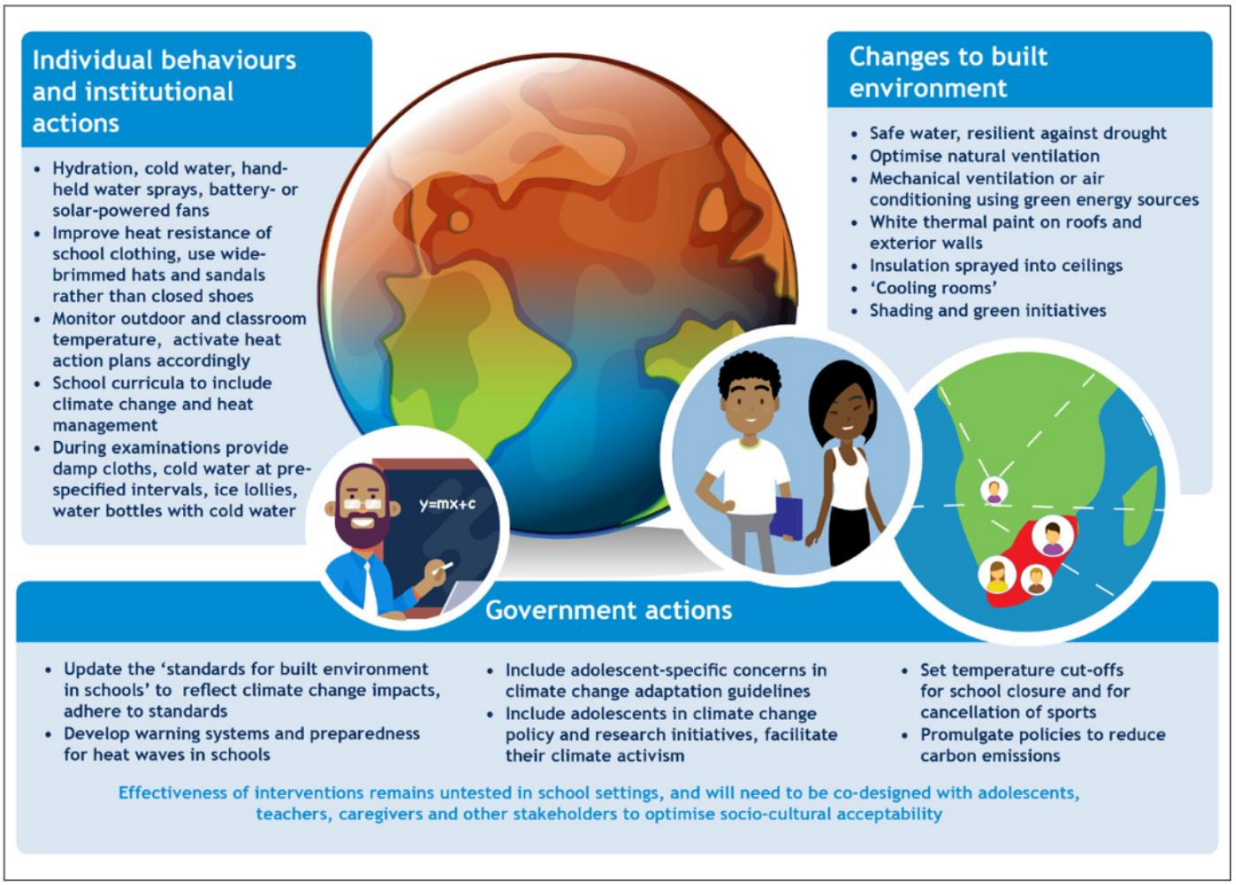
One way to improve equity in these groups is through gender quotas, e.g., requiring a certain number or percentage of group members to be women. Many conservation efforts use gender quotas in their interventions, but these often are insufficient to achieve more than minimal representation of women ("Gender in Conservation and Climate Policy" 2019). More progressive gender quotas that require at least 50% of group members to be women are more effective for maximizing the benefits of conservation interventions (Cook, Grillos, and Andersson 2019).

Close gender gaps in basic education

Education is another sector of gendered social inequity with important implications for climate resilience (Mailloux et al. 2021; O'Neill et al. 2020; C. Kwauk 2020). Emerging research suggests that girls' education is a critical factor in increasing adaptive capacity to climate hazards, enabling women to better support their families, increasing their ability to engage in decision making processes, and mitigating socioeconomic vulnerabilities (Mailloux et al. 2021; O'Neill et al. 2020; Sims 2021; Striessnig, Lutz, and Patt 2013; C. Kwauk 2020).

Broadly, supporting continued school enrollment during and after climate threats is very important for adolescent and youth outcomes, as schools can provide critical support and education to adolescents and youth in extreme situations (Skovdal and Campbell 2015). Researchers from South Africa have suggested a range of interventions to reduce the impact of climate change on adolescents in school (Chersich, Scorgie, et al. 2019):

Figure 16. Actions to reduce the impact of climate change on adolescents in school Source: Chersich, Scorgie, et al. 2019. No changes were made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/4.0/



The relationship between education and climate is complex, as higher education levels may also be associated with economic growth and increased emissions (O'Neill et al. 2020). This suggests that climate-informed education may be critical in pursuing both climate resilience and educational equity (Fry and Lei 2021; C. Kwauk and Casey 2021). However, climate-informed education can be a challenge when resources for achieving basic education are already limited in many places (C. Kwauk 2020).

For more on climate-informed education, see the subsection on education within the Engaging with Adolescents and Youth section of this chapter.

Address gender inequities in systems and infrastructure

Forwarding gender equity can occur through the transformation of social norms, resources, access, and patterns of power – and it can also occur through greater attention to systems and structures.

For example, gender equity can be integrated into the process of repairing and developing physical infrastructure that is climate-resilient (van Eerdewijk, Bråten, and Danielsen 2021):

Table 8. A summary of advances in infrastructure sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation: Infrastructure	
Vulnerability /absorptive capacity	
Groups particularly vulnerable to climate change	Some groups, irrespective of climate change, have less access to infrastructure, e.g., elderly, disabled, women, children
Examples of different, and more severe, experiences of climate change effects for different groups of people in different social positions	Reliance on infrastructure is gendered, e.g., women are more severely affected by break-downs of drinking water, sanitation, waste-disposal infrastructure, and water infrastructure in agriculture and livestock husbandry. Climate-related break-down of infrastructure often leads to increased drudgery of women, which can affect girls' schooling negatively
Adaptive capacity	
Gender/ social differences in ability to respond to climate change	People excluded or deprived from access to infrastructure are less likely to cope from the stresses and shocks of climate change.
How gender and social relations mediate climate change response options	Gender-division of labor/ care-economy make women and girls' experience climate change related break-downs of infrastructure more severe compared to men and boys and also further negatively affects their ability to respond/adapt to climate change.
Examples of climate change actions with potential to enhance equality and social inclusion	Investing in gender responsive and socially inclusive infrastructure development is a promising pathway to strengthening the adaptive capacity of women and girls / those most affected by climate change.
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Case Study: Ethnic minority women's empowerment

Case Study 10. Ethnic minority women's empowerment Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
Vietnam	CARE International in Vietnam	Gender equity, participatory planning, livelihoods, agriculture
Description	This project aims to empower remote ethnic minority women to actively participate in local socioeconomic development planning and decision-making. To achieve this objective, the project focuses on four components: i) women's voice in local development plans; ii) climate-resilient livelihoods; iii) strengthening women's groups; and iv) fighting gender-based violence. The project targets 4,500 women and 3,000 men of Thai, Tay, Dzao, and Hmong people in remote northern mountain areas. Nearly 90% of women were aware of climate change and its implications for their community, and 43% of target women increased their income. The project worked with indigenous communities to conduct climate vulnerability and capacity assessments, as well as research on climate-resilient livelihood models. For the first time in their life, local people reflected on climate change and its impact. A system of Sustainable Rice Intensification (SRI) was applied. People saved 40% of their seedlings, reduced fertilizer use by up to 40%, and saved 30% water. Carbon dioxide (CO_2) emissions from SRI practices can fall by 70%. This model helps farmers adapt better to drought and disaster by reducing water usage and shortening the cultivation period.	
Gender strategy/ impact	The project established a social protection net for local women via a saving and loan association. This is a platform for women to talk, share, start saving, and gain easy access to loans. It improves women's confidence and solidarity. The SRI technical trainings were introduced for men and women. For the first time, the women could build their capacity on technical knowledge and agriculture, which is usually male-dominated. As a result, women improved their income by US$70 per acre of rice.	
Source: Chauhan 2021, citing WECF 2016		
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.		

Learn More: Gender Equity and Climate

	THEME	LEARNING RESOURCE	LINK
	**A review of gender, resilience, and environmental change**	See *A synthesis of convergent reflections, tensions and silences in linking gender and global environmental change research* (Iniesta-Arandia et al. 2016)	https://doi.org/10.1007/s13280-016-0843-0
	**Gender equity and climate policy**	For more on specific policy steps to address the impacts of climate change on women's health, see *Climate change and women's health: Impacts and policy directions* (Sorensen, Murray, et al. 2018)	https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002603
		For more on how gendered assumptions influence and hinder climate resilience progress, ee *Gender equality in climate policy and practice hindered by assumptions* (Lau et al. 2021)	http://www.nature.com/articles/s41558-021-00999-7
	**Girls' education and climate**	For more on the role girls' education plays in climate adaptation, see the Malala Fund's report *A greener, fairer future: Why leaders need to invest in climate and girls' education* (Fry and Lei 2021)	https://www.ungei.org/sites/default/files/2021-03/Girls-Education-Climate-Report-2021-eng.pdf
		For more on challenges and policy approaches for climate resilience within the education sector, see *Roadblocks to quality education in a time of climate change* (C. Kwauk 2020)	https://eric.ed.gov/?id=ED607008
	**Engaging men in climate adaptation**	For more on how to engage men in climate justice work, see *Men, masculinities, & climate change* (Kato-Wallace et al. 2016)	https://promundoglobal.org/wp-content/uploads/2016/04/Men-Masculinities-Climate-Change.pdf
	**Integrating gender equity into climate action and disaster risk reduction**	The UN report *Action not words: Confronting Gender Inequality through Climate Change Action and Disaster Risk Reduction in Asia*, available here (Dankelman 2016)	https://asiapacific.unwomen.org/en/digital-library/publications/2017/04/action-not-words
	**Advancing climate and equity through civil society**	For more on the role of strengthening civil society organizations (CSOs) to address gender in climate resilience work, see *Accelerating Gender-Responsive Climate Action Through Empowered CSOs – Capacity Needs Assessment in Bangladesh, Cambodia and Vietnam* (Naswa 2021)	https://arrow.org.my/wp-content/uploads/2021/11/EmPower-Regional-Brief-PDF.pdf

Migration and Urban Development

As climate shifts livelihoods and ecosystems, many people migrate in response – often towards urban centers. Given this, migration and urban development often go hand-in-hand as populations shift across the landscape in response to changing socioenvironmental pressures.

Ensure safety, autonomy, and resources for people who migrate

Migration is a risk and direct impact of a changing climate – but it can also be an important adaptive strategy. For women who migrate, enabling migration to be adaptive often means working to ensure women have free choice regarding if, when, where, and how to migrate (Evertsen and van der Geest 2020). Distress migration increases the risk of trafficking, slavery, and low bargaining power upon arrival to the destination, so pre-emptive measures to reduce distress migration can be very beneficial (Bharadwaj et al. 2022). However, when people do decide to migrate, they should be supported in that decision (Bharadwaj et al. 2022).

Access to social protections, like a job card, food security, or income support, can reduce odds of migrating and help ensure that migration is supported (Bharadwaj et al. 2022). These protections should be designed to reach marginalized groups, be grounded in rights-based frameworks, and have robust management to ensure they can efficiently deliver portable services (Bharadwaj et al. 2022). In addition, skills development before migration can ensure that people who do decide to migrate are adequately prepared for employment at their destination (Bharadwaj et al. 2022). Facilitation of employment upon arrival and community support for relocation can also benefit those who migrate (Bharadwaj et al. 2022). Services could also include advisory or helpline services (Bharadwaj et al. 2022).

Because many women who migrate due to climate-related pressures do so to find alternative income streams, they may face additional vulnerabilities in the workplace or due to work-related stigma. Workplace adaptations like allowing breaks for prayers, reducing temperatures in factory settings so women can wear modest clothing, and providing day care for children can reduce the stigma and risks they face (Evertsen and van der Geest 2020). Strengthening migrant social networks and connections to local services and resources can also be an important area for partnership and collaboration.

Developing information systems for migration can also ensure policies and programs are responsive to migrants' needs (Bharadwaj et al. 2022).

Understanding gendered vulnerabilities and adaptive capacities around climate-induced migration can inform these efforts (van Eerdewijk, Bråten, and Danielsen 2021):

Table 9. A summary of advances in migration sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation: Climate-induced migration	
Vulnerability /absorptive capacity	
Groups particularly vulnerable to climate change	Gender relations and norms shape different groups of people's migration patterns and experiences at every stage of the migration cycle (predeparture, transit, arrival, stay and return).
Examples of different, and more severe, experiences of climate change effects for different groups of people in different social positions	Climate-induced migration is found to potentially (re)produce and reinforce gender inequalities in the different stages of the migration cycle, i.e., gender relations and norms shape women and men's experiences of migration, including the risks involved throughout the entirety of their migration journey. Out-migration might contribute to changing population structures, such as aging populations with particular vulnerabilities
Adaptive capacity	
Gender/ social differences in ability to respond to climate change	Gender relations and norms might prevent some groups of women from migrating, effectively trapping women in climate stressed communities.
How gender and social relations mediate climate change response options	The ways in which social markers, such as class and marital status, intersect with gender determine whether migration improves or erodes the adaptive capacity of women 'left behind'.
Examples of climate change actions with potential to enhance equality and social inclusion	Climate-induced migration might bring positive changes in women and men's everyday lives as migration might alter unequal gender relations and norms in different contexts.
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Improve climate-resilience of urban centers

Migration flows often move towards urban centers, meaning that urban development is a key part of ensuring healthy, equitable, and climate resilient communities. Research on urban slums in Accra, Ghana, for example, found that despite the severe climate-related hazards in these urban environments, women were, irrespective of age or education, more vulnerable given their lack of access to resources, poor housing quality, high domestic labor burden, and limited role in decision making (Owusu, Nursey-Bray, and Rudd 2019).

Scaling up climate-adaptive urban development often requires establishing multi-level relationships across both local and national stakeholders, bridged by robust policy frameworks and shared goals (Tozer et al. 2022).

Attending to the diverse and intersectional vulnerabilities and adaptive capacities of urban residents can ensure that urban development efforts address these needs (van Eerdewijk, Bråten, and Danielsen 2021):

Table 10. A summary of advances in urban development sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation: Urban development	
Vulnerability /absorptive capacity	
Groups particularly vulnerable to climate change	Communities/dweller in disaster prone, informal settlements/slums built outside formal laws and regulations - in particular and increasingly women and girls in female-headed households, migrant and homeless youth, and individuals whose gender falls outside normative categories
Examples of different, and more severe, experiences of climate change effects for different groups of people in different social positions	Safety of groups mentioned above of particular concern due to insecurity of settlements/housing and increased risk of evictions as well as (especially for women) additional suffering due to insufficient access to essential infrastructure and other basic services
Adaptive capacity	
Gender/ social differences in ability to respond to climate change	Gender differentiated adaptive capacity: women (slum) dwellers often struggle harder to rebuild climate change-affected livelihoods than men
How gender and social relations mediate climate change response options	• At household level: Gender inequitable access to productive resources, low participation in adaptation decision-making and domestic work burdens • At level of urban governance structures and institutions: ○ Gender and social underrepresentation and exclusion from urban decision-making bodies/ planning ○ Lack of recognition of diverse needs, knowledge of and contributions to urban development Existing urban climate adaptation response, relief and recovery efforts entrench rather than address gender and social inequalities
Examples of climate change actions with potential to enhance equality and social inclusion	Post-hazard reconstruction of human settlement that requires property ownership and occupancy rights of women/other particularly vulnerable urban groups
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Case Study: Cash and voucher assistance for adolescent refugees and migrants

Case Study 11. Supporting adolescent refugees and migrants with cash and voucher assistance Source: YLabs 2022

COUNTRY	ORGANIZATION	KEY SECTORS
Ethiopia	YLabs	Migration, adolescents and youth, humanitarian, economic
Description	Taageero Cash is a cash and voucher assistance program that provides economic support to unaccompanied adolescent refugees ages 12-18 – who are often left out of cash transfer programs – in Sheder camp, Ethiopia. The residents of Sheder camp (approx 11,000 as of Dec 2020) are refugees from Somalia, driven from their homeland through a complex mix of conflict, drought, and climate impacts. The project is led by Ylabs, in partnership with Stichting Vluchteling and the International Rescue Committee. The pilot program was the first of its kind with a specific focus on unaccompanied minors. The design and pilot results are informing the development of guidelines for developing similar programs aimed at youth in humanitarian settings-- a population expected to continue to grow as a result of climate-driven migration.	
Gender strategy/ impact	The goal of providing direct cash to unaccompanied adolescents was to reduce the risks that this population disproportionately faces. While conducting early research the team found that there were gender disparities in the negative outcomes and risks these adolescents face. Particularly, young women were more likely to be primary caretakers in the home, more likely to need to drop out of school, and more likely to need to travel outside of the refugee camp to find work that often put them in harm's way. Therefore, the program focused on providing a level of financial assistance to UASC that would allow for young women to remain in school and/or allow them to forgo dangerous working conditions outside of camp. Financial assistance was intentionally not conditional on school attendance, as this would have negatively impacted young women who are fulfilling caregiving roles in their household.	

Source: YLabs 2022c

Learn More: Migration and Urban Development

	THEME	LEARNING RESOURCE	LINK
	**Addressing climate-related migration**	For more on addressing the risks of climate-related migration, see *Social protection and informal job market reform for tackling climate migration nexus* (Bharadwaj et al. 2022)	https://pubs.iied.org/21121iied
		CARE's Guidebook for Integrating Migration and Translocality into Adaptation	https://careclimatechange.org/migration-adaptation-guide/
	**Participatory approaches to strengthening the built environment**	For ten examples of participatory initiatives around climate and the built environment, see IHRB's *Community-led and Participatory Approaches to Climate Action in the Built Environment* report	https://www.ihrb.org/focus-areas/built-environment/community-led-and-participatory-approaches-to-climate-action-in-the-built-environment
	**Local example of urban climate responses**	For examples of how climate resilience can be strengthened in urban areas of Africa, see *Pathways for resilience to climate change in African cities*	https://iopscience.iop.org/article/10.1088/1748-9326/ab7951/meta
		For examples of successful climate-integrated urban development initiatives across Africa, see *Mobilizing infrastructure investments for urban climate action in Africa: enabling factors for multilevel action* (Tozer et al. 2022).	https://doi.org/10.1080/13549839.2022.2100878
	**Evaluating urban adaptation efforts**	The *GAMMA methodology* (Gender Assessment and Monitoring of Mitigation and Adaptation) is a policy-oriented approach to evaluating urban climate mitigation and adaptation (GenderCC 2021)	https://www.gendercc.net/resources/gamma.html
		The Integrating Gender into Urban Climate Change Initiatives (GUCCI) project applies the GAMMA methodology as it aims to integrate gender into urban climate planning and policy	https://womengenderclimate.org/gjc_solutions/integrating-gender-into-urban-climate-change-initiatives-gucci/

Engaging with Adolescents and Youth

Engaging with adolescents and youth on climate is important not only because of the potential impact on their own health and well-being, but also because of the role they play in influencing households, schools, and community settings (Trott 2021a). While climate responses are increasingly gender-responsive, they tend to be less responsive to the needs of adolescents and youth, especially girls (Devonald et al. 2022).

Adolescents and youth play a critical role not only in the future, but also in the present, as active and engaged members of their communities (Walker 2017). Youth can take action through activities like pro-environmental behaviors, civic engagement, and climate justice activism (van Nieuwenhuizen et al. 2021). These types of "active coping" may be critical in mediating the impact of climate on adolescent and youth mental health (Clemens, von Hirschhausen, and Fegert 2022).

Box 4. Key areas for engaging youth on climate

Key Areas for Engaging Youth on Climate Adaptation

(1) Mental health
(2) Migration, urban spaces, and climate resilient livelihoods
(3) Extreme heat resilience
(4) Youth leadership and school enrollment
(5) Sexual and reproductive health systems resilience

Design with youth in mind

Because youth – and young women in particular – are often disproportionately affected by climate threats, it is important to engage with and explicitly design for youth in climate responses. Overall best practices for engaging with adolescents and youth on climate resilience include developing a rights-based safety net, aiming for long-term resilience, reaching the most vulnerable, and building their voice and agency (Bharadwaj 2022). Fostering these enabling conditions can be a critical part of addressing key adverse climate-related effects that adolescents and youth experience, such as child marriage (Asadullah, Islam, and Wahhaj 2021). Based on work with adolescents in China and Nepal, best practices for adolescents and youth programming in the wake of disasters and emergencies include engaging with youth in the process of designing systems and programs to meet their needs, provision of age-specific services (such as psychological support or family reunification), education and training, and age-appropriate ways to contribute to emergency response (Newnham et al. 2019).

Active listening, fostering active engagement opportunities, and building agency can all be critical elements of supporting youth and adolescents in less developed countries who are experiencing climate threats (Sanson, Van Hoorn, and Burke 2019). When bringing youth together, taking a justice-oriented approach to climate action can build alliances between youth in a way that inspires action and builds solidarity (Stapleton 2019). At the same time, it is important to attend to the many different intersectional identities and forms of marginalization (such as disability or migration status) that adolescents and youth experience, which may affect how they engage with and act on climate (Ronoh, Gaillard, and Marlowe 2017; Walker 2021; Bowman 2020).

Support youth livelihoods

Supporting the livelihoods of adolescents and youth amid climate change is also important. However, despite their sizable population and unique needs and desires, youth are not always included in efforts to strengthen livelihoods, particularly in the agriculture sector (De Pinto, Bryan, and Aberman 2020)**.**

Based on work with Wolayta youth in rural Ethiopia, researchers recommend integrating youth needs – such as skills development and fair compensation policies – into livelihoods programming (Tsegay 2021). In areas with high youth unemployment, expanding rural business and employment opportunities that can complement farming may be an effective strategy for supporting youth (De Pinto, Bryan, and Aberman 2020).

Research with youth farmers in Nigeria found that they had a high awareness of climate change: youth reported that they learned coping strategies through trial and error, elders, colleagues, and media (Adeloye and Sotomi 2013). Their use of climate coping strategies varied based on their gender, religion, marital status, ethnicity, age, years of formal education, and farming experience, suggesting that efforts to support youth farmers facing climate change should be tailored to their distinct needs (Adeloye and Sotomi 2013). Often, young people understand climate change and how to adapt to it, but lack the agricultural inputs, financial capital, decision-making power, or land ownership in order to enact those adaptation (Amsler, Hein, and Klasek 2017).

Intergenerational knowledge exchange can also contribute to strengthening adolescent and youth livelihoods. For example, in Malaysia, both youth and older fisherpeople had equivalent abilities to adapt to climate change – an outcome attributed to intergenerational knowledge-sharing through fishing gatherings and several knowledge sharing channels (including television, radio, flags, and in-person) (Samah, Shaffril, and Fadzil 2019). However, while intergenerational learning has potential, it can also be limited by children and youths' autonomy in the household and their parents' disconnection from climate risks (Williams, McEwen, and Quinn 2017). Adolescents and youths may also face challenges if they have gaps in climate knowledge or communication skills: Fijian youth struggled to talk

about climate with their family and had key knowledge gaps around climate change (Scott-Parker and Kumar 2018).

Leverage the transformative potential of climate education

Education can be an important mechanism for engaging adolescents and youth in climate, and several strategies can be used to expand the impact of youth climate education.

Expand resources in schools for climate education

In addition, schools and teachers can play a role in climate education and activism (Dunlop et al. 2021). Research with students in Indonesia found that while students felt they were aware of potential disaster hazards and felt they could keep themselves safe, there were critical gaps in their actual disaster risk reduction knowledge (Amri et al. 2017). Research with youth in Pakistan suggests that youth want more climate education, through both formal education systems and advocacy campaigns (Hassan, Ghias, and Fatima 2018).

Several strategies can be used to strengthen climate education in schools. In Rwanda, disaster risk reduction education in schools – and its overall impact on community resilience – was limited by 1) limited technical expertise and resources for teachers and 2) delivery only to secondary, but not primary or graduate, schools (Nahayo et al. 2018). Addressing these gaps could improve delivery of curricula. Based on disaster risk reduction education in Indonesian schools, researchers recommended creating an online knowledge hub with educational resources, guidelines, and manuals; creating online networks to connect teachers interested in disaster education; integrating this material into teacher training; and planning joint educational activities with schools and local councils/agencies (Amri et al. 2017). Turning to materials that have already been developed in the disaster risk reduction space may provide a useful resource for those developing climate resilience educational materials.

Use transformative learning approaches to foster youth agency and leadership

By leveraging experiential and empowering pedagogical approaches more commonly used in gender transformative curricula, youth climate curricula can better generate transformative change (C. T. Kwauk and Wyss 2022). Many of the youth-focused curricula for climate justice take a more cognitive, rather than socioemotional or behavioral, approach (C. T. Kwauk and Wyss 2022). However, for youth, climate education can be about more than just gaining knowledge: it can also serve as a mechanism for enabling young people – including girls and those from disadvantaged backgrounds – to realize their political agency and engage in climate adaptation efforts (Davies and Hügel 2021; Cutter-Mackenzie and Rousell 2019). By bridging climate justice and gender transformative learning approaches – and taking advantage of shared common ground around community engagement, systems of power, agency, and activism, interpersonal skill development, and health – it may be possible to create truly gender transformative youth education for climate justice (C. T. Kwauk and Wyss 2022). These climate learning spaces

can create a leadership pipeline for women's engagement in community decision making, policymaking, and society at large, which is important because when more women are engaged as leaders, decisionmakers, and participants, more effective climate adaptation measures are taken (Cook, Grillos, and Andersson 2019). Realizing this vision requires recognizing and forwarding youth agency. For example, in research on disaster risk reduction with schoolchildren in Indonesia, though NGOs saw students as passive participants, over 80% of students wanted to be actively involved in disaster planning (Amri et al. 2017).

Develop a range of youth skills through participatory, arts-based, and action-oriented approaches

Many green skills trainings for youth focus on technical skills, but there youth also need to develop a breath of related socioemotional, civic, and justice-oriented skills (C. T. Kwauk and Wyss 2022). One way to do this is by developing programs where adolescents and youth can translate their educational experiences into climate action through participatory activities like climate clubs, homestead gardens, risk mapping, transect walks, and mind mapping, which can be used to co-create knowledge, innovate climate solutions, and advocate for change (Amri et al. 2017; Haynes and Tanner 2015; Molina et al. 2009; Bharadwaj 2022). For example, in Brazil, researchers used a mobile app to have students record their interactions with food, water, and energy, then visually map these images while identifying spaces for taking action and sharing responsibility (Trajber et al. 2019). Activities like these can reveal ways that adolescents and youth are already engaged in ordinary, everyday forms of climate activism (Skovdal and Benwell 2021; Trott 2021b).

Other creative and arts-based approaches can also be used to engage adolescents and youth in climate. Integrating arts – such as photovoice – into after-school climate education programs can help students identify risks in their communities and then take action collaboratively (Trott 2019; 2020; Trott, Even, and Frame 2020). Climate-related photovoice projects can contributed to improved mental health, well-being, and sense of empowerment among adolescents (Grant and Case 2022). Art can also be integrated into sustainable behavior change projects for youth (Bentz and O'Brien 2019). Other arts projects have put youth art in public spaces, such as buses, as a way to engage the broader public in climate education (Hendrickson Lohmeier et al. 2021).

Broad possibilities exist around supporting climate learning and action with participatory, multimedia, and action-oriented approaches. Participatory video making has been used in the Philippines, Puerto Rico, and Canada to help youth to document and raise awareness about their climate-related risks and experiences (Haynes and Tanner 2015; MacDonald et al. 2015; Leckey et al. 2021). Using digital technologies like geotagging and GIS, these participatory approaches to gathering climate media and stories can be used to accelerate storytelling and advocacy through mapping, like with the Act Now for Tomorrow campaign

from UNICEF ahead of COP21 (UNICEF 2015). Other similar approaches include participatory photography and drawing, participatory play, speculative and design fiction, app co-design, climate education, gaming, hacktivism, and social media (Doyle 2020; Rousell et al. 2021; D. Maxwell et al. 2019; Stevenson, Oldfield, and Ortiz 2022).

Foster youth activism – and respond to youth activists

Around the world, many youth are mobilizing in new ways as climate activists (O'Brien, Selboe, and Hayward 2018). Youth climate activists often fuse digital and physical resistance in an innovative ways, leveraging both digital culture and youth culture to build a diverse coalition organized around shared climate activism goals (Wielk and Standlee 2021; Molder et al. 2022). These goals are often oriented towards climate change as an ethical and moral issue, a rights-based approach (Gasparri et al. 2021; Molder et al. 2022). Digital tools can also be used to engage youth in climate resilience planning (Napawan, Simpson, and Snyder 2017).

For youth, repeated and regular participation in climate activism might be an important part of creating climate optimism (Cattell 2021). However, while climate activism is associated with youth resilience and positive development, it can also cause stress, particularly for those from minority communities (van Nieuwenhuizen et al. 2021). For indigenous youth in Canada, for example, climate grief and climate activism are deeply intertwined (Barraclough 2022). Despite progress made towards adolescent and youth participation in policymaking, there is a continued need for climate policymaking to truly engage with youth in an inclusive and meaningful way (Gasparri et al. 2022; J. Ritchie 2021; Benkenstein et al. 2020). In this, as in all initiatives, forwarding and attending to gender is critical.

Case Study: Mobilizing youth advocates through citizen science

Case Study 12. Mobilizing youth as advocates through citizen science Source: YLabs 2022

COUNTRY	ORGANIZATION	KEY SECTORS
South Africa, Nigeria, and Ghana	YLabs	Adolescents and youth, advocacy, air quality, participatory action, urban development
Description	The Cityzens project has trained and mobilized 30 youth leaders (students, activists, scientists, and athletes under the age of 35) in Cape Town, Lagos, and Accra to collect data on air pollution and public space in their cities via wearable sensors. The youth leaders then developed advocacy tactics to obtain public commitments from their city governments to climate-resilient, health-oriented urban development policies, which will be rolled out during and after COP27. This projected is carried out by YLabs, with Urban Better, London School of Hygiene and Tropical Medicine, and Treeshake. The project is an example of facilitating youth leadership in policy advocacy at the intersection of climate, health, and gender representation.	
Gender strategy/ impact	Air pollution exposure impacts are gendered, as women retain a great amount of fine particulate matter in their lung tissue. Pregnant women who have air pollution exposure are also at greater risk for preterm birth and pregnancy complications. Recognizing the gendered impacts of air pollution and of climate change, the C4CA project ensured that at least 50% of the youth leaders were female in each city. Advocacy partnerships in each city were established with a diverse coalition of partners, with a particular point made to include gender justice and reproductive health organizations. When the youth leaders collected data about the quality of public space in their neighborhood, safety for female-presenting people was included as a factor to assess. This helps ensure that gender is a consideration when advocating for sustainable urban infrastructure improvements.	
Source: YLabs 2022a		

Learn More: Adolescents and Youth

	THEME	LEARNING RESOURCE	LINK
	**Children and climate**	For a high-level review of child-centered climate adaptation, see *Why focus on children: a literature review of child-centered climate change adaptation approaches* (Treichel 2020)	https://search.informit.org/doi/abs/10.3316/ielapa.179621861555500
	**Best practices for youth and climate**	For more on best practices for intersectional, gender-equitable climate programming for adolescents and youth, see *Gender equality and climate justice programming for youth in low- and middle-income countries: an analysis of gaps and opportunities*	https://www.tandfonline.com/doi/full/10.1080/13504622.2022.2123894
		For specific guidance on child-centered climate adaptation initiatives in Bangladesh, including how to select, implement, and evaluate solutions, see *Child-centred community-based adaptation in Bangladesh* (Bharadwaj, Chakravarti, and Karthikeyan 2022)	https://pubs.iied.org/20776iied
		For examples of climate resilience projects that engaged adolescents and youth, see *Adolescent well-being and the climate crisis* (McGushin et al. 2021)	https://pmnch.who.int/resources/publications/m/item/adolescent-well-being-and-the-climate-crisis
	**Youth climate activism**	For a digital youth advocacy community (around many issues, including climate), see UNICEF's Voices of Youth hub, Youth Advocacy Guide, and their climate page,	https://www.voicesofyouth.org/ https://www.voicesofyouth.org/youth-advocacy https://www.voicesofyouth.org/climateaction
		For more on youth activism, see UN Women's blog post Youth voices for change: Four young climate action leaders we admire (UN Women 2022)	https://www.unwomen.org/en/news-stories/feature-story/2022/02/youth-voices-for-change-four-young-climate-action-leaders-we-admire
		For lessons and strategies for youth climate advocacy in Africa, see *Youth Climate Advocacy* (Benkenstein et al. 2020)	https://www.africaportal.org/publications/youth-climate-advocacy/

THEME	LEARNING RESOURCE	LINK
Education and climate	For more on the role girls' education plays in climate adaptation, see the Malala Fund's report *A greener, fairer future: Why leaders need to invest in climate and girls' education* (Fry and Lei 2021)	https://www.ungei.org/sites/default/files/2021-03/Girls-Education-Climate-Report-2021-eng.pdf
	For more on challenges and policy approaches for climate resilience within the education sector, see *Roadblocks to quality education in a time of climate change* (C. Kwauk 2020)	https://eric.ed.gov/?id=ED607008
	For more on girls' rights in climate action with an educational lens, see *Girls' education in climate strategies: Opportunities for improved policy and enhanced action in Nationally Determined Contributions* (C. Kwauk et al. 2019)	https://plan-international.org/uploads/2021/12/girls-ed-in-climate-strategies-working-paper-final.pdf
Teaching resources	For classroom resources for schools around climate change and girls' education, see *Climate Change and Girls' Education: school resource pack* as well as the teacher toolkit.	https://www.britishcouncil.or.th/en/school-resource-pack https://www.britishcouncil.or.th/en/teacher-toolkit
	For additional educational resources for youth and climate, see UNICEF's climate and environment themed resources at the World's Largest Lesson	https://worldslargestlesson.globalgoals.org/resources/?_sft_theme=protecting-planet-earth&_sft_language=english
	For French language climate mobilization resources for children and youth, see UNICEF's mobilization toolkit	https://www.unicef.fr/article/pour-lutter-contre-le-changement-climatique-rejoignez-le-mouvement-des-jeunes
	For interactive 30-60 minute activities for engaging children aged 7-12 in climate, see *Children's Climate Cards* from Plan International	https://plan-international.org/publications/childrens-climate-cards/
	For a child-centered approach to personalizing climate action, see the UN's Act Now Climate Action Superhero webpage	https://www.un.org/sustainabledevelopment/climate-action-superheroes/

THEME	LEARNING RESOURCE	LINK
Participatory approaches	For participatory strategies for engaging children and youth in sustainability and planning, see *Placemaking with Children and Youth: Participatory Practices for Planning Sustainable Communities* (Derr, Chawla, and Mintzer 2018)	https://muse.jhu.edu/book/73195
	For detailed outline of participatory action research in Niger – oriented around family planning but translatable to climate integration, see Pathfinder International's Evidence2Action study brief (Pathfinder International 2021)	https://www.pathfinder.org/wp-content/uploads/2021/05/Niger-ULC-YPAR-Study-Brief.pdf
	For more on strategies for sharing knowledge across youth climate education projects, see *Promoting climate change transformation* with *young people in Brazil: participatory action research through a looping approach* (Trajber et al. 2019)	https://doi.org/10.1177/1476750319829202
	For strategies for engaging children in climate change work, see *Child-friendly participatory research tools* (Molina et al. 2009)	https://pubs.iied.org/sites/default/files/pdfs/migrate/G02824.pdf

Economic Well-being and Sustainable Livelihoods

One of the most powerful ways that climate change affects peoples' health and well-being is through its mediating effects on livelihoods and incomes. Therefore, gender-sensitive livelihoods strengthening efforts can have wide-ranging co-benefits for individuals and communities.

Offer training and resourcing to enhance alternative and diverse livelihood options

Livelihoods training, microcredit, loans, access to savings and other tactics for improving financial security, mitigating financial risks, and enhancing economic opportunities can have significant benefits for individuals and communities, particularly when done in a gender sensitive way.

Livelihood diversity is often correlated with adaptive capacity and can be a useful strategy for building climate resilience (Cinner and Bodin 2010; Kotschy et al. 2015; Ganguli 2021; Adzawla and Baumüller 2021). In Pakistan, for example, following severe floods, nearly half of farm households surveyed adopted off-farm livelihood diversification strategies (A. A. Shah et al. 2021). Seeking non-agricultural forms of employment can help mitigate the risks of crop losses and declines in yield (Buechler 2016). Rather than thinking of livelihood diversification strategies as a list of options, ethnographic research on fishers in Bangladesh suggests that diversification can instead be thought of as a fluid, creative way of coping with cross-scale stressors (Deb and Haque 2016).

Female- and male-headed households may have different abilities to pursue and benefit from livelihood diversity, as female headed households tend to have fewer adult members, and consequently have fewer income streams (Balikoowa et al. 2019). In Pakistan and Ethiopia, male-headed households exhibited greater livelihood diversity than female-headed households (Anbacha and Kjosavik 2021; A. A. Shah et al. 2021). However, these gendered trends in livelihood diversification are not universal, as research from Ethiopia did not find gender to be a predictor of diversification (Ayana, Megento, and Kussa 2021). Other factors beyond gender may also contribute to livelihood diversification strategies, like education. Work from Tanzania indicates that while engagement in livelihood diversification practices is gendered, it is also shaped by marital status (Van Aelst and Holvoet 2016).

Beyond quantitative differences in livelihood diversity between men and women, there also may be differences in the types of livelihood diversification strategies that different people use. Research from Pakistan also suggests that different sociodemographic factors and preferences shape the livelihood diversification strategies that men and women use (Habib et al. 2022). Research from Ethiopia suggests that men and women engage in different forms of livelihood diversification, with men focusing on pastoral diversification while women tend to engage more in trade, poultry farming, and selling firewood (Anbacha and

Kjosavik 2021). For women, participation in these activities shifted internal household dynamics, giving them greater decision-making power (Anbacha and Kjosavik 2021). Similarly, in India's Eastern Himalayas, while women engaged with cheesemaking and homestays for tourism, men tended to leverage knowledge around grazing and trekking (Bhadwal et al. 2019). Analyzing local environmental risks can provide insights into locally specific livelihoods opportunities. For example, in research with rural women in Nigeria, several climate-related entrepreneurship opportunities were identified (e.g., around meeting needs for water purification, addressing water logging, converting waste and byproducts to other uses, etc.) (Akinbami et al. 2019).

Research from Pakistan suggests that livelihood diversification can be constrained by factors including climatic risks, lack of natural resources, lack of training or skills, insufficient institutional support, lack of access to credit, weak infrastructure, or limited availability of labor (A. A. Shah et al. 2021). Research from Ghana suggests that while livelihood diversification can reduce climate vulnerabilities, livelihood diversification alone is not sufficient to address gendered differences in climate vulnerabilities (Adzawla and Baumüller 2021). Given this, it may be important to address broader contextual factors and integrate livelihoods skills development with other types of climate resilience programming to enhance communities' adaptive capacity.

Research around livelihood diversity often dovetails with other aspects of climate education in complex ways. For example, in India, perception of climate change was associated with greater benefits from livelihood diversification (Das and Mitra 2021). In Kenya, livelihood diversification was negatively associated with adoption of climate-smart agricultural practices – specifically with the adoption of stress-tolerant livestock (Musyoki et al. 2022). However, interpreting correlations such as these requires a nuanced understanding of the specific context and trends in beliefs and behaviors, drawing continued attention to the importance of understanding the local context.

This is especially important to recognize given that livelihood diversity can also come with risks. For example, it may be poorly paid or unstable work (Buechler 2016). Research from Malawi, Niger, and Zambia, found that extreme weather was a "push" for livelihood diversification and that diversification had greater benefits for poor households (with declining welfare benefits and even negative effects for wealthier households), suggests that livelihood diversity is a reactive, rather than a proactive, response to economic pressures and climatic events (Asfaw et al. 2019). Livelihood diversity can also generate an increased labor burden, especially for women (Chant and Sweetman 2012; Cohen et al. 2016; Anbacha and Kjosavik 2021). This suggests that while livelihood diversity may provide benefits in the aftermath of a socioenvironmental shift, these benefits for adaptive capacity may not necessarily also produce benefits for well-being (Cohen et al. 2016).

Case Study: Economic empowerment of rural women with solar energy and micro-entrepreneurship

Case Study 13. Economic empowerment of rural women with solar energy and micro-entrepreneurship Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
India	AIWC-Priyadarshini Mahila Samajam	Agriculture, energy, sustainable livelihoods
Description	This green energy project aims to demonstrate the economic sustainability and gender impact of selling solar-dried fruits, vegetables, and condiments. The micro-enterprise, created and managed by five women, uses two solar dryers (capacity of 50 kilograms each) to process and transform local seasonal fruits and vegetables into packaged food products with strong value added. They work with 43 women suppliers who receive important additional revenues and reduce product wasting. The organization trains women's groups in solar drying processes and marketing skills.	
Gender strategy/ impact	Women are empowered through local production and sale of high value-added food products. Women employees and suppliers experienced a revenue increase from US$10 to US$30 per month, depending on the season and product. They also had a reduced labor burden of two hours per day, creating time for other income generating activities. They participated in purchasing and processing decisions, marketing, and profits sharing. The micro-enterprise participates in fairs and festivals to share knowledge and offer training support.	
Source: Chauhan 2021, citing WECF 2016		

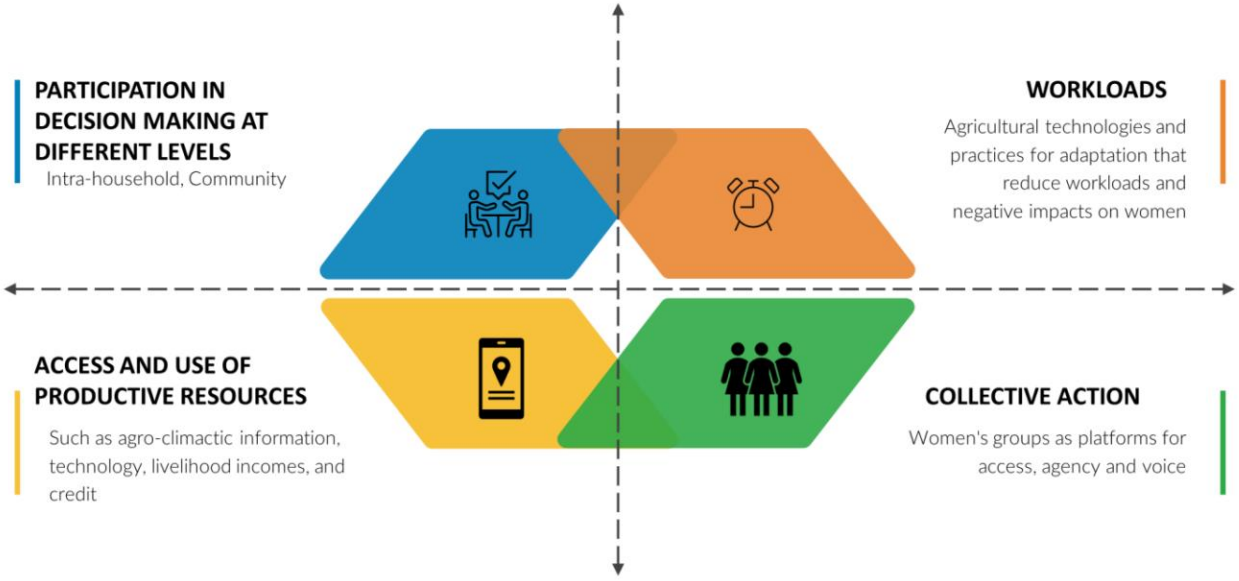
Learn More: Economic Well-being and Sustainable Livelihoods

	THEME	LEARNING RESOURCE	LINK
	**Climate and women's economic advancement**	For broader perspectives on climate change and women's economic empowerment, see *Women's Economic Empowerment and Climate Change: A Primer* (Livingstone, Jenkins, and Cardinal 2021)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/980912/Guidance3-WEE-Climate-Change-Primer.pdf
	**Local examples of climate, gender, and livelihoods work**	For more on gender, climate, and livelihood diversity, see *Effects of livelihood diversification on gendered climate vulnerability in Northern Ghana* (Adzawla and Baumüller 2021)	https://doi.org/10.1007/s10668-020-00614-3
		For more on climate-related entrepreneurship opportunities for women, see *Exploring potential climate-related entrepreneurship opportunities and challenges for rural Nigerian women* (Akinbami et al. 2019)	http://www.link.gale.com/apps/doc/A571017879/AONE?u=txshracd2548&sid=bookmark-AONE&xid=d3bc00ed
	**Livelihood diversity approaches**	For a review of theories and approaches for livelihoods diversification, see *Livelihoods Diversification Analysis (LDA) Literature Review* (Persha and Farrell 2017)	https://www.usaid.gov/sites/default/files/documents/1860/LivelihoodsDiversification_Final_LitReview_ENG.pdf

Climate-Adaptive Agricultural Practices

As previously discussed, climate hazards are significantly impact the agriculture sector, and these changes have gendered impacts. Several dimensions of gender inequality shape climate change adaptation in agricultural practices (Tavenner et al. 2020):

Figure 17. Four gender in/equality dimensions that shape climate change adaptation in agriculture Source: Tavenner et al. 2020. No changes were made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc/4.0/



At the same time, agriculture and natural resource management are informed by existing climate-related vulnerabilities and adaptive capacities (van Eerdewijk, Bråten, and Danielsen 2021):

*Table 11. Agriculture and natural resource management sector-specific knowledge on gender equity and social inclusion related to climate change impacts and adaptation*Source: van Eerdewijk, Bråten, and Danielsen 2021

A summary of advances in sector-specific knowledge on gender equity and social inclusion related climate change impacts and adaptation: Agriculture and natural resource management	
Vulnerability /absorptive capacity	
Groups particularly vulnerable to climate change	Poor, rural, and/or indigenous communities and groups, small-scale food producers - in particular women.
Examples of different, and more severe, experiences of climate change effects for different groups of people in different social positions	Reliance on agriculture and access to natural resources depends on social positions, e.g., indigenous women rely on healthy forests for their food security, fuel and other ecosystem products and services
Adaptive capacity	
Gender/ social differences in ability to respond to climate change	Gender differences in adoption of climate-smart agriculture practices, e.g., women's response options are often more limited, low- cost, and/or low-tech than men's: • Gender/social discrimination in access to and control over agricultural resources, inputs, and services (e.g., land, technology, agroclimatic information, human and financial capital) can lead to disparities in use of and benefits from rural climate services • Institutional constraints, both formal (i.e. land rights) and informal (i.e., restrictive gender/social norms and pervasive stereotypes about rights and roles), can lead to male/ elite-centred agriculture and natural resource management systems and reproductive labour burden, restricted mobility etc. • Underrepresentation and exclusion from participation in decision-making of marginalized groups at all institutional levels (from household to governance/policy) can cause undervaluing/ underrecognition of different needs, economic contributions and knowledge • Social inequalities permeate institutional structures and can lead to maladaptive interventions/ policies emphasizing elite/male preferences and (re)masculinization and elite capture of (new) opportunities
How gender and social relations mediate climate change response options	Women's collective action can enhance gender equality and women's agency: it can provide the basis for women to gain better access to information; increase production; decrease workloads; and play a leading role in community decision-making.
Format adapted and text excerpted from van Eerdewijk, Bråten, and Danielsen 2021	

Gender-oriented strategies for addressing climate in agriculture can be oriented around strengthening livelihoods, increasing preparedness, and removing systemic barriers for women in the agricultural sector (Chauhan 2021):

Table 12. Strategies and practices for climate-smart agriculture Source: Chauhan 2021

Promoting women's livelihoods in agriculture	**Gender preparedness for climate-smart agriculture**	**Addressing structural changes to reduce gender barriers and discrimination in agriculture**
• Analyze the impact of introducing new varieties and promote a more equitable distribution of reproductive work • Adapt promoted practices to the existing gender division of labor for agriculture and livestock management • Provide training on agricultural extension and climate smart agriculture to women • Make marketing facilities available • Institutionalize alternative provisions to accommodate women, women's groups, and cooperatives that are unable to provide the collateral needed for accessing agricultural credit	• Utilize local agricultural knowledge and engage women and men to ensure indigenous crop varietals are used where possible • Build community resilience on food security through the establishment of local climate-smart seed banks owned and managed by women • Involve women and men in conservation of biodiversity • Provide specific nutritional supplements for women and girls	• Facilitate equitable access to and control of resources, as well as the distribution of their benefits (including productive resources, jobs, training, and credit) • Improve women's land tenure security • Encourage equity in having access to irrigated land ownership • Expand access to credit, insurance, and other financial mechanisms • Revise the existing strategies that enable the flow of credit from public/commercial banks and financial institutions to support and increase women's access to credit • Adapt participation/ membership criteria and reduce participation barriers for women's active participation and leadership in decision-making bodies at all levels (i.e., forestry, watershed management, irrigation, water, coastal management, biodiversity conservation, and disasters)

Source: Chauhan 2021

Alleviate barriers to agricultural resources and innovation

Gendered roles, responsibilities, and norms can shape key barriers to peoples' ability to implement new, improved, and adaptive agricultural practices.

Strengthen access to core enabling services and resources

Improving equitable access to agricultural resources is one way to improve adaptation. For example, female-headed households may struggle to hire labor for their farms, which may prevent them from full productive utilization of their land as fertile seasons shorten (Balikoowa et al. 2019; Larson et al. 2016; O'Sullivan et al. 2014; Ali et al. 2016). Research from Uganda suggests that addressing child care responsibility and market access could be key in bridging gendered gaps in agricultural productivity (Larson et al. 2016; Ali et al. 2016). Because risk aversion may negatively influence individuals' willingness to adopt climate-smart agriculture technologies, risk insurance may be one way to lessen the risk of agricultural innovation (Musyoki et al. 2022).

Secure land tenure

Female-headed houses – particularly those led by widowed women – may also own less land or face more precarious land tenure, in part because of cultural and legal practices around inheritance and ownership of land (Balikoowa et al. 2019). However, research from Malawi and Ghana suggests that traditional land tenure practices can be revised and adapted at the local level (Fischer et al. 2021). For more on securing land tenure, see the Land Management and Forest Protection subsection of this chapter.

Expand education, extension services, and knowledge-sharing networks

Research in Uganda indicates that expanding access to extension services could play an important role closing gender gaps in agriculture (Larson et al. 2016; Ali et al. 2016). Expansion of extensionist services through trainers and clubs can increase both men and women farmers' knowledge about climate-smart agriculture, though depending on the program design and the presence of persistent contextual inequities, women may experience fewer benefits from these services than men (Duffy et al. 2021).

However, other peer extension and knowledge exchange approaches may be effective alternatives. For example, when women farmers connected with a lead farmer in their community who was trained to train others, however, they were more likely to have increased knowledge about climate-smart agriculture (Duffy et al. 2021). Research in Bangladesh suggests that expanding women's social circles outside of the household can also support crop diversity and more climate resilient agricultural practices (De Pinto et al. 2020). Similarly, in a study of small farmers in Uganda, Ghana, and Bangladesh, the "climate analogue approach" allowed farmers to identify nearby regions with an analogous future climate, enabling peer farmer-to-farmer learning and adoption of new climate-smart agriculture practices (Jost et al. 2016).

Strengthen women's voices in farm decision making

Research from Bangladesh indicates that improving some aspects of women's empowerment – such as women's voice in farm decision-making – can lead to crop diversification and crop transitions, suggesting that women's empowerment is an important aspect of climate resilience agriculture programming (De Pinto et al. 2020). Women's control over assets, however, was not associated with crop diversification, perhaps because of social norms and stigmas around participating in agriculture, working outside the home, or wealth (De Pinto et al. 2020). In rural Cameroon, religious and cultural norms around decision-making and control of land that forward men as sole decision makers as well as women's uncertainty over their long-term ability to access and manage the land led women to focus more heavily on less sustainable short-term crops (Nchu, Kimengsi, and Kapp 2019).

Expand and implement agricultural adaptation strategies

A range of agricultural adaptation strategies can be used to increase climate resilience and gender equity. Climate-smart agriculture (CSA) practices encompass a range of interventions focused on increasing productivity, improving resilience and adaptation, and reducing greenhouse gases (Mutenje et al. 2019; FAO 2017a; Lipper et al. 2014). These practices also work to build an evidence base, increase the effectiveness of local institutions, advocate for aligned climate and agriculture policies, and draw together climate and agriculture financing in flexible, innovative, contextually-specific ways (Lipper et al. 2014). However, gendered constraints in access to agricultural resources in turn affect what is farmed and how it is farmed, producing gendered choices in agricultural adaptation strategies (Buechler 2016).

Any effort to select and promote particular adaptive strategies should seriously consider the gendered sociocultural context in which those strategies emerged. This is particularly important because many agricultural climate adaptation approaches, such as sustainable agricultural intensification, were not developed with gender in mind and could better achieve equitable outcomes if they were redesigned to integrate gender (Pretty et al. 2018; Fischer et al. 2021). Climate-smart agriculture (CSA) practices, for example, have been criticized for treating farming as a linear process and for not attending to patterns of power and social differences (Khoza, van Niekerk, and Nemakonde 2021). However, while significant research has focused on outside barriers to climate adaptation in agricultural systems, such as socioeconomic or institutional factors, less work has examined how internal factors, like customary rules and cultural systems, shape gender inequity in agricultural adaptation (Nchu, Kimengsi, and Kapp 2019).

Broadly, agricultural adaptation is often influenced by complex gendered flows between labor, values and assumptions, resources, and power (van Eerdewijk and Danielsen 2015). Thus, a gender transformative approach is a critical part of implementing climate-smart

agricultural practices because of how these barriers can influence and mutually reinforce each other.

Implement adaptive agricultural practices responsive to intersectional needs

An individual's roles and responsibilities – including gendered responsibilities – can shape which types of agricultural approaches are desirable or feasible for them. In a study from Uganda, women farmers reported both human and livestock health effects of flooding (such as worms and malaria for children and foot rot for livestock), and noted that in response to flooding, it was common to transition to hardier, small livestock such as goats (Nkuba et al. 2019). This research suggested that men were more likely to transition to mobile pastoralism, while women were more likely to engage in more sedentary forms of livestock management (Nkuba et al. 2019). In another study from eastern Uganda, male-headed households tend to have larger quantity and diversity of livestock than female-headed households, likely because managing livestock on this terrain requires significant labor that may be challenging for female heads of households to shoulder in addition to their other responsibilities (Balikoowa et al. 2019). Men may similarly have greater crop diversity in this region because of gender norms and social status associated with non-food crops such as coffee (Balikoowa et al. 2019).

In research on agricultural adaptation in Ghana, scholars found that modern technologies like tractors or fertilizers can be difficult or dangerous for women to use, and that women were spending increasing amounts of time carrying out agricultural labor (A. Ahmed et al. 2016). When implemented with women and sustainability in mind, however, renewables-powered water pumps, biodigesters, and harvest refrigerators and dryers can provide impactful long-term benefits for women farmers (Chauhan 2021).

Leverage diverse and traditional agricultural strategies

For many communities around the world, agriculture is not only an economic pursuit but also a cultural and community practice. In their study of gendered roles in reindeer herders among indigenous Sami, in the context of community resilience and adaptation, researchers reindeer husbandry is simultaneously a business enterprise, a familial and communal practice, and a livelihood practice with rich cultural knowledge and traditions (Buchanan, Reed, and Lidestav 2016). Given gendered roles and values in participation in reindeer husbandry, men and women may consequently contribute to household and community adaptive capacity in different ways (Buchanan, Reed, and Lidestav 2016). In this work, researchers suggest that in some ways, men may be more vulnerable to climatic and economic shifts because their roles are more specialized, emphasizing the need for attention to within-household dynamics (Buchanan, Reed, and Lidestav 2016).

Rural women may use traditional strategies – such as seed storage, dairy farming, or bee products – to ensure steady income and food supplies even during climate-associated

disasters, but in times of crisis, some strategies like gathering wild plants or hunting game may reach unsustainable levels (Chauhan 2021).

Support and learn from small-scale producers

Small production spaces like home gardens or small orchards are not typically the focus of agricultural climate adaptation, but gendered patterns around their use shape women's lives in important ways (Buechler 2016). In these spaces, women may experiment with responses to climate variations and pests such as by forwarding biodiversity, trying improved plant species, or reusing water (Buechler 2016). In these research from Mexico, however, these strategies may face limitations in the face of long-term drought, and other adaptive approaches such as adding other sources of on-farm income or renting land may be less accessible to women than men because women tend to have smaller parcels (Buechler 2016). In addition, limited water supplies for these plots can limit women's adaptive capacity as water must be shared across household uses (Buechler 2016).

Improve forecasting

Improving access to and quality of both indigenous forecasts and scientific forecasts can enable farmers to make more informed decisions about their adaptation approach (Nkuba et al. 2019). For example, research with pastoralists in Uganda found that those who used only indigenous forecasts were more likely to cope through off-farm work or selling livestock, while those who used both types of forecasts were more likely to migrate their livestock (Nkuba et al. 2019). Improving forecasting involves not only improving the quality and frequency of the forecasting but also its accessibility, particularly to women and marginalized populations.

Close gaps in agriculture returns

Structural inequalities, such as those around class inequities, transaction costs of business, or lack of attention for small producers, can affect both men and women farmers attempting to adapt (Buechler 2016). However, in order to fully realize the benefits of adaptive agricultural practices, it is important to rectify not only gendered gaps in access to agricultural resources but also gendered gaps in returns on those resources (Teklewold, Gebrehiwot, and Bezabih 2019).

Use integrated approaches to strengthen the co-benefits of climate-resilient agricultural practices

Strengthening agricultural practices to be more gender-equitable and climate resilient has many additional co-benefits, including for nutrition. For example, research from Ethiopia suggests that households that used a greater number of climate-smart agriculture adaptive practices also had greater dietary diversity and protein consumption, and these improvements were more pronounced for female-headed households than male-headed households (Teklewold, Gebrehiwot, and Bezabih 2019). These benefits can be produce through a range of pathways, depending on the specific context (Bryan et al. 2017).

Case Study: Vegetable gardens and renewable energy for women

Case Study 14. Vegetable gardens and renewable energy for women Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
Cambodia	UNEP, UN Women	Agriculture, energy, disaster risk reduction
Description	UN Women and UN Environment have jointly initiated the EmPower project for strengthening gender-responsive climate and disaster risk reduction (DRR) policies. Between 2018 and 2022, the program will focus on Bangladesh, Cambodia, and Vietnam, along with many governmental, non-governmental, and civil society organization partners, towards achieving this. In Cambodia's Pursat province, the project builds on a scoping study by EmPower and Nexus for Development which highlighted how the area was facing the dual burden of excess and little water. On one hand, there were floods which wash away the harvest. On the other hand, during some months, taps run dry, paddy fields wither, and villagers walk up to 20 kilometers to collect water. With an aim to promote climate-resilient livelihoods, the project encourages and supports women to use renewables – powered by water pumps, biodigesters, and harvest refrigerators and dryers – that can greatly benefit women farmers in the long run. Through support from the project, women have also started diversification into home-grown vegetable gardens. From Chinese Cauliflower to lettuce and gourds, multi-cropping in these gardens is not only helping keep the land fertile but is also a steady source of income, bringing nearly US$500 per growing cycle. Water for the gardens comes from local/family wells, with the help of an electric pump and/or diesel generator, which are enabled through the promotion of renewable energy in areas where gaining access to the grid is still a challenge.	
Gender strategy/ impact	The most crucial part of this project is to encourage women and marginalized groups to participate in the decision-making process; generate, analyze, and use sex, age, and disability disaggregated data (SADDD) to inform policy; improve gender-responsiveness in climate and disaster risk reduction policies; enable women to use renewable energy as economic resources for resilient livelihoods; and improve regional mechanisms, processes, and knowledge on climate change and disaster risk reduction to include gender and human rights.	
Source: Chauhan 2021, citing UN Women and UNEP 2019		
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Learn More: Climate-Adaptive Agriculture

THEME	LEARNING RESOURCE	LINK
	For guidance, planning tools, and case studies on CSA, including financing and monitoring and evaluation support, see CGIAR's CSA 101 hub	https://csa.guide/
	For guidance on CSA, see the FAO's *Climate Smart Agriculture Sourcebook*. See also their page on gender and climate smart agriculture. For a feminist critique of the FAO's approach to gender and CSA, see *Saying all the right things? Gendered discourse in climate-smart agriculture* (Collins 2018)	https://www.fao.org/climate-smart-agriculture-sourcebook/en/ https://www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c6-gender/c6-overview/en/ https://doi.org/10.1080/03066150.2017.1377187
Guidance on climate smart agriculture	For best practices for scaling up gender-inclusive CSA practices, see *Expanding Opportunities: Scaling Up Gender and Social Inclusion in Climate-Resilient Agriculture* (Huyer et al. 2021)	https://cgspace.cgiar.org/bitstream/handle/10568/114223/AICCRA%20Info-Note-GSIScaling.pdf?sequence=1&isAllowed=y
	For a summary of guidance on integrating gender into CSA practices, see *A gender-responsive approach to climate-smart agriculture: Evidence and guidance for practitioners* (Nelson and Huyer 2016)	https://hdl.handle.net/10568/73049
	For more on gender-sensitive approaches to climate-smart agriculture, see *Rethinking Climate-Smart Agriculture Adoption for Resilience-Building Among Smallholder Farmers: Gender-Sensitive Adoption Framework* (Khoza, van Niekerk, and Nemakonde 2021)	https://link.springer.com/content/pdf/10.1007/978-3-030-42091-8_130-1.pdf
	For guidance on identifying and prioritizing CSA strategies, see *Climate smart agriculture rapid appraisal (CSA-RA): A tool for prioritizing context-specific climate smart agriculture technologies* (Mwongera et al. 2017)	https://doi.org/10.1016/j.agsy.2016.05.009
	CARE's Gender and Inclusion Toolbox for participatory climate and agriculture work	https://careclimatechange.org/gender-inclusion-toolbox/
Women's empowerment in agriculture	For a critique of approaches to women's empowerment in agriculture, see *Hitting the target and missing the point? On the risks of measuring women's empowerment in agricultural development* (Tavenner and Crane 2022)	https://doi.org/10.1007/s10460-021-10290-2

	Research on gender, climate, and agriculture	For data on gender aspects of and gender impacts in climate-smart agriculture, see CGIAR's gender tool	https://ccafs.cgiar.org/resources/tools/gender-aspects-and-potential-gender-impacts-climate-smart-agriculture-options
		For recent research around gender, agriculture, and climate change, see the special issue around *Gender Equality in Climate Smart Agriculture: Frameworks, Approaches and Technologies* in the journal *Climatic Change.* For a critique of climate-smart agriculture and women, see the introduction to this issue (Huyer and Partey 2020)	https://link.springer.com/journal/10584/volumes-and-issues/158-1 https://link.springer.com/article/10.1007/s10584-019-02612-5
		For a synthesis of literature on CSA approaches, see *Prioritizing climate-smart agriculture: An organizational and temporal review* (Gardezi et al. 2022)	https://doi.org/10.1002/wcc.755
	Local examples of gender, climate, and agriculture	For a review of gender dimensions of agriculture and climate change, in Southeast Asia, see *Gender dimension of climate change research in agriculture (Case studies in Southeast Asia)* (Paris and Rola-Rubzen 2018)	https://cgspace.cgiar.org/handle/10568/100189
		For more on how gender can be integrated into sustainable agricultural intensification, see *Sustainable agricultural intensification and gender-biased land tenure systems:* (Fischer et al. 2021)	https://doi.org/10.1080/14735903.2020.1791425
		For more on participatory knowledge production in agricultural work – including the impact of gender and power on agricultural climate adaptation strategies– see *Knowledge politics in participatory climate change adaptation research on agroecology in Malawi* (Kerr et al. 2018)	https://www.cambridge.org/core/journals/renewable-agriculture-and-food-systems/article/knowledge-politics-in-participatory-climate-change-adaptation-research-on-agroecology-in-malawi/E72C7FC73BAD4A878A1A2FD02618E824
		For an example of an agroforestry and clean cookstoves project in Honduras, see *Women-led agroforestry and clean cookstoves in Honduras* (Hottle 2015)	https://hdl.handle.net/10568/69448
	Seed justice	For a tool to support seed diversity and access with the goal of promoting sustainable and just agriculture, see the Open Source Seed Initiative	https://osseeds.org/
	Gender-inclusive agricultural advising	See CARE's checklist *Gender-inclusive actionable agro-advisories*	https://careclimatechange.org/gender-inclusive-actionable-agro-advisories-a-checklist/

Managing Drought and Water Insecurity

Water access is critical for household level health and well-being. In a study of women's water access in Sub-Saharan Africa, water access was positively associated with measures of empowerment and social support (Monteith et al. 2020). However, despite the importance of water access, research in South Africa suggests that governments are often reactionary, rather than precautionary, when it comes to managing water shortages (Patrick 2021). This puts a greater burden on individuals and communities to manage drought themselves.

Strengthen diverse household water management techniques

Water inaccessibility can be driven by a range of environmental, systemic, and individual factors (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022). Even households who have access to "permanent" water sources, rather than seasonal water sources, may face water insecurity Pearson, Mayer, and Bradley 2015). These drivers shape the coping strategies that households use, as well as the gendered risks (including safety risks) that can come along with these strategies (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022).

Coping strategies for water inaccessibility can generally be organized around three approaches: 1) exit (e.g., identifying new water sources, storing water, reusing water, sharing water, or migrating), 2) loyalty (e.g., reducing water consumption, rescheduling or limiting water-related activities, or water treatment), and 3) voice (e.g., making complaints or engaging in social actions) (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022). In response to water shortages, households may reuse water for other purposes, ration water, harvest rainwater, travel further to collect water, or purchase water (Patrick 2021). Social networks are often key for managing water insecurity (e.g., through water sharing), but for those who are not closely linked to local social networks, such as migrants or those from outside the ethnic majority, this approach may not be viable (Pearson, Mayer, and Bradley 2015).

Improve water management in agricultural settings

Research on rural farmers in Uganda identified drought coping strategies including early planting, mulching, food and water storage, use of credit, and small-scale irrigation (Twongyirwe et al. 2019). Though researchers did not find gendered differences in perceptions of drought or use of coping strategies, other factors such as marital status, access to credit, number of livestock, and number of meals per day were significantly associated with perceptions of drought and use of coping strategies (Twongyirwe et al. 2019). Other research from Eswatini suggests that men and women may cope with drought differently, finding that while men migrated and sought additional employment, women sought foreign aid, changed crop production techniques, sold livestock, or adjusted water management approaches (Myeni and Wentink 2020).

Drought management strategies such as improved water irrigation should also be paired with attention to transportation, crop processing, markets, information access, financing, and social safety nets (Twongyirwe et al. 2019). However, it's important to be aware of potential drawbacks of some drought management strategies. For example, while sand dams can increase water security and thus provide many co-benefits for community members, they may not be cost-effective, may not provide high-quality water, and their benefits might not be equally shared (H. Ritchie, Eisma, and Parker 2021).

Implement supports to alleviate drought's impact on mental health

In a literature review on the mental health effects of drought, researchers identified several protective factors including social support, community knowledge and preparedness, mental health literacy, and assistance from the government (Vins et al. 2015). Coping mechanisms included putting practical solutions into place, using techniques like positive thinking and reframing, engaging with social and religious support, and getting some distance from the challenge (Vins et al. 2015). Less positive coping strategies also included alcohol, substance abuse, and denial (Vins et al. 2015). Strengthening protective factors and healthy coping mechanisms, alongside practical and systemic shifts to address the drought and its effects, could support mental health in times of drought.

Case Study: Strengthening women's access to improved solar irrigation systems in West Africa

Case Study 15. Strengthening women's access to improved solar irrigation systems Source: WECF 2018

COUNTRY	**ORGANIZATION**	**KEY SECTORS**
France, Burkina Faso, Benin, and Togo	Electriciens sans frontières	Water, energy
Description	SISAM is an innovative solar irrigation solution that is local, affordable, renewable, and adapted to the constraints of family farming. It meets the needs of 100 market garden farms, mostly managed by women who have little access to water. A local production line for distribution of pumps, known as "minivolanta", has been built. Access to local microfinance (in the form of microleasing) is also incorporated into the project. Activities include production, financing, distribution, maintenance of pumps and irrigation installations. The project contributes to the increased income of market gardeners, as well as freeing up time. The development of local solar pumping solutions ensures a 100% renewable response to addressing water needs. The project allows	

	market gardeners to ensure production in the dry season and provides training in good water management practices aimed at combating further drying-up and degradation of arid zones. By mitigating the carbon impact through technology that limits CO2 emissions from fossil fuels and international transport, and enabling adaptation and food self-sufficiency, the project aims to have a concrete impact on climate change. SISAM plans to reinforce and disseminate this action beyond the first 100 beneficiary farms. Regional and national authorities are involved in the consultation process leading to the signing of conventions. An impact assessment and capitalization process is planned in order to determine the modalities for upscaling. An information campaign on the effectiveness of SISAM solutions for food security and irrigation improvements, the development of the local economy, and a better quality of life for workers and households will be conducted.
Gender strategy/ impact	Women's involvement is ensured at all stages of the project by taking into account gender specificities, setting up separate meetings and childcare, and dedicated trainings, and enabling participation in management. The priority targets are the farms managed by women. Although women make up the majority of market gardeners in sub-Saharan Africa, their access to resources and funding is limited. Gender impacts include improving women's incomes, building their capacity, easing their workload, and empowering them.
Source: WECF 2018	

Case Study: Women's groups and sustainable water management

Case Study 16. Women's groups and community-based sustainable water management Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
Indonesia	YAKKUM Emergency Unit (YEU)	Water. Forestry
Description	The Gemawang, Kaloran, and Temmangung districts in Central Java are threatened by water scarcity and landslides due to deforestation. This project empowers women's groups to identify and implement adaptation strategies within their communities. The women conduct field assessment and feasibility studies with village authorities and water experts and select appropriate water	

	management technologies to adapt to a changing environment. They use water saving solutions, water infiltration techniques, and ecological sanitation, improving livelihoods in their community. Massive deforestation in the Central Java area significantly reduced groundwater supply and led to a severe drought. The changing function of the forest caused serious damage to the land and increased the risk of landslide. The women's groups and people in the sub-villages have worked together to develop sustainable water management systems, preserve important old trees, and replant young trees around the water sources to prevent landslide, maintaining water supply through infiltration and preserving a balanced ecosystem. These measures are effective climate adaptation strategies.
Gender strategy/ impact	The project was initiated by women. The women's groups are actively involved in decisions on water management technology and they do advocacy at both local and regional levels. Ten members of the women's group Munca Lor's were involved in the regional authority's field assessment on water. Gender equality is also strengthened through income-generating activities through the sale of water technology. This new income can be used to maintain facilities, set up social funds, and ensure self-development.
Source: Chauhan 2021, citing WECF 2016.	
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Learn More: Drought and Water Insecurity

	THEME	LEARNING RESOURCE	LINK
	Gender mainstreaming in water and drought work	For a review of mainstreaming gender and climate in water and drought work, see *A conceptual framework for gender and climate mainstreaming to mitigate water inaccessibility in rural sub-Saharan Africa* (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022)	http://onlinelibrary.wiley.com/doi/abs/10.1002/wat2.1591
	Watershed planning	CARE's Visioning Approach in Community Watershed planning	https://careclimatechange.org/visioning-approach/
	Local example of water reform in Tanzania	For more on water sector reform as part of climate resilience efforts in Tanzania, see *Water sector reform, climate change and climate-resilient planning in central Tanzania* (Allegretti and Greene 2022)	https://pubs.iied.org/sites/default/files/pdfs/2022-06/20981iied.pdf

Managing Food Insecurity

Managing food insecurity is a critical adaptive strategy and is tightly linked to climate-smart agriculture (Bryson et al. 2021; Habtezion 2017). Gendered vulnerabilities to food insecurity are complex. On the one hand, some research suggests that female-headed households are less sensitive to food insecurity when faced with extreme weather, perhaps due to food storage practices and conscientiousness around ensuring household food security (Balikoowa et al. 2019). On the other hand, research from Bangladesh suggests that women are more vulnerable than men to climate-related food insecurity (Hossain and Majumder 2018). Therefore, it is differential and intersectional vulnerabilities be considered in communities experiencing food insecurity.

Enact safety nets like cash transfer, crop storage, and savings

Climate-associated extreme weather can both produce food shortages and increase food prices, both of which can contribute to food insecurity (Dasgupta and Robinson 2021). Research from safety net programs in Ethiopia suggests that providing cash assistance is more effective for reducing food insecurity than providing food assistance (Dasgupta and Robinson 2021). In this study, food assistance was overall ineffective (Dasgupta and Robinson 2021). Though families experiencing food insecurity may spend cash transfers on other urgent household needs, such as paying off debts, this should not discourage the use of cash transfers as a food insecurity mitigation approach (Dejene and Cochrane 2022). Decision-making around spending cash assistance may be gendered, with other research from East Africa suggesting that women are more likely to use credit for food than for on-farm investments compared to men (Carranza and Niles 2019).

Women may often skip meals when faced with food insecurity, so food security programming that does not explicitly address gender may put additional burden and responsibility on women (Alston and Akhter 2016). Many nutrition programming options – such as expanding breastfeeding, diversifying food production, or improving cookstoves – can have additional benefits for climate, gender, and health (Swinburn et al. 2019). Reducing food insecurity is particularly essential for those who are pregnant (Bryson et al. 2021). Gendered aspects of access to land, forests, and other natural resources are also often left out of conversations around climate and nutrition (Agarwal 2018).

In Ethiopia, having savings or the ability to store crops to sell later for a higher price was associated with reduced food insecurity, but these strategies were often inaccessible for households most in need (Dasgupta and Robinson 2021). This suggests that programs that can support savings, as well as national-level crop reserves, can support rural households in managing food insecurity (Dasgupta and Robinson 2021).

Increase agricultural yields while generating food sovereignty

Given that food insecurity is likely to increase in coming years due to climate change, there is a need to work to increase crop yields (for example, through climate-smart agricultural

practices) (Dasgupta and Robinson 2021). In addition, although food security work often narrowly focuses on crop yields, it is also important to address livestock, fisheries, pests, and diseases (Campbell et al. 2016). With that said, though, increasing agricultural yields alone will not resolve food insecurity: food sovereignty and just distribution and use of food resources are critical. For more on climate and agriculture, see the Climate-Adaptive Agricultural Practices subsection of this book.

Case Study: Improving food security and livelihoods through sustainable mangrove management

Case Study 17. Improving food security through sustainable mangrove managment Source: Konia, Masike, and James 2019

COUNTRY	ORGANIZATION	KEY SECTORS
Papua New Guinea	The Nature Conservancy	Food security, mangrove management, livelihoods
Description	In Papua New Guinea, clearing of coastal mangroves is exacerbating the effects of climate change and threatening local food security. This community-led program is focusing on improving women's livelihoods and mangrove management by shifting towards alternative forms of income from sustainably harvested mangrove products like crabs and clams. The program also provides training around mangrove restoration specifically designed for local women. It supports women with purchasing and using clean cookstoves. Expansion of ecotourism is also generating additional income streams. The program also explicitly engages with community members with disabilities in this work. By restoring mangrove ecosystems and strengthening community capacity to sustainably manage mangroves in the future, while also shifting towards cleaner cooking methods and increasing incomes, this project is improving food security and climate resilience.	
Gender strategy/ impact	Prior to this project, women in the region had limited access to leadership positions, capacity-building trainings, loans, and networking. This project is expanding women's leadership and networks, centering their knowledge, expertise, and needs.	
Source: Adapted from Konia, Masike, and James 2019		

Learn More: Managing Food Insecurity

	THEME	LEARNING RESOURCE	LINK
	**Gender, climate, and food security**	UNDP's policy brief *Gender, climate change and food security* (Habtezion 2017)	https://www.undp.org/publications/gender-climate-change-and-food-security

Managing Heat

Because gender shapes vulnerability and responsibilities, it can also influence heat exposures and experiences of heat's effects (Kjellstrom, Oppermann, and Lee 2020). Older people and migrants may also face higher risk of adverse effects of heat exposures (Kjellstrom, Oppermann, and Lee 2020).

Communicate about heat risks

Education, training, communication about heat risks may help alleviate heat-related impacts of climate change (Habibi et al. 2021; Parsons et al. 2022; McElroy et al. 2022; Sorensen, Murray, et al. 2018). In addition, early warning systems can support heat awareness, particularly for pregnant women and vulnerable workers (Habibi et al. 2021; McElroy et al. 2022). For more on early warning systems, see that subsection in this chapter.

Research from the United States suggests that subjective experiences of heat exposures were associated with protective behaviors (e.g., using fans, staying indoors, using air conditioning, checking on friends and neighbors, or going to a cooler place) (Esplin et al. 2019). Risk perception was also associated, though to a lesser degree, with protective behaviors as well (Esplin et al. 2019). Engaging in protective behaviors was also associated with other interacting aspects of identity including age, race/ethnicity, gender, political ideology, and income (Esplin et al. 2019). This suggests that increasing recognition of heat's effects and risks could shape the uptake of protective behaviors, but that these efforts should be tailored to the unique constraints and resources of different populations (Esplin et al. 2019).

Resource heat-protective actions and infrastructure

Protective behaviors could include hydration, seeking shade, adjusting work schedules or intensity, wearing heat-appropriate clothing, using fans, staying indoors, using air conditioning, checking on friends and neighbors, going to cooler places, etc. (Habibi et al. 2021; Esplin et al. 2019; Ahmad et al. 2020; Kjellstrom, Oppermann, and Lee 2020). However, in areas that also have limited resources and lack access to energy or water, implementing these actions may be difficult, if not impossible. In these contexts, investing in community infrastructure may be a viable alternative. In addition, enhancing social safety nets can also support households' ability to invest in heat protective resources. This has dual importance: because heat can reduce productivity – and, consequently, income – and because managing the health risks of heat may entail further adjustments to one's labor, cash transfers, capacity building, and livelihoods support may be effective ways to support communities experiencing extreme heat (McElroy et al. 2022; Pega et al. 2015; Sorensen, Murray, et al. 2018). Ensuring these resources are designed and delivered in a gender-sensitive way is critical to ensuring their efficacy.

Within workplace settings, expanding availability of air conditioning and temperature controls, regulating exposure to heat, preventing dehydration, having unions and safety committees, implementing frequent breaks, and enacting safety policies and regulations can help reduce thermal strain (Kjellstrom, Oppermann, and Lee 2020; Parsons et al. 2022; Habibi et al. 2021).

At a broader level, this may include efforts to mitigate urban heat islands (Aghamohammadi et al. 2021; Kakkad et al. 2014; Lundgren et al. 2013). For more on urban development, see that subsection of this chapter.

Implement specific heat-related support for people who are pregnant

Heat exposure is particularly risky for people who are pregnant. Strengthening healthcare systems, such as by increasing antenatal care through rural health workers, can help reduce infant mortality attributable to heat (Banerjee and Maharaj 2020; Sorensen, Murray, et al. 2018; Sorensen, Saunik, et al. 2018). Maternal wards can be air conditioned or moved to lower levels of hospitals (Kakkad et al. 2014; Sorensen, Murray, et al. 2018).

For individual women, early warning systems can inform women when they should stay indoors or seek shade (McElroy et al. 2022). For those who are breastfeeding, recent research has indicated that infants under 6 months of age can be exclusively breastfed and do not need supplementary food or water, even in hot weather conditions, and public health messaging around infant feeding practices in hot climates can be adapted to include these findings (Edney et al. 2022).

Case Study: Cool roofs for the urban poor

Case Study 18. Cool roofs for the urban poor Source: Chauhan 2021

COUNTRY	ORGANIZATION	KEY SECTORS
India	Mahila Housing SEWA Trust (MHT)	Heat, health, livelihoods
Description	Abnormally high temperatures not only increase energy demand but also impact health and livelihoods of the poor, especially those living in urban slums. More than 60% of urban roofs are made from metal, asbestos, and concrete, trapping heat inside buildings. Home-bsed workers, mostly women, are most affected by this, with reports of decline in their productivity by up to 30% in summer. To address this, the MHT piloted a program on cool roofs for the urban poor in India. By shifting to passive cooling, these homes could better aapt to days of extreme heat, making houesholds less vulnerable to weather impacts and improving their resilience against climate change risks. Cool roofs reflect sunlight and absorb less heat. Depending on the setting, cool roofs can help keep indoor	

	temperatures lower by 2-5 degrees Celsius (3.6-9 degrees Fahrenheit) compared to traditional roofs. Cool roofs can cost from as little as 0.5 per square foot for a simple lime-based paint, to more expensive coatings or membranes. There are three key models of cool roofs that are being piloted: A. "Air Lite" ventilators: made of fiber sheet, these dome-shaped roof ventilators not only improve air circulation and reduce inner temperatures, they also enable better day-time lighting of homes, thereby reducing electricity consumption (of fans and tube lights) by almost half and helping deal with indoor air pollution B. "Mod-Roof" tops: made of paper waste and coconut husk, these waterproof mod-roofs not only reduce home temperatures by 6-8 degrees Celsius but also provide for a cheaper and environmentally-friendly alternative to RCC roofs. They are easy to dismantle and can be reinstalled after adding additional floors or when moved to a new location. It is a boon for slum dwellers with uncertain land tenures. C. Heat-reflective paints: painting the roofs of households with heat-reflective paint lowers indoor temperatures by up to 2 degrees Celsius MHT also partnered with the University of Chicago Energy and Environment Lab in Delhi and with National Defence Research Council (NDRC) to evaluate the effectiveness of these technologies in lowering indoor temperatures.
Gender strategy/ impact	Cool roofs have multiple benefits for women, as highlighted from the pilots. They help reduce energy bills, while also providing bearable afternoon time for home-based women workers. The project also mobilizes women to generate awareness on the benefits of using the product by training women entrepreneurs, and designs a loan product to create a sustainable business models. Cool roofs also help build community resilience to extreme heat. The organization also elevated the experience through women leaders at the city level. Ahmedabad City now has a cool roofs program for over 3,000 low income homes as part of its heat action plan.
Source: Chauhan 2021 and Mahila Housing Trust 202)	
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.	

Learn More: Managing Heat

	THEME	LEARNING RESOURCE	LINK
	**Managing heat alongside other health risks**	For more on managing heat alongside competing complex health risks, see *COVID-19 and heat waves: New challenges for healthcare systems* (Bose-O'Reilly et al. 2021)	https://www.sciencedirect.com/science/article/pii/S0013935121004473
	**Managing heat in the workplace**	For more on evidence-based approaches to address the occupational risks of extreme heat, see *The impacts of climate change on occupational heat strain in outdoor workers: A systematic review* (Habibi et al. 2021)	https://www.sciencedirect.com/science/article/pii/S2212095521000018
	**Reducing heat risks for vulnerable populations**	The Extreme Heat Resilience Alliance is working to reduce extreme heat risk	https://onebillionresilient.org/2020/08/04/extreme-heat-resilience-alliance-reducing-extreme-heat-risk-for-vulnerable-people/

Early Warning Systems and Hazard Management

One key way to enhance climate resilience is by strengthening preparedness for and management of climate risks in a gender-informed way.

Implement early warning systems

Early warnings for hazards allow individuals and communities to prepare for anticipated risks (IPCC 2018). Early warning systems can use both scientific and Indigenous knowledge about environments and hazards (IPCC 2018). Early warning systems can be particularly valuable in low- and middle-income countries (Mallett and Etzel 2018). However, many people lack access to early warning systems. In one study of climate change in South Africa, for example, 72.3% of participants never received a warning before an extreme weather event (Patrick 2021).

Implementing gender-responsive early warning systems is a critical step in reducing gendered vulnerabilities to climate hazards (Mustafa et al. 2019; Tanner et al. 2019; Werners et al. 2021). In the Cyclone Preparedness Program (CPP) in Bangladesh, women took on the responsibility of providing early warnings, which increased the willingness of other women in the community to evacuate ahead of storms (Tanjeela and Rutherford 2018). In the Philippines, participatory radio strengthened community resilience following super typhoons (Fluck 2017).

Strengthen hazard management and disaster risk reduction efforts

Researchers in Pakistan recommend the widespread inclusion of women in disaster risk reduction trainings and tailoring disaster response efforts to the needs of both men and women (Zeeshan and Khan 2019).

When considering gender and disaster risk reduction more broadly, there are several key benchmarks that programs can consider around 1) understanding disaster risk ,2) strengthening disaster risk governance, 3) investing in disaster risk reduction, and 4) building back better (UN Women 2021a). Within these spheres, collecting sex and gender disaggregated data, conducting gender analyses, implementing gender responsive policies and accountability, ensuring safety and reduction of gender-based violence, consulting with and forwarding the leadership of women, mainstreaming gender, and investing in women's resilience, livelihoods, social protections, and equitable infrastructure can all contribute to gender-inclusive disaster risk reduction (UN Women 2021a).

Case Study: Strengthening climate information and early warning systems

Case Study 19. Strengthening climate information and early warning systems Source: Chauhan 2021

COUNTRY	**ORGANIZATION**	**KEY SECTORS**
Cambodia	UNDP	Disaster risk reduction, agriculture, water
Description	Supported with funding from the Global Environment Facility – Least Developed Countries Fund, this project (2015-2020) is supporting the Royal Government of Cambodia (RGC) to bridge existing gaps in institutional capacity, inter-ministerial coordination, and infrastructure. IT focuses on enhancing the inclusion of climate change consideration in short- and long-term planning, sectoral planning, and other decision-making processes. Data generated through installed hardware, along with risk mapping and forecasted data, are being made available to specifically benefit agriculture and water management sectors in their planning processes. Under the project: • 24 automatic weather stations and 29 automatic hydro stations were installed • 29 hydrologists, meteorologists, and technicians were trained in modelling and forecasting • A Forecast Application for Risk Management (FARM) Field School curriculum was developed • A seasonal forecast system (FOCUS) was established • Three national climate outlook forums ("Monsoon Forums") were hosted • Drought Information Hubs (InfoHubs) were established in Takeo, Kampot, Kampong Chhnang, Pursat, and Battambang provinces, with another three to be developed by May 2020 • More than 60 trainings were conducted for local agricultural cooperative leaders, farmer, and partners on drought-resistant agricultural techniques • Five international partnerships and four local partnerships were forged • More than 20 women were trained in disaster risk reduction and early warning systems • More than 1,300 farmers were trained in disaster risk reduction and early warning systems • More than 1,300 farmers were trained in drought-resistant agricultural techniques	

	• 12,511 Cambodians were reached through the extension of the phone-based early warning services EWS1294 (in Koh Kong, Sihanoukville, Kampong Cham, Tboung Khmum, and Prey Veng) • 2,369 children were trained in school safety drills The project also partnered with EWS1294, a free mobile phone service developed by the non-governmental organization (NGO) People in Need (PIN) in Cambodia following severe flooding in 2013. The focus is to extend the service from the existing five provinces to eight provinces, with the goal of nationwide coverage by 2020. EWS1294 is a practical means for Cambodians to receive early warning messages. According to a 2016 study, more than 96% of Cambodians report owning a phone, and more than 99% are reachable through some sort of phone. Members of the public register by simply dialing 1294 and entering their location. In the event of an emergency, such as a flood or storm, users in the affected area receive an audio message from the National Committee for Disaster Management warning them of the risks and steps to take to protect themselves, whether evacuating to the nearest safe site, staying indoors, or securing their livestock. Since being piloted in 2013, EWS1294 integrated into the National Committee for Disaster Management's disaster management strategy. In 2018, UNDP and PIN also worked together to install water-level stations and engage with communities in the flood-prone coastal provinces of Koh Kong and Sihanoukville.
Gender strategy/ impact	Within the project, UNDP, with a focus on enhancing gender equality in early warning systems and disaster risk reduction, also forged a partnership with Action Aid for increasing the representation of local organization and women in disaster management and climate adaptation decision-making. This ensures their voices are heard locally and nationally and makes sure their knowledge and contributions are maximized. The project focuses on selecting, training, and linking local women as "DRR Champions" with skills in community-based disaster risk reduction; hazard, vulnerability, and capacity assessments; and leadership and advocacy. The project also developed a Women's Resilience Index for Cambodia. Women and youth will be trained in data collection and entry, with analysis supported by international specialists. The project will also produce and promote a women's "Charter of Demands for Disaster Risk Reduction and Climate Change Adaptation." The Charter will be developed based on data and consultative workshops, and on input from women "DRR Champions" from the two provinces. The Charter will provide the basis for advocacy at the sub-national and national levels, seeking action on priority areas.
Source: Chauhan 2021, citing UNDP GEF 2020	
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.	

Learn More: Hazard Management, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Gender and disaster risk reduction**	For more on gender transformative approaches to disaster risk reduction, see *A feminist vision for transformative change to disaster risk reduction policies and practices* (Yadav et al. 2021)	https://www.sciencedirect.com/science/article/pii/S2212420920315284
		For more on taking action for gender and disaster risk reduction, see the GFDRR's Gender Action Plan 2016-2021 (GFDRR 2017)	https://www.gfdrr.org/en/publication/gender-action-plan-2016-2021
		For guidelines on integrating gender into disaster management, developed for Cambodia, see *Guidelines for Mainstreaming Gender in Inclusive Disaster Management* (NCDM 2021)	https://www.empowerforclimate.org/en/resources/g/u/i/guidelines-for-mainstreaming-gender-in-inclusive-disaster-management
		CARE's Landscape approach to disaster risk reduction in 7 steps	https://careclimatechange.org/a-landscape-approach-to-disaster-risk-reduction-in-7-steps/
		CARE's guide on integrating gender into climate change and disaster risk reduction	https://careclimatechange.org/making-it-count-integrating-gender/
	**Women's organizations and disaster resilience**	For more on perspectives from women's organizations in Asia on climate and disaster resilience, see *Breaking Silos, Building Resilience: Listening to Women-Focused Organisations for Climate Action and Disaster Risk Reduction* (UN Women 2021a)	https://www.empowerforclimate.org/en/resources/b/r/e/breaking-silos-building-resilience-listening-to-women-focused-organisations-for-climate-action
	**Technology for disaster resilience**	For more on mobile technology for disaster resilience, see *Improving Disaster Resilience Using Mobile Based Disaster Management System* (Aydin et al. 2016)	https://www.sciencedirect.com/science/article/pii/S2212017316000281
	**Local example of disaster governance**	For an example of local disaster governance, see *The Real Governance of Disaster Risk Management in Peri-urban Senegal: Delivering Flood Response Services through Co-production*	https://doi.org/10.1177/1464993416674301

Maladaptation

Despite important emerging work around climate adaptation efforts can reinforce gender inequities, displace vulnerabilities, and generate other forms of maladaptation, maladaptation has received relatively little consideration within policymaking, project planning, and funding spaces (Resurrección et al. 2019; Atteridge and Remling 2018; van Eerdewijk, Bråten, and Danielsen 2021). Maladaptation generally describes "the negative effects of introducing climate change adaptation initiatives without an understanding of how these initiatives are shaped by, and entangled in, context-specific gender and social dynamics" (van Eerdewijk, Bråten, and Danielsen 2021, citing Magnan et al. 2016; Gonda 2016; Resurrección et al. 2019).

Many short-term adaptive strategies can have longer-term negative effects or may cause harm alongside their adaptive action. For example, research from South Africa suggests that in times of extreme water shortage, people may turn to violent protest, theft, or the destruction of communal property (Patrick 2021). While child marriage can reduce household food consumption needs and, in some contexts, provide an additional influx of money for households, it has serious long-term consequences for the health and well-being of the child or children being married (Chauhan 2021). Poorly designed infrastructure projects can also increase social and economic vulnerability in the long-term, such as how the Lesotho Highlands Water Project elevated HIV risk and produced economic losses for women (Braun 2020).

Experiences of maladaptation can also be highly gendered. For example, research from Cambodia suggests that migration can at times be maladaptive in the long-term and ultimately contribute to persistent poverty, particularly because it is not associated with improved food security (Jacobson et al. 2019). These experiences can be exacerbated for women. This is because for women, the high social risks of migration – and its downstream effects on their physical and mental health – can mean that migration poses serious additional risks (Evertsen and van der Geest 2020; Ganguli 2021). Similarly, while selling assets such as jewelry can be an effective short-term coping strategy, sale of such assets is often gendered practice that can in fact increase vulnerability (Rao et al. 2019). Similarly, though livelihood diversity is a popular tactic for mitigating women's vulnerabilities to climate change, research from South Africa suggests that women's participation in the informal economy may make them more vulnerable than men to climatic shocks and variations (Flatø, Muttarak, and Pelser 2017). It can also create an increased labor and time burden for women (Chant and Sweetman 2012; Cohen et al. 2016; Anbacha and Kjosavik 2021).

Other forms of maladaptation occur when opportunities for adaptive benefits are not fully realized due to program structures and incentives. For example, in REDD+ community forestry programs, offering payments based on carbon stocks may incentivize less diverse

forests, which do not have the same ecological benefits and may produce less resilient communities (Pandey, Cockfield, and Maraseni 2016)

Maladaptation also occurs when individual adaptive actions are insufficient or ineffective given the level of risk. In forestry research in Cameroon, some adaptive strategies were ineffective, given the scale of environmental change, and others, while effective, used resources inefficiently, shifted pressures to different sectors, or had undesirable secondary effects (Keenan 2015; Bele et al. 2013). While individual-level adaptive responses can have some beneficial effects, they are often insufficient to generate robust community resilience, which requires additional, novel strategies to overcome existing financial, technological, and educational constrains such as expanded public infrastructure (e.g., roads), agricultural research, extension services, and weather forecasts (Bele et al. 2013). Such strategies requires outside support through international organizations, national and regional governments, and non-governmental organizations (Bele et al. 2013).

"Poorly informed climate change adaptation research therefore risks diminishing different groups of people's capacities and opportunities to benefit from adaptation interventions and to cope with and manage the impacts of climate change in their everyday lives." – (van Eerdewijk, Bråten, and Danielsen 2021)

Developing effective climate adaptation programming also entails thinking through potential maladaptive outcomes. These outcomes can occur along four key dimensions of maladaptation: process (maladaptation occurs as a process that exacerbates existing vulnerabilities), multiple drivers (maladaptation occurs when the multiple drivers of systemic vulnerability are not addressed), temporal scales (maladaptation occurs when adaptive efforts undermine future or long-term adaptive capacity), and spatial scales (maladaptation occurs when an adaptive measure produces collateral vulnerability or displaces vulnerability elsewhere) (Magnan et al. 2016). It is also important to consider how gender norms and inequities can contribute to maladaptation (van Eerdewijk, Bråten, and Danielsen 2021). From a programmatic standpoint, not including gender can also be a maladaptive approach. Given this, climate financing must be directed towards gender-transformative and women-led climate adaptation and mitigation efforts (Schalatek 2015; S. Wong 2016; Sanjeet Singh and Jayaram 2021; Frenova 2020; Schalatek 2009).

Because identifying maladaptation is subjective, there are several different approaches to take in terms of mitigating maladaptation risk. Magnan et al. identified three primary frameworks for avoiding maladaptation: the pathways framework, the precautionary framework, and the assessment framework (Magnan et al. 2016). The pathways framework follows five potential pathways of maladaptation: 1) increased emissions, 2) increased burdens on the vulnerable, 3) significant opportunity cost, 3) increased incentives for adaptation, and 5) limitations on future possibilities or flexibility (Magnan et al. 2016; Barnett et al. 2013). Alternatively, the precautionary framework aims to reduce

maladaptation through a more cautious approach that accounts for the possibility of conflicts and consequences within purportedly adaptive efforts using strategies that are: 1) no-regret or win-win, 2) reversible, 3) have safety margins, 4) use soft, rather than technical, approaches, 5) reduce time horizons for decision making, and 6) account for conflicts and interactions (Magnan et al. 2016; Hallegatte 2009). Finally, the assessment framework addresses forecast or expected effects of climate change, positioning climate adaptation within a broader suite of sustainable development initiatives that 1) avoid degradation, 2) avoid displacement of pressure, 3) support protective ecosystems, 4) maintain flexibility and account of ecosystem uncertainties, 5) focus primarily on adaptation, not emissions reductions, 6) originate with local characteristics and values, 7) recognize and enhance local knowledge, and skills, 8) bring in additional skills, 9) reduce inequities, 10) support livelihood and subsistence diversification, and 11) address ongoing and emerging changes to livelihoods, economies, and subsistence activities (Magnan 2014; Magnan et al. 2016). Drawing on each of these perspectives is key because aspects of each framework address different dimensions of maladaptation, and addressing a greater range of dimensions of maladaptation can reduce the risk of maladaptive practices occurring (Magnan et al. 2016).

Learn More: Maladaptation

	THEME	LEARNING RESOURCE	LINK
	**Maladaptation risks in climate work**	*Addressing the risk of maladaptation to climate change* (Magnan et al. 2016)	http://onlinelibrary.wiley.com/doi/abs/10.1002/wcc.409
	**Forwarding good adaptive practices**	CARE's Adaptation Good Practice Checklist	https://careclimatechange.org/adaptation-good-practice-checklist/

Chapter 3: Advancing Impact in Climate Change, Gender, and Health Programming

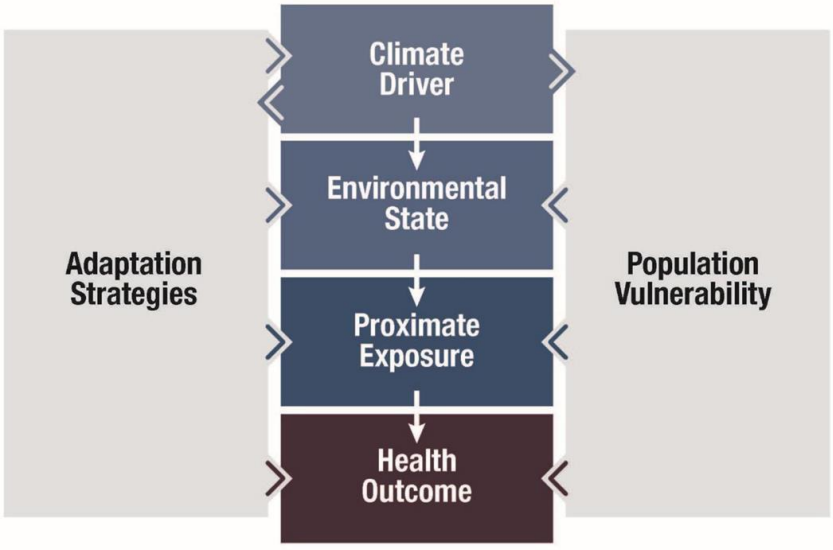
As Chapters 1 and 2 made clear, climate risks – and solutions – are diverse. Translating this knowledge to impactful action can be challenging, particularly given the complex, collaborative pathways that dynamically link climate, gender, and health. This chapter offers insight into advancing impact in this space through systematic planning strategies. Because understanding the processes that link climate change with adverse outcomes are complex and contextually specific, the chapter opens with an exploration of frameworks linking climate, gender, and health, including frameworks for understanding how transformational adaptation occurs. Then, the chapter explores how to move these frameworks into action through frameworks for climate integration, tools for identifying and selecting local climate solutions, and guidance on developing theories of change, including sample theories of change. Then, the chapter offers case studies of integrated programming around climate, gender, and health. The chapter concludes with best practices and lessons learned in this space.

Frameworks Linking Climate, Gender, and Health

Connecting Climate Change and Health Risks

Modeling the pathways that connect specific climate threats with specific health outcomes is a useful strategy for understanding how programmatic approaches can be targeted to local, contextualized needs. These frameworks and models can also be used to inform monitoring and evaluation of programs (for more on measuring impact, see Chapter 4). For example, Liu et al. proposed the Integrated Climate Change and Health Indicator System Framework (ICCHIS), after comprehensively reviewing existing theoretical frameworks and models for linking environment and sustainable development (Liu et al. 2021). They reviewed and built upon the Driving Force-Pressure-State-Impact Response (DPSIR) model, the Divers-Pressures-State Exposure-Effect-Action (DPSEEA) model from the WHO, the

*Figure 18. The Integrated Climate Change and Health Indicator System Framework*Source: Liu et al. 2019. No changes made. A copy of the license is available here: http://creativecommons.org/licenses/by/4.0/

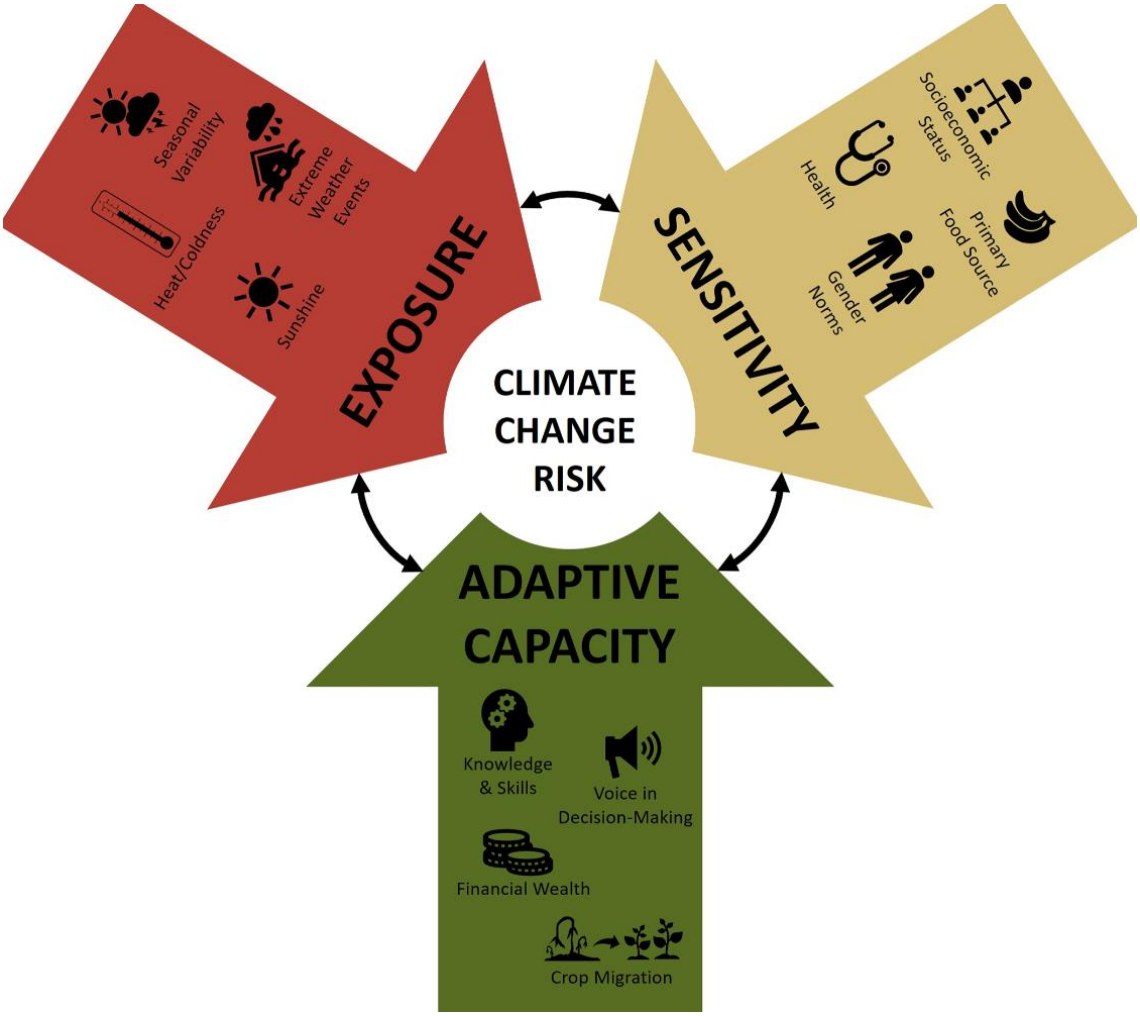


Multiple Exposures-Multiple Effects (MEME) framework, and the National Climate Indicator System (NCIS) (Liu et al. 2021). Gender could be integrated into this framework.

Though simple, this framework acknowledges the impact of a range of environmental trends and exposures, adaptation efforts, and existing vulnerabilities in shaping health outcomes.

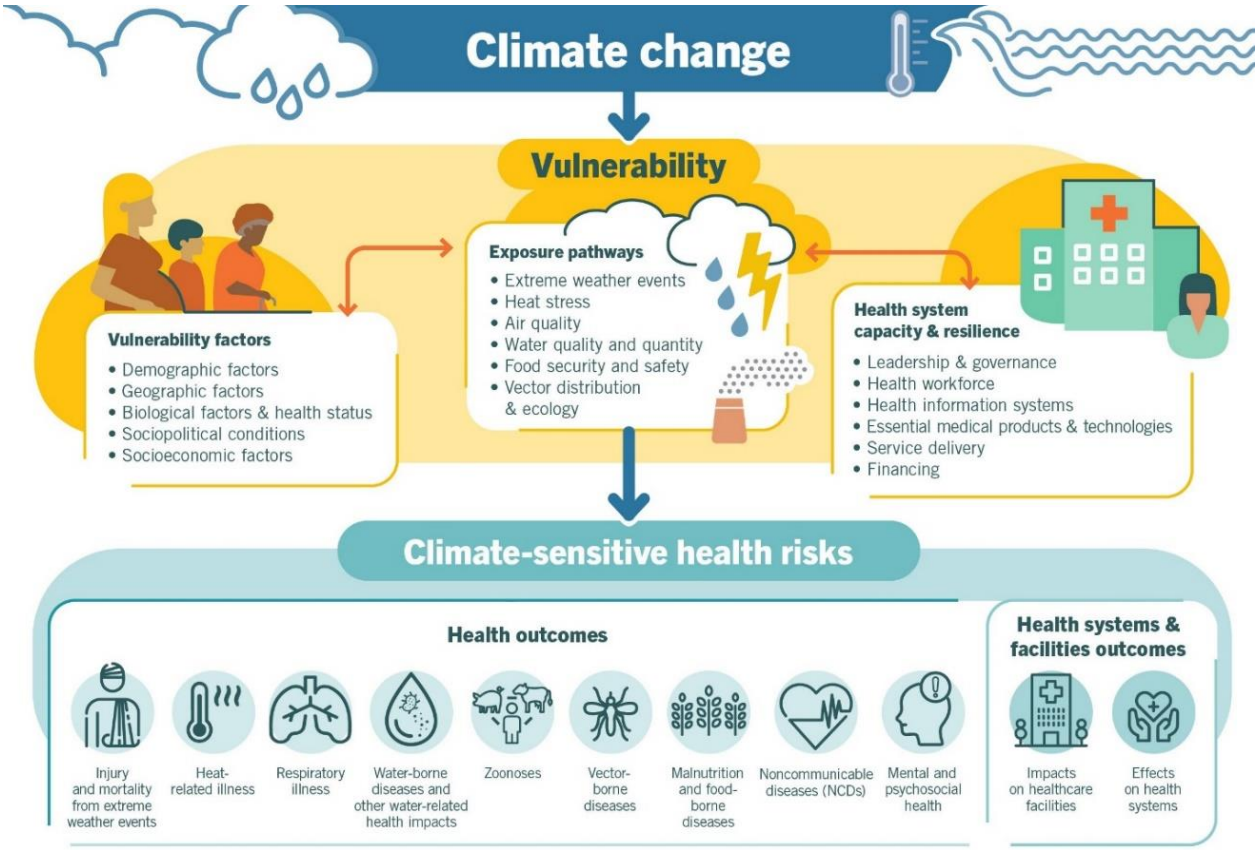
In examining how climate change affects food insecurity and maternal health for Indigenous and non-Indigenous women in Uganda, researchers developed this climate risk framework to show how exposure, vulnerability, and adaptive capacity come together to shape risk (Bryson et al. 2021):

Figure 19. Climate change risk framework linking exposure, sensitivity, and adaptive capacity Source: Bryson et al. 2021. No changes were made. A copy of the license is available here: https://creativecommons.org/licenses/by/4.0/



The WHO also developed a broader model that articulates direct and indirect links between climate change, vulnerability, and climate-linked health risks (WHO 2021c):

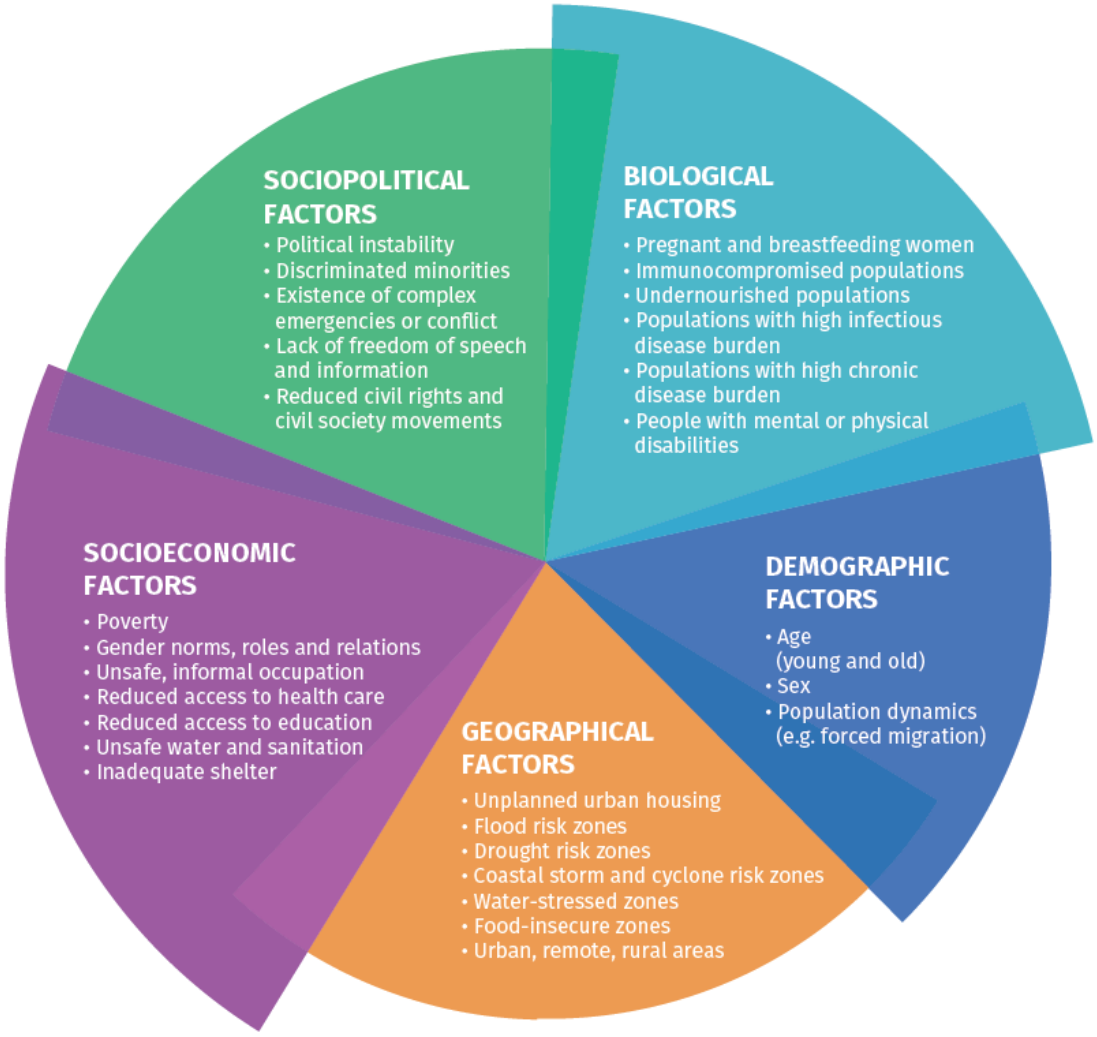
Figure 20. Connecting climate change, vulnerabilities, and climate-sensitive health risks Source: WHO 2021b. No changes made. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/



This model specifically highlights vulnerabilities and risks within health systems (WHO 2021c).

Vulnerability factors affecting the health effects of climate change can also be grouped around five categories: 1) sociopolitical factors, 2) biological factors, 3) demographic factors, 4) geographical factors, and 5) socioeconomic factors (WHO 2021b):

Figure 21. Vulnerability factors that shape the health effects of climate change Source: WHO 2021. No changes made. The license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/



Source: Based on Gamble JL, Balbus J, Berger M, et al. Populations of concern. In: The impacts of climate change on human health in the United States: a scientific assessment. Washington, DC: U.S. Global Change Research Program; 2016; and Quality criteria for health national adaptation plans. Geneva: World Health Organization; 2021.

To operationalize these models and assess whether climate impacts may be present, and the degree of those impacts, consider the WHO's framework for risks and impacts in the presence of hazards, exposures, and vulnerabilities (WHO 2021b):

Table 13. Connecting climate hazards with impacts Source: WHO 2021a. Formatting adapted. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/

CLIMATE HAZARD PRESENT	EXPOSURE PRESENT	VULNERABILITY PRESENT	CLIMATE RISKS	IMPACTS PRESENT
No	N/A	N/A	None	No
Yes	No	N/A	None	No
Yes	Yes	None or low	None – low	Yes (possible)
Yes	Yes	Medium or high	Low – high	Yes (probable)

Learn More: Additional Frameworks Connecting Climate and Health

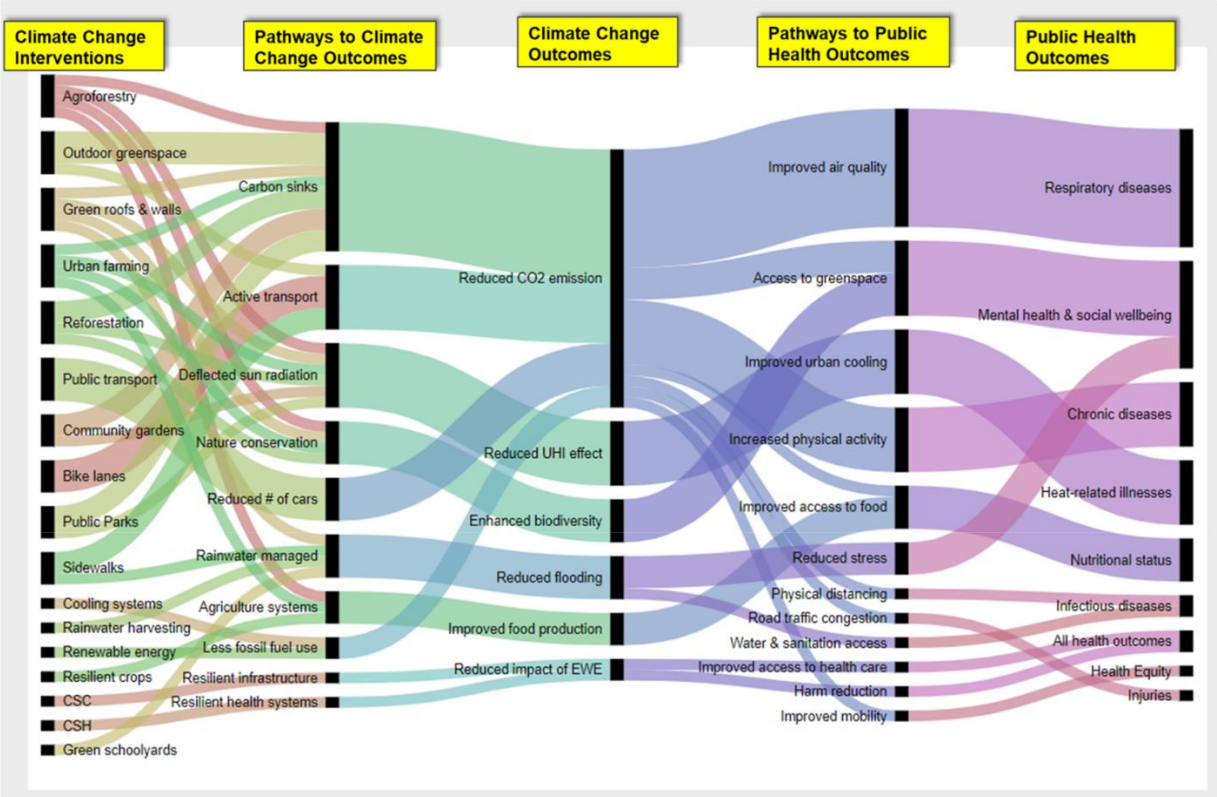
THEME	LEARNING RESOURCE	LINK
Integrating health of humans, animals, and the environment	The One Health framework aims to optimize health by taking an integrated interdisciplinary, cross-sectoral approach to human and environmental health. This framework addresses human-animal-environment interactions through shared environments, food systems, and medicines (Amuasi et al. 2020).	https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31027-8/fulltext
	For best practices around integrating a One Health approach, see the World Bank Group's Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems at their Interface	https://documents.worldbank.org/en/publication/documents-reports/documentdetail/703711517234402168/operational-framework-for-strengthening-human-animal-and-environmental-public-health-systems-at-their-interface
	To learn more, see the CDC's One Health Resource Library	https://www.cdc.gov/onehealth/resource-library/index.html
	For an analysis of how OneHealth compares to other frameworks for environment and health, see *The Impact of Climate Change on Health: Reducing Risks and Increasing Resilience in the Era of COVID-19* (Machalaba et al. 2021)	https://www.ecohealthalliance.org/wp-content/uploads/2021/11/The-Impact-of-Climate-Change-on-Health.pdf

	THEME	LEARNING RESOURCE	LINK
	**Understanding a range of models for climate vulnerability**	In his review of models and metrics for measuring vulnerability, Wisner covers several core frameworks for understanding vulnerability, particularly around climate and disaster. The article considers a range of vulnerability definitions, how vulnerability looks across scales and can progress, and how different types of vulnerability connect and interact (Wisner 2016).	https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-25
	**Using a socioeconomic development framework to understand climate impacts**	The Shared Socioeconomic Pathways (SSP) model was designed to examine how climate change might affect socioeconomic development (van Vuuren et al. 2014; O'Neill et al. 2014). The SSP model is oriented around scenario research, with five qualitative scenarios around prospective future development (Jiang and O'Neill 2017). The SSP model addresses health, but was not designed with health outcomes as its primary target (Bikomeye, Rublee, and Beyer 2021). For a detailed evaluation of how climate change and health can be integrated into the SSP, and the consequences of following different pathways, see (Samuel Sellers and Ebi 2018).	https://www.mdpi.com/1660-4601/15/1/3
	**Using a multi-dimensional, holistic approach to understand vulnerability**	The MOVE framework brings together vulnerability across social scales as well as around exposures, susceptibility, and lack of resilience. Together with existing hazards, these produce risks that can be managed or adapted to through interventions and governance (Birkmann et al. 2013). The MOVE framework was applied to examine social vulnerabilities to flooding in Côte d'Ivoire (Kablan, Dongo, and Coulibaly 2017).	https://doi.org/10.1007/s11069-013-0558-5
	**Additional resilience frameworks**	For additional resilience frameworks, see *A Common Analytical Model for Resilience Measurement* (FSIN 2014)	https://www.fsinplatform.org/sites/default/files/paragraphs/documents/FSIN_TechnicalSeries_2.pdf

How Climate Interventions Impact Health Outcomes

Just as climate hazards can affect health outcomes, so too can climate interventions. Bikomeye, Rublee, and Beyer created a new conceptual model linking climate interventions with public health outcomes across high-, middle-, and low-income contexts, visualizing the overlapping pathways and benefits of different climate responses (Bikomeye, Rublee, and Beyer 2021):

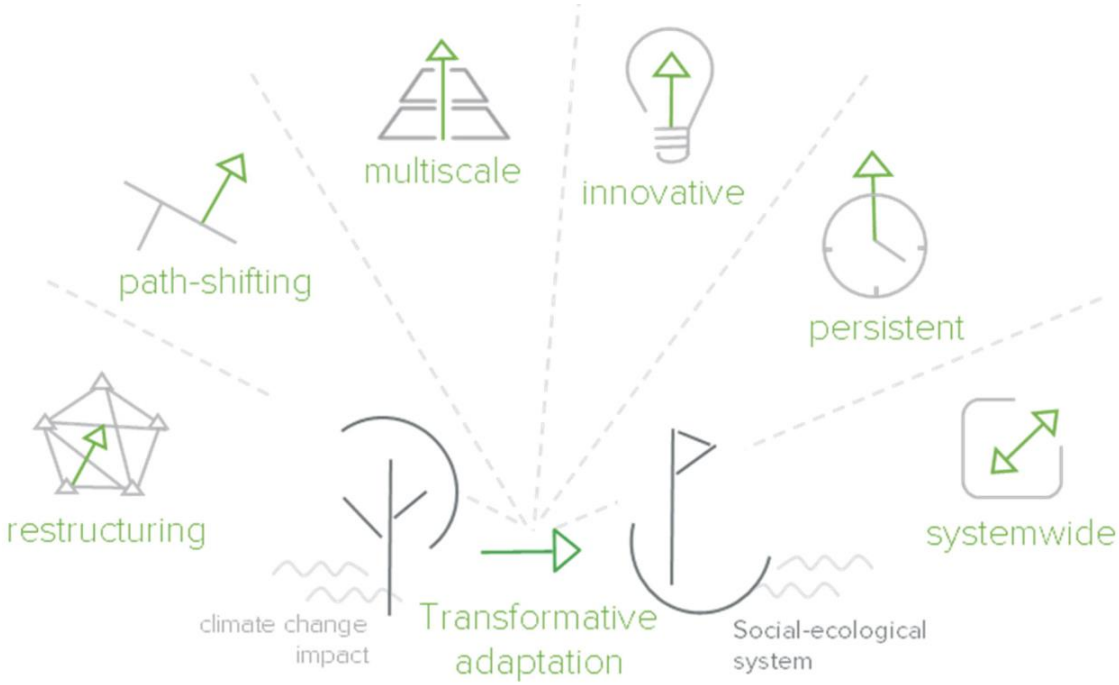
Figure 22. Conceptual framework for linking climate mitigation and adaptation strategies and health Source: Bikomeye et al 2021. Note: CSH = Climate Smart healthcare. CSC: Climate Smart Construction. EWE: Extreme weather events.



Creating Transformative Climate Adaptation

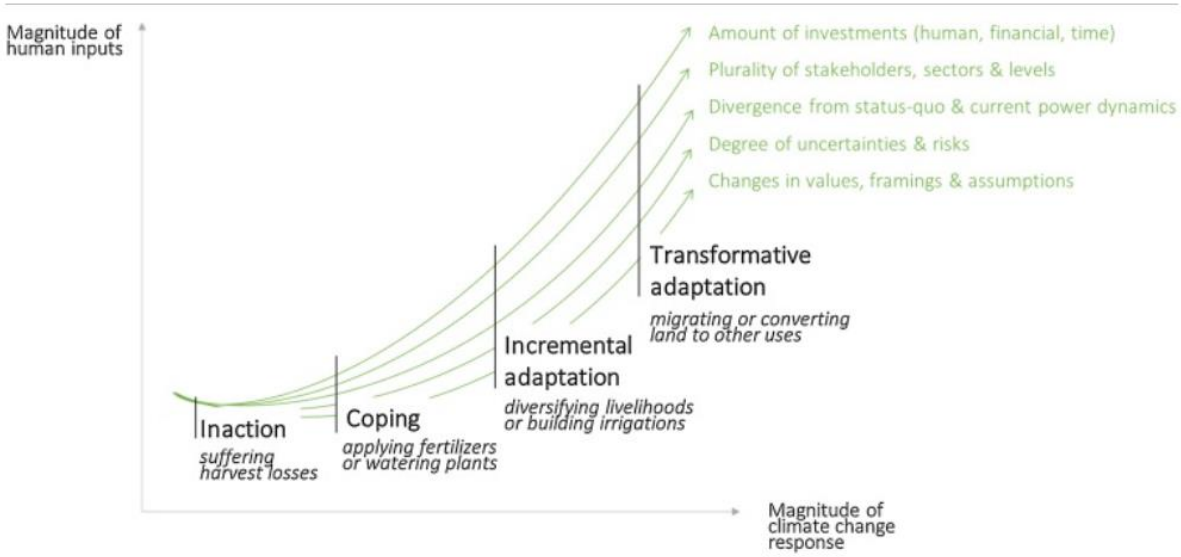
Interventions oriented towards adaptation have been critiqued for being applied in ways that reinforce or generate vulnerability or drive maladaptation (S. Eriksen et al. 2021; Fedele et al. 2019). In response to this, Fedele et al. Identified six characteristics of transformative adaptation in their overview of transformative adaptation (Fedele et al. 2019):

Figure 23. Six characteristics of transformative adaptation. Source: Fedele et al. 2019. No changes were made. The license is available here: https://creativecommons.org/licenses/by-nc-nd/4.0/



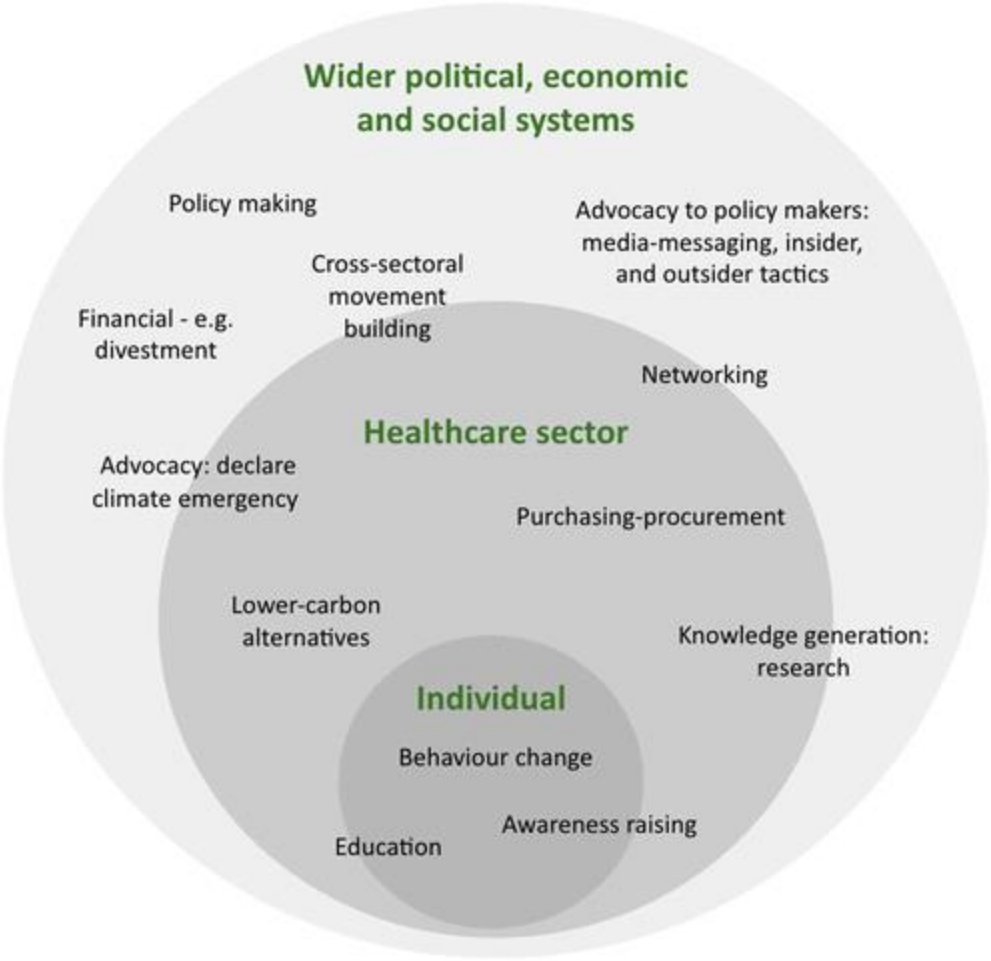
In this understanding, achieving transformative adaptation is a product of the scale of response to climate change, whether in terms of investments, stakeholder engagement, shifting of power dynamics and status quo, response to uncertainty and risk, and shifts in values and assumptions (Fedele et al. 2019):

Figure 24. Strategies for responding to climate change Source: Fedele et al. 2019. No changes were made. The license is available here: https://creativecommons.org/licenses/by-nc-nd/4.0/



In Fedele et al.'s model, multiscale efforts are a critical part of generating transformative adaptation. In their study of the climate change and health movement in England, researchers identified theories of change across different areas of influence (individuals, sectors, and systems) and mechanisms for producing change (Issa et al. 2021). They note that "the climate change and health space is somewhat skewed towards actions at the individual and sectoral levels," with less attention on system level change (Issa et al. 2021, 20). Individual level activities are popular, but often too slow or not feasible for making a meaningful impact on climate. This tendency, they note, should not be surprising, given the challenges of structural and systemic change paired with a healthcare sector that already tends towards individualism (Issa et al. 2021). They identify several domains and means for generating change across scales in the climate-health space (Issa et al. 2021):

Figure 25. Domains and mechanisms for creating change around climate and health Source: Issa et al. 2021. No changes were made. A link to the license is available here: https://creativecommons.org/licenses/by/4.0/



Other recent research on social networks and adaptation suggests that whether households react to climate effects in terms of adaptation or transformation depends on 1) their ties to either divergent or interconnected ecological resources and 2) their perception of their own power around resource management (Barnes et al. 2020).

In their work on climate-smart regenerative agriculture, Gosnell et al. argue that transformation happens at practical, personal, and political levels. Using the concept of "zones of friction and traction," they describe feedback loops of emotions, cultural norms, values, identity, and monitoring that produce behavior change and transformation (Gosnell, Gill, and Voyer 2019). Transformation occurs through these interactions between personal, political, and practical spheres (Gosnell, Gill, and Voyer 2019). Similar work has suggested that climate adaptation occurs through *both* incremental and transformational cycles of change (Park et al. 2012).

From Planning to Action: Developing Contextualized Climate, Gender, and Health Strategies

Frameworks like those described in the previous section help orient us towards key patterns and linkages between climate, gender, and health. This section explores how these frameworks can be used to move from planning to action by developing strategies that are tailored to the needs, risks, and strengths of particular communities.

Integrating Climate and Gender into Programming

ARROW's Training Manual on Gender and Climate Change Resilience introduces five widely-used frameworks for climate integration, with guidance on how to integrate gender into each (Chauhan 2021):

1. Local Adaptation Plans of Action (LAPAs): LAPAs are typically spatially oriented, focusing on adaptation needs of specific geographic regions. They can integrate gender and participatory approaches, and can be top-down or community-based.
2. City Resilience Framework: This framework is focused on advancing urban climate resilience. It integrates health as one of four dimensions of focus; each dimension has established goals and indicators. This can be top-down or community-based.
3. Infrastructure-Based Adaptation Planning: These approaches are often engineering- and disaster-oriented, focusing on design approaches to mitigate anticipated future outcomes. They can be top-down or community-based.
4. Ecosystem-based Adaptation (EbA): EbA models leverage environmental resources to protect against climate change and disasters by maintaining ecosystem services and promoting ecosystem resilience. They can be top-down or community-based.
5. Community-Based Adaptation (CBA): CBA approaches are fundamentally community led. In CBA frameworks, communities prioritize needs and actions. CBA approaches are strengths-based and focus on increasing adaptive capacity.

Identifying Appropriate Climate Solutions

How can we identify climate solutions? The reality is that communities are *already* adapting to climate change, because they have no other choice. However, given the scope of climate change's impacts, we also know that we have to respond in ways that are more collaborative, more inclusive and equitable, more effective, more responsive to dynamic local contexts, and more effective at building on the knowledge of others.

Collectively strengthening our response to climate change requires participatory, collaborative engagement. This enables teams, institutions, and resource networks to forward local communities' autonomy by 1) advancing their leadership and voices, 2) building on their existing knowledge and strengths, and 3) responding to community-identified critical needs and gaps.

These participatory conversations can be augmented by using the knowledge of others to foster creativity, ideation, and scope of integrated solutions. Reviewing Chapter 2 of this book, as well as reviewing databases of peer-reviewed publications and grey literature, can be useful for understanding the breadth of possibilities that exist for responding to climate challenges. There are *many* different ways to respond to climate threats. This knowledge can be helpful for sparking a creative expansion of what kinds of climate strategies are possible, for facilitating informed participatory workshops grounded in best practices and lessons learned from others, and for enhancing conversations around the specifics of how climate solutions can be implemented.

Given the breadth of climate solutions that exist, one way to identify locally-appropriate climate solutions is by using frameworks for understanding how various climate exposes shape gendered health outcomes. These frameworks can address specific climate risks and impacts, and they offer ways ensure gender and other aspects of identity remain centered in as these responses are identified, evaluated, and implemented. These frameworks can serve as useful tools for understanding key patterns to consider when developing programming.

For example, Sorensen et al. followed these exposure pathways to identify gendered impacts and cross-sectoral risk-responsive solutions (Sorensen, Murray, et al. 2018):

Table 14. Climate exposure pathways, impact on women, and gender-based solutions Source: Sorensen, Murray, et al. 2018. Excerpted and formatted. A copy of the license is available here: https://creativecommons.org/publicdomain/zero/1.0/

EXPOSURE PATHWAY	IMPACT ON WOMEN	GENDER-BASED SOLUTIONS	SECTORS INVOLVED
Increasing frequency of extreme heat events and rising average seasonal temperatures	Increased morbidity and mortality and poor birth outcomes	• Provide air conditioning in maternal wards (shown to decrease intensive care need in neonatal period) • Increase access to prenatal care in heat-vulnerable areas • Implement heat early-warning systems with educational messages targeted at women • Collect and disseminate gender-disaggregated public health data • Consideration of the detrimental effects of urban heat islands, especially in regions with poor access	• Public Health • Urban planning • Medicine
Excerpt from: Sorensen, Murray, et al. 2018. See article for a full list of exposure pathways and gender-based solutions.			

This type of framework can be adapted for specific contexts, as was done in this framework of health-related climate change impacts in India (Sorensen, Saunik, et al. 2018):

Table 15. Connecting climate exposures, vulnerabilities, and solutions in India Source: Sorensen, Saunik, et al. 2018. Excerpted and formatted. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-nd/4.0/

EXPOSURE PATHWAY	CLIMATE CHANGE PROJECTIONS AND IMPACTS IN INDIA	WOMEN'S HEALTH VULNERABILITIES	CULTURAL AND SOCIOECONOMIC VULNERABILITIES	GENDER-BASED SOLUTIONS
Water insecurity and increased risk of waterborne disease	Based on 2015 estimates, only 62% of urban communities and 28% of rural communities in India have access to improved sanitation. (World Bank Group, 2018a) Future impacts of heavy precipitation and drought (Barros et al., 2014) may worsen these conditions.	• Water scarcity forces provision from sources that may be biologically and toxicologically contaminated, resulting in bacterial, viral and protozoan infections as well as toxin exposure (Duncan, 2006) • Traveling long distances to procure water increases exposure to heat (Shiva & Jalees, 2005) • Lack of access to water and sanitation creates unsafe conditions for women, especially during reproductive times (Birch et al., 2012)	• Traditionally, women have the household role of providing water for the family. Water scarcity equates to more time spent harvesting water and less time spent on other activities of livelihood such as economic gain • In some regions carrying water may use up to 85% of a woman's daily energy intake (Duncan, 2006)	• Increase accessibility to affordable home water filters • Increase public investment in water infrastructure in high risk areas such as urban slums. • Water scarcity forces provision from sources that may be biologically and toxicologically contaminated, resulting in bacterial, viral and protozoan infections as well as toxin exposure (Duncan, 2006) • Increase accessibility to affordable home water filters • Traveling long distances to procure water increases exposure to heat (Shiva & Jalees, 2005) • Increase public investment in water infrastructure in high risk areas such as urban slums. • Lack of access to water and sanitation creates unsafe conditions for women, especially during reproductive times (Birch et al., 2012)
Excerpt from Sorensen, Saunik et al. 2018. See article for a full list of climate solutions.				

A similar framework was used by the WHO in their report *Gender, Climate Change and Health* (World Health Organization 2014). This framework adds the additional element of interventions that can benefit both women and men:

Table 16. Gender dimensions of climate change impacts Source: WHO 2014. Excerpted and formatted. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/

IMPACT OF CLIMATE CHANGE	GENDER DIMENSIONS (EXAMPLES)	GENDER-SENSITIVE ADAPTIVE STRATEGIES (EXAMPLES)	POSSIBLE INTERVENTIONS BENEFICIAL TO BOTH WOMEN AND MEN (EXAMPLES)
Increase in infectious diseases	Women constitute the majority of those who take care of the sick (both as household caregivers and as front-line health workers). Women often lack, or have less access to, health services	A gender perspective must be incorporated into infectious disease analysis and research to target policies and programs. Collected data must be disaggregated by sex, age, socioeconomic status, education, ethnicity, and geographical location, where appropriate. An understanding of gender and its implications for health and health-seeking behavior should be incorporated into training of health professionals and development of health-sector responses.	Ensure better availability and access to, and support by, health systems for both women and men, but especially for women, given their caregiving roles. Support outreach activities, using gender-sensitive information, education, and communication strategies and materials for advocacy and training. Promote childcare facilities and other approaches to support women's caregiving role, while trying to transform related gendered roles and norms.
Excerpted from WHO 2014. See source for full list of climate change impacts and responses.			

An alternative approach to modelling pathways of gendered climate change impacts was also used in this report to more clearly highlight multiple impact pathways and response strategies (World Health Organization 2014). This framework uses a two-step approach, first identifying general impacts and responses, then considering gender-specific effects:

Table 17. Impact pathways and current responses to climate change Source: WHO 2014. Excerpted and formatted. A copy of the license is available here: https://creativecommons.org/licenses/by-nc-sa/3.0/igo/

EXAMPLE IMPACT PATHWAYS		EXAMPLE CURRENT RESPONSES	
Meteorological conditions exposure	**Human/social consequences of climate change**	**Mitigation actions**	**Adaptation actions**
Warming Humidity Rainfall/drying Winds Extreme events	Displacement Shifts in farming and land use	Alternative energy Accessible clean water	Addressing water shortage Crop substitution Community education on early warning systems and hazard management
Examples of impact outcomes and responses that are gendered in their effects			
• Injury/death from hunger • Epidemics • Mental health issues • Water-related infections	• Migration • Exacerbation of malnutrition • Increased violence against women and girls	• Hydropower – leading to more snail hosts for schistosomiasis • Cleaner air – less cardiorespiratory diseases (gendered profiles)	• Unexpected nutrient deficiencies • Impacts of water quality • Fewer deaths in extreme events
Excerpted from WHO 2014, drawing on McMichael and Bertolinni 2009.			

The frameworks described above follow exposure to climate threats and the associated health and socioeconomic impacts to identify potential climate solutions. An alternative would be to start with existing social norms and examine how those practices are affected by climate change. For example, think back on the table in the opening section of Chapter 1, Part 2 that described gender roles and climate change impacts across sectors(Chauhan 2021).

By adapting this framework to add a column for possible interventions, this framework offers an alternative approach to developing gender-appropriate, climate-responsive interventions:

Table 18. Gender roles and differentiated vulnerabilities Source: Chauhan 2021

GENDER ROLES AND DIFFERENTIATED VULNERABILITIES

Sector	Major Gender Roles		Climate Change Impacts	Gendered Vulnerability to the Impact	Possible Interventions
Food	Men	• Money for food	Reduced food production globally and ensuing increase in food prices	• Increased poverty as share of food bill in household expenses goes up • Increased mental stress for more income and financial management	• Vocational training for climate resilient livelihoods • Psychosocial support for men and boys
	Women	• Food and nutrition management • Cooking	Forest conservation policies will reduce access	• Increased poverty as share of food bill in household expenses goes up • Increased stress for food and nutrition security in family • Skewed intrahousehold distribution pattern will lead to reduced food and nutrition intake for women and girls • Indigenous and poor women dependent on forest will face more problems	• Targeted nutrition support for at-risk families • Gender-sensitive, equitable forest access policies that allow for sustainable community use and management of forest resources • Alternative energy sources to reduce forest fuels • Vocational training for climate-resilient livelihoods • Training and resourcing for climate resilient household and community gardens and food sources

Adapted from Chauhan 2021 to include the additional column on the far right. See source for full table. Note that these roles and interventions are not fixed and need to be contextualized; they serve as examples for ideation.

Another way to conceptualize this would be to consider prevention and response options across scales (e.g., individual and community, national/regional, and global scales) (Machalaba et al. 2021).

Selecting Solutions

Evaluating and selecting solutions among the many possibilities can be challenging. ARROW offers guidance on ranking and evaluating gender-responsive adaptation approaches in a participatory way, including a template for evaluating climate-resilient solutions (Chauhan 2021):

Table 19. Template for gender-responsive climate-resilient solutions Source: Chauhan 2021

	TYPE OF CLIMATE-RESILIENT SOLUTIONS			
CRITERIA FOR PREFERENCE	**Community-based rice drying improvement with solar technologies**	**Household irrigation improvement with solar technologies**	**Community-based vegetable conservation improvement with solar cooking technologies**	**Community-based chicken and duck production improvement with solar incubator**
Percentage of people involved				
Number of months providing employment/income				
Stability of incomes				
Losses faced due to natural hazards				
Potential of increased income stability and reduced losses				
Percentage of women involved in the activity				
Percentage of women owning the business				
Percentage of women having received training in the business				
Potential number of women's groups/businesswomen who can take up the enterprise				
Will it reduce the drudgery of women and girls?				
Total				

Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.

The criteria used might look different in different communities and may reflect the needs and interests of different stakeholders. Note also that the impact of a climate solution depends not only on the solution itself, but also *how* it is enacted. Prioritizing equity across a range of identities and reconfiguring power dynamics in the decision-making process is therefore critical.

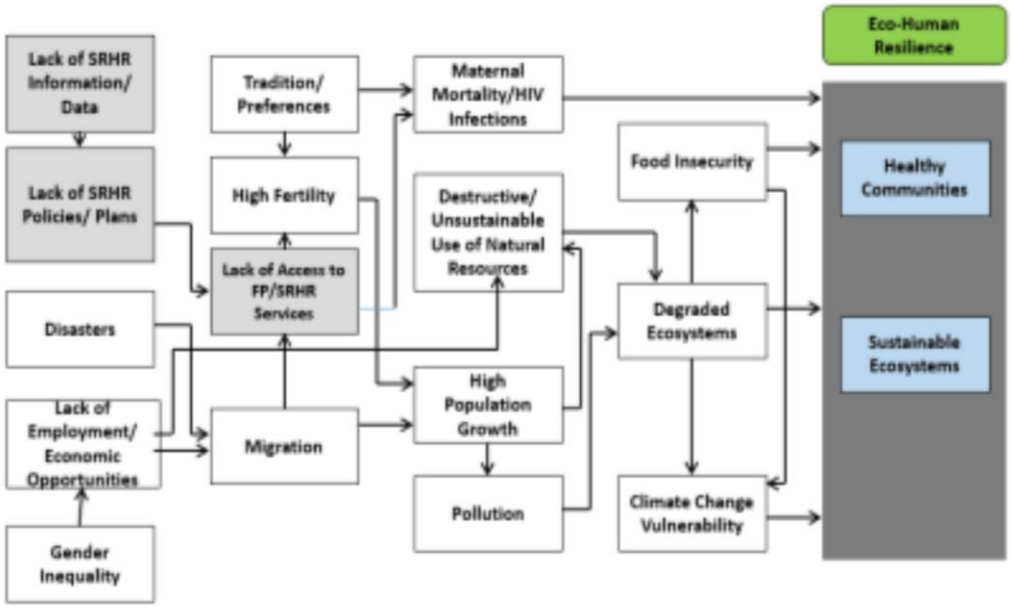
Leveraging Frameworks and Theories of Change to Integrate Climate Solutions

Issa et al. argued that "no one theory of change can be applied to this 'climate change and health' movement" (Issa et al. 2021, 20).

Climate change is complicated, and so are its effects on communities. Holistic, cross-sectoral solutions can be especially effective for addressing complex challenges – but given the myriad risks, vulnerabilities, and resources at play, identifying and developing integrated solutions can be difficult. Strong frameworks can serve as a tool for handling this challenge strategically.

For example, based on previous projects in coastal communities, ARROW generated a framework connecting SRHR, climate change, and resilience (Castro and Hernandez 2015). The framework was validated through focus groups and key informant interviews (Castro and Hernandez 2015). In this framework, a range of contextual factors shape climate change vulnerability, limiting communities from reaching the goal of "eco-human resilience," defined as healthy communities and sustainable ecosystems:

Figure 26. Framework for Population, Health, Environment and Climate Change Source: Castro and Hernandez 2015



Frameworks like these highlight the importance of generating climate resilience and adaptation through holistic, integrated approaches. Improved adaptive strategies, resources, and knowledge are important for climate adaptation. However, these improvements alone will be insufficient if other factors that shape possibilities for adaptation remain unaddressed.

Learn More: Sample Theories of Change for Climate, Gender, and Health

	THEME	LEARNING RESOURCE	LINK
	**Water access in Sub-Saharan Africa**	In this framework, interconnected individual, systemic, and environmental factors shape water accessibility. Water accessibility is also mutually connected with both coping strategies and consequences for health, nutrition, socioeconomic status, and safety. Here, how people cope with and adapt to water inaccessibility (that is, their own solutions to this climate challenge) is shaped by both the factors that drive their water access challenges *and* the consequences of their inability to access water. Frameworks like this draw attention the different types of climate solutions individuals and communities deploy – and highlight how these are the dynamic products of the local context (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022).	http://onlinelibrary.wiley.com/doi/abs/10.1002/wat2.1591
	**Gendered effects of climate change in South Asia**	This model links climate "signals" (that is, climatic shifts, changes, hazards, disasters, etc.) with the impact of those signals. That impact mutually interacts with women's vulnerability context, which in turn shapes and is shaped by the "adaptation arena" and women's well-being outcomes. The activities in the adaptation arena are influenced by both individuals' roles and resources as well as their decision making power (Patel et al. 2020).	http://www.proquest.com/docview/2532587779/abstract/F02E6E6DEBD4FB5PQ/1

THEME	LEARNING RESOURCE	LINK
 **Integrating health and sexual and reproductive health into conservation**	THE CMP-Moore Learning Initiative produced two collaboratively developed theories of change around conservation and health topics: one for conservation and health broadly, and one for conservation and reproductive health. The work is robustly researched and the full report covers the methods used to develop the TOC, lessons learned, case study applications, and recommendations. Overall, they focus on integrated partnerships with simultaneous delivery.	https://docs.google.com/presentation/d/1WYKU_h9UPAhNcyizlicTvoCiHH-JKsz4l61Lpllt3FI/edit#slide=id.gaede20286e_0_8
 **Advancing women's empowerment and collective action on climate change**	The WOCAN theory of change aims to advance women's empowerment and collective action to tackle climate change, poverty, ad food insecurity within enabling environments. In this framework a range of leadership, measurement, technical, and innovation activities contribute to outputs like increased funding, stronger networks, and improved policies. This framework attends to gender and climate across a range of scales and domains.	https://www.wocan.org/our-theory-of-change/
 **Centering resilience and learning**	BRAC's theory of change for climate resilience centers resilience by first asking "resilience for whom?" and "resilience to what?" Then, through a cyclical process, it focuses on building different types of resilience through anticipatory capacity, absorptive capacity, transformation, and adaptive capacity. Iterative learning is integrated throughout. This framework could be adapted to develop theories of change that explicitly integrate thematic outcomes around gender and health (Nasir et al. 2020).	https://brac.net/downloads/Resilience-Framework.pdf

THEME	LEARNING RESOURCE	LINK
Enabling gender-transformative climate work across scales	The CLARE Research Program funds gender-integrated climate research. In their theory of change, they first identify gender-related climate outcomes and impacts across a range of change scales, from incremental to transformative change. Second, they identify the arenas through which social inequities are produced and reproduced across scales – which affects individual-level vulnerability and adaptive capacity. Third, they identify the intersectional individual level factors that shape vulnerability and adaptive capacity in the face of climate change. Finally, they provide an outline of outputs, outcomes, and impacts that their work at the nexus of gender and climate can aim for, across scales of change.	https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/60798/IDL-60798.pdf?sequence=2
Strengthening agricultural outcomes through climate-smart agriculture	The FAO's theory of change for climate-smart agricultural programming is oriented around four interacting areas of focus: evidence, dialogue, tools, and practice change. Activities across each of these areas contribute to sustainable improvement of food and agriculture systems. The theory of change also includes guidance on implementation and developing partnerships (FAO 2017b).	https://www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c10-evidence-based-implementation/chapter-c10-1/en/

Learn More: Tools and Guidance for Planning

Developing conceptual frameworks and theories of change is critical not only for communicating complex socioecological interlinkages, but also for developing and identifying robust and appropriate indicators for programming in this sphere (Apatinga, Schuster-Wallace, and Dickson-Anderson 2022). Although programming integrating climate, health, and gender is still in its nascent stage, practitioners in this space can apply and leverage existing knowledge from across sectors.

THEME	LEARNING RESOURCE	LINK
Theories of change for climate adaptation	Sea Change and UKCIP issued a guidance note on theories of change in climate adaptation. They begin with an introduction to what theories of change are and why they are a good fit for climate adaptation. The note includes links to resources, including software for developing theories of change, templates, training manuals, and recommended readings. They recommend having both simplified models and a full model.	https://www.ukcip.org.uk/wp-content/PDFs/MandE-Guidance-Note3.pdf
Planning in climate and gender projects	CDKN and partners created a guide for monitoring and evaluation around gender quality and climate action projects. In Chapter 3, they discuss planning and identifying solutions, including how to use a problem tree, resilience wheel, and vulnerability assessments to identify solutions and set project goals (Dupar and Velasco 2021)	https://wrd.unwomen.org/practice/listing-toolbox/advancing-gender-equality-and-climate-action-practical-guide-setting
Participatory theories of change and planning	Because the CMP-Moore Learning Initiative so thoroughly documented their planning – which included surveys, interviews, and group sessions – it serves as a useful tool for understanding how participatory processes can be used to build theories of change that incorporate the voices of many stakeholders.	https://docs.google.com/presentation/d/1WYKU_h9UPAhNcyizIicTvoCiHH-JKsz4l61Lpllt3FI/edit#slide=id.gaede20286e_0_8
	CARE's Practical Guide to Participatory Scenario Planning	https://careclimatechange.org/practical-guide-to-participatory-scenario-planning-seasonal-climate-information-for-resilient-decision-making/
	CARE's Planning for Resilience: A Practitioners Manual	https://careclimatechange.org/planning-for-resilience/

Implementing Integrated Approaches to Accelerate Climate Resilience: Case Studies

These selected case studies highlight recent work in the climate-gender-health nexus that expand their impact by integrating cross-sectoral approaches to build climate resilience.

Case Study: Integrating family planning and marine conservation

Case Study 20. Integrating family planning and marine conservation Source: Blue Ventures 2022

COUNTRY	ORGANIZATION	KEY SECTORS
Madagascar	Blue Ventures	Sexual and reproductive health and rights, fisheries management, conservation
DESCRIPTION	The Safidy – *"choice"* – project works with isolated rural communities to strengthen health systems, reproductive health, and health behavior is key conservation areas in Madagascar. These community health workers provide a wide suite of health services, education, and materials. Through a program that uses community health workers alongside marine conservationists, voluntary contraception use increased from 10% in 2007 to 59% in 2013, the fertility rate was halved, and women using family planning services earned more than double those who did not. The program integrates provision of materials, education, technical guidance, partnership facilitation, and outreach activities such as theater and storytelling sessions. The project bridges health and environmental networks through fostering cross-sectoral partnerships, offering technical guidance and mentorship, leading learning exchanges and training workshops, creating technical resources, and fostering an enabling policy environment.	
GENDER STRATEGY/ IMPACT	The project engages with both men and women, using topics like food security to lead into conversations about family planning, reproductive rights, and gender norms. The project forwards gender equity in marine conservation, trains women on how to monitor fisheries, strengthens women's livelihoods, and increases their representation in decision-making bodies.	
Source: Blue Ventures 2022; Robson et al. 2017		

Case Study: Integrated resilience in the Lake Chilwa Basin using an Ecosystem Approach

Case Study 21. Integrated resilience in the Lake Chilwa Basin using an Ecosystem Approach Source: Chiotha et al. 2017; Layzell 2018

COUNTRY	ORGANIZATION	KEY SECTORS
Malawi	Leadership for Environment and Development (LEAD), Forestry Research Institute of Malawi (FRIM) and WorldFish	Reforestation, livelihoods
DESCRIPTION	The program followed the 12 principles of the Ecosystem Approach and had impacts organized around four themes: ecosystem resilience, social resilience, natural resource monitoring, and communication and outreach. Tree planting and regeneration efforts produced 6,670 hectares of tree cover and 71% survival of seedlings. Agribusiness and livelihoods capacity building produced an increase in agricultural yield from 1,500 Kg/ha to 3,500 Kg/ha. Community members were trained in participatory natural resource monitoring techniques around water levels, weather, wetland birds, and fisheries, allowing forecasting of lake recessions and floods. Knowledge was documented and disseminated through group discussions, participatory storytelling, farmer field days, lead farmer approaches, exchanges, demonstration sites, mass media communications, and community radio. Best practices from this program, such as using solar fish dryers and the EA approach, have been tested and implemented in subsequent projects. The program used a wide range of integrated approaches to improve socioecological resilience, from beekeeping and clean cookstoves to health systems strengthening, childcare, and specific responses to environmental shocks.	
GENDER STRATEGY/ IMPACT	The program used a gender transformative approach and trained both men and women as gender champions. Using gender and social analyses, gender transformative programming was tailored to the specific needs of different groups of program recipients. This method first shifted beliefs and norms around gender roles, then advanced women in decision making roles at multiple levels of communities and society. Through this approach, ongoing drivers of differences in vulnerabilities to climate change are being addressed. In addition, both women and men received capacity building training across a range of livelihoods sectors tailored to their specific needs and roles, contributing to increased resilience.	
Source: Chiotha et al. 2017; Layzell 2018		

Learn More: Resources for Identifying Additional Case Studies and Climate, Gender, and Health Solutions

	THEME	LEARNING RESOURCE	LINK
	**Personal stories from women climate champions**	*The Re-Envision Resilience Virtual Photobook* from EmPower, the UN Women Regional Office for Asia and the Pacific, and the UN Environment Programme Regional Office for Asia and the Pacific offers stories from women climate champions across Asia (Santos 2021)	https://asiapacific.unwomen.org/sites/default/files/2022-05/CREA_PHOTOBOOK_LAYOUT_OPT2A_3_reduced.pdf
	**Climate solutions and project case studies**	For case studies on specific gender-responsive climate solutions, see Module 4, Handout 20 of the *Training Manual on Gender and Climate Change Resilience* (page 262)	https://arrow.org.my/wp-content/uploads/2021/08/Empower-Training-Manual_GCCR-compressed.pdf
		For examples of technical, non-technical, and transformational climate solutions that aim for gender justice, see the Women and Gender Constituency's repository *Gender Just Climate Solutions*	https://womengenderclimate.org/gender-just-climate-solutions-2/gender-just-climate-solutions/
		For additional case studies around climate, gender, and health from the Asia Pacific region, see Chapter 2, beginning page 47, of *Climate change, gender equality and human rights in Asia: Regional review and promising practices* (Pross et al. 2020)	https://asiapacific.unwomen.org/en/digital-library/publications/2021/01/climate-change-gender-equality-and-human-rights-in-asia
	**Climate mitigation and gender case studies**	For case studies on gender-integration into climate mitigation policy in India, see *A two-step approach to integrating gender justice into mitigation policy: examples from India* (Michael et al. 2020)	https://doi.org/10.1080/14693062.2019.1676688
	**Family planning and conservation case studies**	Brief summaries of the Margaret Pyke Foundation's projects around family planning and conservation in sub-Saharan Africa	https://margaretpyke.org/environment/projects/ https://margaretpyke.org/environment/projects/
	**Population, health, and environment case studies**	A list of Population, Health, and Environment projects by country	http://www.ehproject.org/phe/phe_projects.html
		For a map of Population, Health, and Environment Projects worldwide, see the PACE PHE Projects Map	https://www.prb.org/resources/population-health-environment-and-development-activity-map/

Lessons Learned and Best Practices for Climate, Gender, and Health Programming

It's critical that projects in the climate-gender-health nexus be implemented in a manner aligned with existing evidence and best practices, particularly because when implemented poorly, climate mitigation and adaptation work risks exacerbating existing gender and health inequities (Mailloux et al. 2021; Haines and Ebi 2019; Patz et al. 2014).

"Community-based women-led [Climate Change and Disaster Risk Reduction] CCDRR programmes should be the key gender mainstreaming approach." – (Chauhan 2021)

Prioritize intersectional, gender-transformative equity

Centering equity and social justice is central to ensuring that interventions in this nexus provide benefits for climate resilience, public health, and gender equity (Mailloux et al. 2021). Research within the conservation space suggests that benefits for wellbeing, poverty alleviation, and conservation can be maximized by shifting away from a focus on community infrastructure and direct livelihoods improvements towards projects that center on equity, social and human capital, and connection to beneficial resource networks (Franks, Booker, and Roe 2018; Tolbert et al. 2019). This requires using robust measures of equality, and conducting, critiquing, and communicating both gender and sex disaggregated work (Lau et al. 2021).

Advance Women

When women are involved, programs and policies are more impactful and equitable (Engelman and Johnson 2019; Giudice et al. 2021; Cook, Grillos, and Andersson 2019). To do so – and to ensure that benefits are universal and enduring – requires a deep understanding of different women's realities and everyday experiences, and the root causes of vulnerabilities and difference (Naswa 2021; Rao et al. 2019). Moreover, programs should go beyond narrowly focusing on women's vulnerabilities, which risks casting them as victims (Chauhan 2021). It is essential to prioritize intersectionality and ensure that there is diverse representation of different groups of women, paying attention to both inter- and intra-household dynamics (Arwida et al. 2017).

Advancing women as active participants in their communities can occur through direct outreach, capacity building, working to ensure a critical mass of women in the room, selecting meeting times that work for women, education, economic empowerment programs. and directly addressing the different needs, desires, strengths, barriers, and vulnerabilities of women in a flexible, intersectional, and locally-contextualized manner (Arwida et al. 2017; Cook, Grillos, and Andersson 2019; Tanyag and True 2019; Ganguli 2021; Sorensen, Murray, et al. 2018). In addition, because men and women may participate in groups differently, and because men may dominate mixed settings, it is often important

to ensure there is a critical mass of women in the room to ensure women's voices are not only physically present but substantively influential (Sesan et al. 2019; Phan, Jou, and Lin 2019; Cook, Grillos, and Andersson 2019; Arwida et al. 2017; Mendelberg and Karpowitz 2016). Leveraging women's existing expertise and networks is one way to increase recognition of women as leaders and vital participants, as well as mitigate additional burdens of participation (Arwida et al. 2017; Tanyag and True 2019).

Engage Men

Men, too, face gendered risks and vulnerabilities with a changing climate – and engaging with men is central to gender-transformative work in the climate-gender-health space. In clean cookstoves work, for example, men are often left out, despite their traditional roles in many communities as financial decision-makers or program goals of transforming those traditional roles (Lindgren 2020).

"It might be equally important to enhance household cooperation through recognizing and supporting male endeavors too, especially helping young men face the livelihood crisis they are confronting. This is because, women are fast reaching the limits to which they can stretch themselves, and are turning to family and kin relationships, renegotiating them in the best way they can, to ensure not just survival, but a degree of stability and reciprocity in their lives. In times of crisis, social relations trump all other resources, material and non-material." – (Rao et al. 2019)

Engaging men as role models and actively engaging men in behavior change is a central element of building resilience around climate, gender, and health (Ganguli 2021).

Use participatory approaches

Gender-integrated climate resilience and health programming functions best when it uses a deeply engaged, bottom-up, participatory approach (Chauhan 2021; Tickamyer and Kusujiarti 2020; Sorensen, Murray, et al. 2018). Participatory processes help ensure programs build on already-existing forms of local resilience, leveraging both local and scientific knowledge to co-create solutions through collaborative dialogues (Chauhan 2021). Creative communication strategies can be used to build engagement (Chauhan 2021; Robson et al. 2017; Chiotha et al. 2017; Layzell 2018). Several principles can be used to guide community-based adaptation approaches (Chauhan 2021):

Table 20. Key principles for a community-based adaptation planning process Source: Chauhan et al. 2021

PRINCIPLE	BASIC COMPONENTS	GENDER COMPONENTS
Bottom-up and participatory	Community plays a major part in the problem analysis, identification, and solutions prioritization.	Women are an integral part of the community and they need to be meaningfully participating in all planning processes.
Building on local resources	It is important to build on existing strengths and available resources of the community.	Women are not only linked closely to natural resources and infrastructure but also have different priorities for its utilization and maintenance.
Combining local and scientific knowledge and co-creation of solutions	Integrating local knowledge along scientific information and research findings helps ensure building of robust, locally-relevant adaptation action plans	Women are a critical source of local knowledge both for productive and survival activities. They also have different criteria for selection of adaptation options.
Collaborative dialogue and cross-learning	Enables spaces for dialogue and two-way learning between communities, and other stakeholders including local authorities, researchers, and social entrepreneurs.	Women from all ages and socio-economic background need to be involved in the process. Forum for providing voice for gender concerns.
Flexible and context-specific	Tailored to local realities, the plans are most context-specific and can easily be adjusted to align with specific objectives, a preferred sectoral focus, and available resources to carry out the process.	Tailored to sectors which address women's practical needs and provision of resources for the same. Local level flexibility also enables better intersectoral convergence for addressing gender concerns.
Documentations and communication	The local relevance increases interest levels and also provides space for iteration. Becomes a starting point for awareness-raising and behavior change activities, among others.	Can be communicated in local language and in means and formats which help reach out to everyone, especially illiterate women and women with disabilities
Monitoring and evaluation	It is also important to identify indicators and tracking mechanisms to monitor the progress on the plans. A formative Monitoring & Evaluation (M&E) system needs to be designed so that any new information and learnings can be incorporated into the plans and activities.	There should be a specific focus on monitoring who is taking the key implementing decisions, who controls the process, who is getting the benefit, and who is left out during implementation. Inclusion of all women, LGBTIQ persons irrespective of their class, caste, ethnicity, age (dis)ability, and others should be monitored.
Source: Chauhan 2021, adapted from Care International, Vietnam 2015.		
Source Disclaimer: This is an adaptation of an original work by ARROW and UN Women. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by ARROW and UN Women.		

When participatory approaches are used to engage both women and men, different priorities can emerge: for example, women may be more likely to forward needs for maternal and child health care or family planning services (Engelman and Johnson 2019). Consultative participatory approaches are also central in ensuring that agricultural interventions meet women farmer's preferences and reduce labor for women farmers, rather than increasing their workload (van Eerdewijk, Bråten, and Danielsen 2021; Badstue et al. 2020; van Eerdewijk and Danielsen 2015; Huyer et al. 2021; 2021). While locally-led projects can face challenges around capacity, perceived risk, and financing, these challenges can be mediated through flexible funding approaches, flexible program design, and investment in both institutional and technical capacity building (Tye and Suarez 2021)

Collaborate across scales and sectors

Work at the nexus of climate, gender, and health, crosses scales and sectors, so it is critical to bridge silos and invest in multisectoral, intersectional, and interdisciplinary expertise and partnerships across levels (Lau et al. 2021; Sorensen, Murray, et al. 2018). These expertise and partnerships can play a critical role improving monitoring and data collection, important elements of shifting climate risks (Sorensen, Saunik, et al. 2018). Collaborative partnerships between organizations, such as between reproductive health groups and conservation organizations, can enable sharing of resources and expertise in a way that strengthens relationships with communities and better serves local needs (Engelman and Johnson 2019). Organizations can also help to shoulder the burden and risks of innovation and advocacy, which are central to climate resilience work (Cohen et al. 2016; Shrestha and Dhakal 2019).

Be specific about how change happens

Reach of programming does not equate to benefit or "empowerment" (Lau et al. 2021). While training is an important element, training and information provision alone are often insufficient to generate transformative change (Chauhan 2021; Lindgren 2020). It is essential to continue to push back against difficult to measure, more intractable barriers to achieving gender equity that can hamper climate resilience and health work, from gender sensitivity in developing practices, to gender-integrated program delivery, to addressing and shifting gendered norms, practices, and policies from the household level to the international level (Lau et al. 2021; Nelson and Huyer 2016; Chauhan 2021). While it is important for programs to meet immediate needs and demonstrate tangible benefits for community members in order to create a strong foundation for ongoing programming, doing transformative work takes time, so it is critical to resist short timeframes and take a long-term approach (Lau et al. 2021; Chauhan 2021).

Adaptation has benefits – but it can also have costs. Paying close attention to how change happens helps practitioners recognize not only macro-level economic benefits, but also micro-level economic, social and cultural costs (Tickamyer and Kusujiarti 2020). It's critical

to avoid assumptions that technology will increase empowerment, reduce labor, and inherently have long-term environmental outcomes, particularly without engagement in the structural, political, socioeconomic, and intrinsic factors that can shape adoption of new technologies (Badstue et al. 2020; Mulema, Cramer, and Huyer 2021; van Eerdewijk, Bråten, and Danielsen 2021; Meijer et al. 2015). For example, both extrinsic and intrinsic factors (such as knowledge, perceptions, and attitudes) play a role in adoption of new agricultural technologies (Meijer et al. 2015). Research around contextual factors like tradition, culture, and personal choice often portray these factors as barriers – but they also serve as valuable resources and information sources that can be used to shape how programmatic options and technologies are designed (Lindgren 2020).

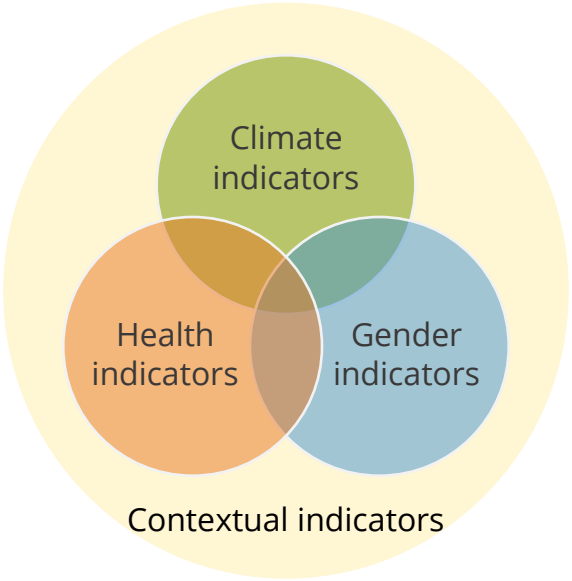
Learn More: Best Practices for Climate, Gender, and Health Programming

	THEME	LEARNING RESOURCE	LINK
	**Gender-transformative climate resilience**	For a detailed analysis of best practices for gender-transformative climate resilience, see *Gender-transformative climate change adaptation: Advancing social equity* (Resurrección et al. 2019)	https://genderandsecurity.org/sites/default/files/Resurreccion_et_al_-_G-Transformative_Climate_Change_Adaptatn_-_Advancg_Soc_Equity.pdf
		For approaches to mainstreaming gender in climate resilience projects, see *Leveraging co-benefits between gender equality and climate action for sustainable development: Mainstreaming gender considerations in climate change projects* from UN Women (UN Women 2016)	https://unfccc.int/files/gender_and_climate_change/application/pdf/leveraging_cobenefits.pdf
	**Intersectional, locally led, and participatory approaches**	For tools and guidance for building and implementing intersectional programs and policies, see UN Women's *Intersectionality Resource Guide and Toolkit* (UN Women 2021b)	*https://wrd.unwomen.org/practice/listing-toolbox/intersectionality-resource-guide-and-toolkit*
		For a review of approaches to locally-led climate adaptation, see WRI's *Locally Led Climate Adaptation: What Is Needed to Accelerate Action and Support?* (Tye and Suarez 2021)	https://www.wri.org/research/locally-led-climate-adaptation-what-needed-accelerate-action-and-support
		For guidance and best practices on participatory approaches, see IIED's *Participatory Learning and Action* series	https://pubs.iied.org/series/participatory-learning-and-action
	**Engaging men in climate justice**	For more on how to engage men in climate justice work, see *Men, masculinities, & climate change* (Kato-Wallace et al. 2016)	https://promundoglobal.org/wp-content/uploads/2016/04/Men-Masculinities-Climate-Change.pdf

Chapter 4: Measuring Impact around Climate, Gender, and Health

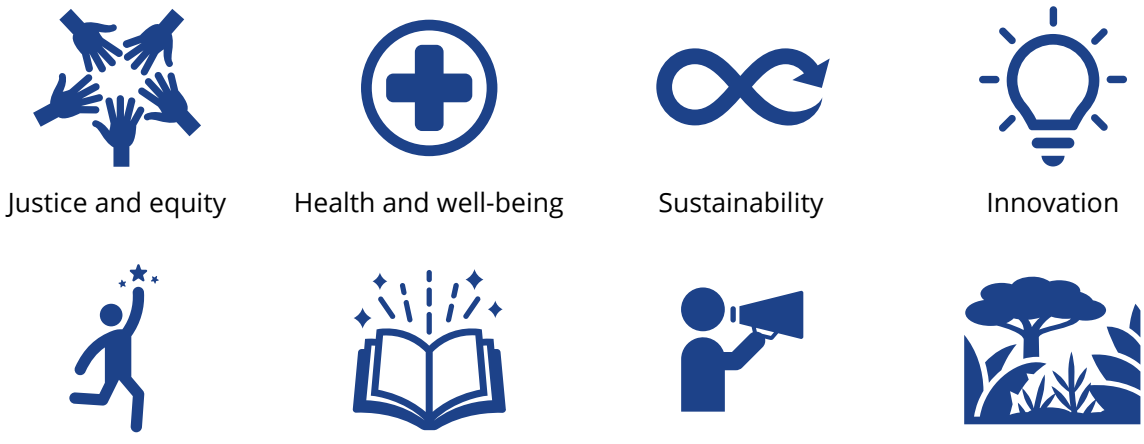
When it comes to metrics for understanding program reach and impact in the climate-gender-health space, researchers and practitioners have *many* options to choose from. Integrated programs may need to draw on metrics from multiple sectors.

Figure 27. Relationships between climate, gender, and health indicators Source: Authors



In evaluating climate-related programming, it's important to consider not only what worked in the program, but also what might work in the future – that is, "climate futures" (that is, what might work in the future), as well as frame evaluation through core values, and facilitate learning (Marsac et al. 2022). In doing this, consider framing evaluation through core values embodied within the project or program goals (Marsac et al. 2022).

Figure 28. Values that may inform evaluation of climate, gender, and health programming Source: Authors



Measuring resilience, adaptive capacity, and vulnerability is complex, contextually specific, and subjective. Given this, here are six principles to consider when developing and selecting measurement tools and strategies in this space:

1. **Measure across scales.** Bring together context-specific metrics with more widely used metrics when possible. This can be done by integrating available national or regional data where possible or using existing measurement tools for developed for a specific concern, if available.
2. **Forward intersectionality.** Strive for intersectionality in data collection and analysis whenever feasible. Intersectionality helps us see what's really happening and where points of vulnerability actually lie. If we want to resist myths and stereotypes, this is critical.
3. **Combine qualitative and quantitative approaches.** Use mixed-methods approaches to fill gaps. Quantitative data is important for understanding scale and impact, but can sometimes miss the nuance of peoples lived experiences. With quantitative data, you only know what you ask and measure. Qualitative data can help identify where knowledge might be missing.
4. **Use absolute and relative measure.** Use both absolute and relative measures when examining climate hazards. This is key because the frequency and severity of climate hazards is projected to increase – but if we effectively build resilience and adaptive capacity, the relative impact of these hazards should lessen. Both are important for understanding changing dynamics.
5. **Interpret with caution.**Take care in what we measure and how we interpret it. Stay cautious and open about correlations, gaps, and is actually being measured. What we measure, we incentivize.
6. **Facilitate learning.** Given the urgency of climate threats and the many gaps in knowledge about climate's effects and appraoches for addressing those effects, it's more important than ever to ensure that we can learn from each other. This means investing in robust climate-gender-health monitoring and evaluation, acknowledging successes and challenges, and sharing results widely so others can also benefit.

Organization

This section includes 1) indicator themes for evaluating strengths and vulnerabilities around climate-gender-health, 2) indicators for evaluating the impact of climate on gender and health, 3) indicator themes for evaluating resilience and adaptive capacity, particularly as they relate to changes in resilience and adaptive capacity due to a particular activity or intervention, and 4) guidance on warning indicators. This format is adapted from the work of Ebi et al. 2018, who conceptualized climate and health indicators around vulnerabilities and exposures, impacts and projected risks, and adaptation processes and resilience. Each section includes 1) models and indices, 2) sample indicator themes, 3) a review of notes and gaps, and 4) additional resources. This section focuses more heavily on indicators for adaptation efforts than mitigation efforts. As you navigate this chapter, please keep in mind the following notes about the indicator themes described here:

1. **Disaggregation:** Given the critical importance of gender in climate and health work, all of the indicators described in this section should be sex/gender disaggregated, as appropriate. Additional disaggregation is recommended as feasible within the community, project, or program's context, including by age, ethnicity, economic status, education level, disability status, marital status, urban/rural residence, etc. Greater specificity strengthens both program efficacy by revealing who is and is not represented and more clearly identifying intersectional needs. Moreover, more granular data would benefit others in the broader climate-gender-health community.
2. **Metrics:** Given the range of needs and resources that communities, projects, and programs may have, metrics are not specified within indicator themes below. This is why they are described as "indicator themes" and not "indicators." They may be assessed as numbers, percentages, rates, etc. as appropriate for a given context and may be measured across scales, e.g., individual, household, community, institution, national, etc. Further adaptation may be required to ensure that they are sufficiently specific, measurable, and time-bound.
3. **Directionality:** Some indicators have been revised to reduce directionality; that is, they have been altered to reflect trends and changes without necessarily implying improvement or worsening. This has been done to reduce bias, create space for failure and learning, and resist assumptions of program efficacy.
4. **Comprehensiveness:** Current indicators are limited by the scope of historic and current programming, technology, and resources. New climate actions and programmatic approaches may require new metrics to better reflect their impact. Citations for these indicators generally reflect their use in the climate-gender-health space and point readers to sources where they may learn more, but it's important to acknowledge that many have been used widely in other programs and research that were beyond the scope of this review.

Learn More: Cross-Cutting Resources for Monitoring and Evaluating Climate, Gender, and Health Projects

This chapter is not meant to replace or replicate the wealth of resources that already exist offering guidance on monitoring and evaluating projects around different aspects of climate, gender, and health. Rather, its goal is to orient readers towards resources that can be used to bridge and address specific project needs.

	THEME	LEARNING RESOURCE	LINK
	**Guidance on gender and climate programs**	CDKN's *Advancing gender equality and climate action: A practical guide to setting targets and monitoring progress* offers comprehensive guidance for monitoring and evaluation in the climate, gender, and health space	https://wrd.unwomen.org/practice/listing-toolbox/advancing-gender-equality-and-climate-action-practical-guide-setting
		For a detailed guide on gender and climate resilience, see the ARROW Training Manual on Gender and Climate Change Resilience, which includes gender assessments, vulnerability assessments, resilience indices, best practices/principles for community-based adaptation, examples of communication tools, a monitoring and evaluation framework, sample gender indicators and analyses, a gender monitoring matrix, and examples of different models for adaptation	https://arrow.org.my/publication/training-manual-on-gender-and-climate-change-resilience/
	**Gender and environment data community**	The Gender and Environment Data Alliance was launched by WEDO, IUCN, and other collaborators to increase application and accessibility of gender-environment data	https://docs.google.com/forms/d/e/1FAIpQLSeJ2t3_sYDTuHBCw88J6q0MPwqaOzsGOxyvHHlIpxRqqCNxtA/viewform
	**Climate evaluation**	The Global Environment Facility (GEF) maintains several tools for measuring climate adaptation, climate mitigation, biodiversity, forestry, land degradation, and other key climate-related markers	https://www.thegef.org/documents/tracking-tools-results-frameworks
		The Green Climate Fund has several policies and frameworks for monitoring and evaluating climate programming	https://www.greenclimate.fund/about/policies/results-monitoring-evaluation

Climate-Gender-Health Strengths and Vulnerability Indicators

Vulnerability assessments are critical in ensuring that climate resilience programming meets local needs and is attuned to contextual power dynamics and histories:

"A comprehensive assessment of women's and men's assets and vulnerabilities is foundational to any adaptation or development project, including disaster risk reduction, transportation, finance, communication, water management, technology transfer, agriculture, and health. Such assessments not only provide a more in-depth understanding of the effects of climate change but also reveal the political, physical, and socioeconomic reasons why individuals suffer disproportionately. This creates a stronger opportunity for effective intervention" – (Sorensen, Murray, et al. 2018)

In evaluating vulnerability:

1. **Pay attention to future vulnerabilities:** Many vulnerability assessments include current and past vulnerability, but do not consider future vulnerabilities, especially future non-climactic vulnerabilities that may interact with climate-associated risks (Windfeld et al. 2019).
2. **Center on community-level risks and needs:** Vulnerability assessments sometimes sacrifice community-level specificity to make regional generalizations, which may risk losing contextual granularity that is key to tailored adaptation strategies (Windfeld et al. 2019). Centering diverse community voices through participatory assessments is critical.
3. **Examine interactions and intersections:** Vulnerability is dynamic and shaped by a range of interacting and intersectional aspects of identity and society. Given this, there is a continued need to evaluated interactions between sub-systems and scales (Salgueiro-Otero and Ojea 2020). This is particularly important in drawing attention away from portrayals of categories of people as inherently vulnerable, and instead drawing attention to the systems and structures that produce those vulnerabilities.
4. **Notice emergent strengths:** Vulnerability assessments can also reveal areas of strength within individuals, communities, or regions. These strengths and resources are vital to recognize, leverage, and build upon.

Strengths and Vulnerability Assessment Toolkits

GOAL	TOOLKIT	LINK
Measuring gendered vulnerability and leadership in climate	CARE's Gender-sensitive Climate Vulnerability and Capacity Analysis (GCVCA) is a toolkit specifically oriented at evaluating individual and community level vulnerability	https://careclimatechange.org/wp-content/uploads/2019/06/GCVCA_Practitioners-Guide-FINAL-July-2014.pdf
	UN Women's *Toolkit for Assessing Women's Leadership in Disaster and Climate Resilience* can be applied for country and organizational assessments	https://wrd.unwomen.org/practice/listing-toolbox/toolkit-assessing-womens-leadership-disaster-and-climate-resilience
	UNDP's Capacity and Vulnerability Analysis Framework (CVA) uses a matrix approach to evaluate vulnerabilities and capacities within communities around physical, social, and motivational domains. It can be disaggregated by gender, class, or other categories of difference.	https://www.adaptation-undp.org/sites/default/files/resources/6_capacities_and_vulnerabilities_assessment_framework_cva_framework.pdf
Evaluating community level climate risks with participatory methods	IISD's *Community-based Risk Screening Tool – Adaptation and Livelihoods* (CRiSTAL) identifies both risks and resources, then bridges those towards the design of climate adaptative activities	https://www.iisd.org/cristaltool/
	The *Vulnerability Reduction Assessment Tool* (VRA) is a participatory approach for community-based adaptation programs (Droesch et al. 2008)	https://www.betterevaluation.org/sites/default/files/Attachment_CBA_VRA_Guide_Dec_
	The *Participatory Assessment of Climate and Disaster Risks (PACDR)* tool uses a participatory approach to vulnerability and risk assessment	https://pacdr.net/
	Practical Action's *Participatory Climate Risks Vulnerability and Capacity Assessment* operationalizes the Adaptive Livelihood Framework	https://www.unisdr.org/preventionweb/files/17623_participatoryclimateriskvulnerabili.pdf
Assessing vulnerability and resilience in health systems	The WHO's report *Climate Change and Health: Vulnerability and Adaptation Assessment*	https://www.who.int/publications/i/item/9789240036383
Assessing vulnerability and adaptation at the national level	The WHO issued guidance on conducting national and subnational vulnerability and adaptation assessments in their report *Climate Change and Health: Vulnerability and Adaptation Assessment*	https://www.who.int/publications/i/item/9789240036383

GOAL	TOOLKIT	LINK
Evaluating climate risks and vulnerabilities	GIZ's *Assessment of Climate-Related Risks: A 6-step Methodology* assesses climate risks to inform climate risk management	https://www.giz.de/en/downloads/giz2021-en-climate-related-risk.pdf
	GIZ and EURAC's *Climate Risk Assessment for Ecosystem-based Adaptation: A Guidebook for Planners and Practitioners* uses an ecosystem adaptation orientation	https://www.adaptationcommunity.net/wp-content/uploads/2018/06/giz-eurac-unu-2018-en-guidebook-climate-risk-asessment-eba.pdf
	GIZ's *The Vulnerability Sourcebook: Concept and Guidelines for Standardised Vulnerability Assessments* evaluates climate risks aligned with IPCC approaches	https://www.adaptationcommunity.net/download/va/vulnerability-guides-manuals-reports/vuln_source_2017_EN.pdf
	See also: GIZ and EURAC's updated *Risk Supplement to the Vulnerability Sourcebook*	https://transparency-partnership.net/system/files/document/GIZ EURAC_2017_Risk supplement to the vulnerability sourcebook.pdf

Strengths and Vulnerability Models and Indices

GOAL	MODEL/INDEX	LINK
Using an index approach to measuring vulnerability in communities	*The Livelihood Vulnerability Index* measures livelihood risks related to climate variability (Alam 2017; Hahn, Riederer, and Foster 2009; Adu et al. 2018; Venus et al. 2022; Suryanto and Rahman 2019). The LVI was expanded in Uganda to create a gender vulnerability index based on IPCC's framing of vulnerability (Balikoowa et al. 2019).	https://www.sciencedirect.com/science/article/abs/pii/S095937800800112X
	The Sustainable Livelihood Approach is a participatory approach aims to understand the livelihoods and opportunities of those in poverty (Alam 2017; Kollmair and Gamer 2002; Serrat 2017).	https://link.springer.com/chapter/10.1007/978-981-10-0983-9_5
	The Climate Vulnerability Index includes vulnerability around both "universal value" and community capacities, and focuses on world heritage sites (Alam 2017; CVI 2022).	https://cvi-heritage.org/
Evaluating gender integration in climate policy	*The Gender Climate Tracker* monitors how gender equity is being integrated into global and national environmental policy	https://www.genderclimatetracker.org/

GOAL	MODEL/INDEX	LINK
Using an index approach to measuring climate and social vulnerability at the country level	*The ND-Gain Country Index* describes climate vulnerability at the country level (Notre Dame Global Adaptation Initiative 2022).	https://gain.nd.edu/our-work/country-index/
	The Social Institutions and Gender Index measures gender discrimination and gender inequality within social institutions (OECD 2022).	https://www.genderindex.org/
	The Gender Inequality Index (GII) takes a holistic approach to its economic measures, integrates reproductive health and political participation, and is structured such that included variables cannot compensate for others (Andrijevic et al. 2020).	https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indicies/GII
	The Social Vulnerability Index was created through the collaboration of several US government agencies. It uses census variables to estimate vulnerability to disasters and natural hazards based on social and demographic factors (Flanagan et al. 2011).	https://www.atsdr.cdc.gov/placeandhealth/svi/index.html
Understanding children's' climate risks	For data on climate and youth, see UNICEF's report *The Climate Crisis Is a Child Rights Crisis: Introducing the Children's Climate Risk Index* and accompanying interactive atlas of risks (Rees et al. 2021	https://data.unicef.org/resources/childrens-climate-risk-index-report/
Using an index approach to measure flood risk	The *Integrated flood risk index* was developed and operationalized for use in urban communities in Pakistan (Rana and Routray 2018)	https://doi.org/10.1007/s11069-017-3124-8
Evaluating risks in disaster and conflict settings	*The World Bank Group's Climate and Disaster Risk Screening Tool* includes rapid and in-depth vulnerability assessments that can be applied across sectors and scales.	https://climatescreeningtools.worldbank.org/
	The Disaster Fragility Conflict and Violence (Disaster-FCV) Index was developed through a study from GFRDRR and The World Bank in South Sudan. The index pairs spatial data about conflict, food insecurity, and resettlement with data about hazards and disaster risk (World Bank 2022).	https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099224105052224937/idu07f57dafb04f73041c908b2b05335b2a14ca6
Using an index approach to evaluate climate-related business risks	*The Climate Change Vulnerability Index.* Produced by Maplecroft, a global risks advisory firm, this index looks at business, operations, and supply chain risks due to climate change (Maplecroft 2022).	https://www.maplecroft.com/risk-indices/climate-change-vulnerability-index/

Strengths and Vulnerability Indicator Themes

These indicator themes for evaluating strengths and vulnerabilities are oriented around ten categories: 1) demographics and social characteristics, 2) health and health systems, 3) income, livelihoods, and employment, 4) agriculture, 5) ecological systems and human-environment relations, 6) water, 7) information access, 8) mobility and transportation infrastructure, 9) governance, and 10) migration and flows. They are not all-inclusive, but rather offer a glimpse into the breadth of characteristics that might contribute to an individual, community, or region's strengths and vulnerabilities.

Demographics and Social Characteristics

Indicator Theme	**Source**
Access to electricity	Boyer, Meijer, and Gilligan 2020
Age/age composition	Ganguli 2021; Romanello et al. 2022
Age of first union	Ganguli 2021
Age of household head	Balikoowa et al. 2019
Aspirations for the future	CARE International 2014
Bodily autonomy	CARE International 2014
Caste	Ganguli 2021
Child-bearing age	Ganguli 2021
Conflicts (household and communal)	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017; Ganguli 2021
Culture	Ganguli 2021
Current strategies for coping, adapting, and risk management	CARE International 2014
Decision-making power	Ganguli 2021
De jure/de facto single-headed households	Ganguli 2021
Demographic trends	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Education, including access to, level of, and quality of education both generally and for the household head	Ebi et al. 2018; Ganguli 2021; Balikoowa et al. 2019; Boyer, Meijer, and Gilligan 2020
Ethnicity	Ganguli 2021; CARE International 2014
Existing innovative approaches to adapt	CARE International 2014
Food security	Romanello et al. 2022
Gender and gender norms	Romanello et al. 2022; CARE International 2014; UNDP 2017
Household size	Balikoowa et al. 2019

Indicator Theme	Source
Household type (e.g., male- or female-headed)	Ganguli 2021
Literacy	Boyer, Meijer, and Gilligan 2020
Marital norms, child marriage, and power over marital decisions	CARE International 2014' Boyer, Meijer, and Gilligan 2020
Number of dependents (including elderly persons)	Ganguli 2021
Perceived magnitude of barriers to adaptation	Droesch et al. 2008
Perceived ability of community to create change	UNDP 2017
Perceived ability of community to sustain adaptation programs or efforts	Droesch et al. 2008
Perception of treatment with respect	Monteith et al. 2020
Poverty	Romanello et al. 2022
Religion	Ganguli 2021; CARE International 2014
Satisfaction with freedom to choose what to do with one's life	Monteith et al. 2020
Social group membership	Balikoowa et al. 2019; CARE International 2014
Social group inequity	Boyer, Meijer, and Gilligan 2020; CARE International 2014
Social organization, including social and traditional norms, social capital, and social networks and networking activities	Ganguli 2021; Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017; UNDP 2017; CARE International 2014
Urban concentration	Boyer, Meijer, and Gilligan 2020

Health and Health Systems

Indicator Theme	Source
Access to health services	Ebi et al. 2018
Availability of health resources	Ebi et al. 2018
Cases of climate-related disease*	Nelson and Kuriakose 2017
Healthcare sector emissions	Romanello et al. 2022
Health insurance coverage	Ebi et al. 2018
Health status	Romanello et al. 2022
Health system capacity	Ebi et al. 2018
Health system capacity to manage extreme event	Ebi et al. 2018

Maternal mortality	Boyer, Meijer, and Gilligan 2020
Mental health	Romanello et al. 2022
Population exposed to extreme weather	Ebi et al. 2018
Population that is pregnant	Ebi et al. 2018
Population with climate-sensitive chronic disease	Ebi et al. 2018
Public health infrastructure	Romanello et al. 2022
Status of health delivery infrastructure	Ebi et al. 2018
Status of public health infrastructure	Ebi et al. 2018
Undernourishment	Boyer, Meijer, and Gilligan 2020

*Adapted from "respiratory disease" to be more generalizable

Income, Livelihoods, and Employment

Indicator Theme	**Source**
Access to livelihood assets	CARE International 2014
Access to markets	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Allocation of household resources (e.g., to self-care or household care)	Ganguli 2021
Control over livelihood assets	CARE International 2014
Division of labor	CARE International 2014
Economic development	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Economic sector(s)	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Economic value of resources	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
GDP per capita	Boyer, Meijer, and Gilligan 2020
Growth or replacement rate of resources	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Income	Ganguli 2021
Income inequality	Ebi et al. 2018
Labor availability	Ganguli 2021
Labor capacity/physical capacity	Romanello et al. 2022
Labor force participation	Boyer, Meijer, and Gilligan 2020

Indicator Theme	Source
Livelihood diversification (e.g., number of strategies available as options, indexed using the income proportion from each income source, etc.)	Ganguli 2021; Andersen, Verner, and Wiebelt 2017; Balikoowa et al. 2019
Number living in poverty	Ebi et al. 2018
Perceived vulnerability of livelihood to existing climate change	Droesch et al. 2008; CARE International 2014
Perceived vulnerability of livelihood to developing climate risks	Droesch et al. 2008
Primary or secondary employment activity	Ganguli 2021
Productive resources or skills	UNDP 2017; CARE International 2014
Relative wealth or poverty	Ebi et al. 2018
Reliance on store-bought goods	Ganguli 2021
Time use	CARE International 2014
Transactional sex participation	Ganguli 2021
Units/quantity of resources	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Work experience	Ganguli 2021
Workload	Ganguli 2021
Salaried income	Balikoowa et al. 2019
Remittance income	Balikoowa et al. 2019

Agriculture

Indicator Theme	Source
Ability to hire farm labor	Balikoowa et al. 2019
Access to 2-3 month weather projections	Balikoowa et al. 2019
Access to credit	Nchu, Kimengsi, and Kapp 2019
Access to extensionist services and information	Ganguli 2021; Balikoowa et al. 2019; Nchu, Kimengsi, and Kapp 2019
Access to and use of irrigation facilities	Balikoowa et al. 2019; Ganguli 2021
Agricultural and aquaculture productivity	Romanello et al. 2022
Cash crop income diversity	Balikoowa et al. 2019
Crops grown	Nchu, Kimengsi, and Kapp 2019
Dependence on seasonal crops	Balikoowa et al. 2019
Emissions from agricultural production and consumption	Romanello et al. 2022
Employment in agriculture	Boyer, Meijer, and Gilligan 2020
Land ownership/land tenure status, property rights system, and land disputes	Ebi et al. 2018; Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017; FAO 2017; Nchu, Kimengsi, and Kapp 2019
Livestock asset diversity	Balikoowa et al. 2019
Livestock cash income diversity	Balikoowa et al. 2019
Perceive their land as not fertile	Balikoowa et al. 2019
Purpose for farming (e.g., subsistence or income generation)	Ebi et al. 2018
Reliance on traditional sources of livelihood (e.g., natural resources)	Ganguli 2021
Seasonal or permanent source for water	Ganguli 2021
Share of agricultural income in total household income	Ebi et al. 2018
Size of land or farm	Ganguli 2021; Balikoowa et al. 2019
Strategies for increasing yield with limited land access/control	Nchu, Kimengsi, and Kapp 2019
Steep land or topography	Balikoowa et al. 2019; Ganguli 2021
Storage of part of previous season's harvest and storage characteristics	Balikoowa et al. 2019; Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Type of crops	Ganguli 2021
Use of agroforestry	Balikoowa et al. 2019`
Use of animal traction	Balikoowa et al. 2019
Use of improved cultivars	Balikoowa et al. 2019
Use of inorganic fertilizers	Balikoowa et al. 2019
Uncertainty about adopting new practices	Nchu, Kimengsi, and Kapp 2019

Ecological Systems and Human-Environment Relations

Indicator Theme	Source
Access to wild-harvested food plants (WFPs) and medicinal plants	Ganguli 2021
Climate patterns	Ebi et al. 2018; Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017; CARE International 2014; Romanello et al. 2022
Biodiversity and habitat	Boyer, Meijer, and Gilligan 2020
Distance to fuelwood	Ganguli 2021
Ecological performance measures	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Exposure to climate hazards or natural disasters	Boyer, Meijer, and Gilligan 2020; Ebi et al. 2018; CARE International 2014
Location	Ebi et al. 2018; Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Perception of change in climate (e.g., temperature and rainfall)	Nchu, Kimengsi, and Kapp 2019; CARE International 2014
Pollution patterns	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Power and influence over use of natural resources and benefits from natural resources	CARE International 2014
Topography	Ganguli 2021
Upstream or downstream location of farm or household	Ganguli 2021
Use of ecological resources	UNDP 2017; CARE International 2014

Water

Indicator Theme	Source
Access to drinking water	Boyer, Meijer, and Gilligan 2020
Access to wetlands	Balikoowa et al. 2019
Distance to water source	Ganguli 2021
Level of water stress	Boyer, Meijer, and Gilligan 2020
Perceived water quality	Monteith et al. 2020
Perceived water sufficiency	Monteith et al. 2020
Population in low elevation zones	Boyer, Meijer, and Gilligan 2020
Reliance on surface water	Ganguli 2021

Indicator Theme	Source
Water availability	Ganguli 2021
Water quality	Ganguli 2021
Water source type (e.g., surface, groundwater, piped, etc.)	Monteith et al. 2020; Ganguli 2021
Water source ownership (public vs shared)	Ganguli 2021

Information Access

Indicator Theme	Source
Access to disaster and hazard risk information	CARE International 2014
Climate change awareness	Ganguli 2021
Information and communication technology diversity	Balikoowa et al. 2019
Information sharing	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Knowledge and knowledge access	CARE International 2014
Media exposure	Ganguli 2021
Media organizations	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Mobile phone usage	Boyer, Meijer, and Gilligan 2020
Technological context / availability of technology	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017

Mobility and Transportation Infrastructure

Indicator Theme	Source
Cost of transportation	Uteng and Turner 2019
Gender integration in transportation policy	Uteng and Turner 2019
Inclusion of gender in transportation and infrastructure planning	Uteng and Turner 2019
Mobility needs and strategies	Uteng and Turner 2019

Governance

Indicator Theme	Source
Control of corruption	Boyer, Meijer, and Gilligan 2020
Government effectiveness	Boyer, Meijer, and Gilligan 2020
Government organizations; systems of rules and governance	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Government support	Ganguli 2021
Inheritance rights	Boyer, Meijer, and Gilligan 2020
Laws against gender-based violence	Boyer, Meijer, and Gilligan 2020
Lobbying activities	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Non-governmental organizations	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Non-governmental organization support	Ganguli 2021
Parental authority	Boyer, Meijer, and Gilligan 2020
Political representation (e.g., degree, gender parity)	Boyer, Meijer, and Gilligan 2020
Political stability	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Processes for local planning	CARE International 2014
Self-organizing activities	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
State use of political terror	Boyer, Meijer, and Gilligan 2020
Violent conflict	Boyer, Meijer, and Gilligan 2020; Romanello et al. 2022
Voice and accountability	Boyer, Meijer, and Gilligan 2020; CARE International 2014

Migration and Flows

Indicator	Source
Flows in and out of the focal context	Salgueiro-Otero and Ojea 2020, citing McGinnis and Ostrom 2014 and Blythe et al. 2017
Migration/outmigration	Romanello et al. 2022; Ganguli 2021
Mobility	Ganguli 2021

Telling a Story with Data: Bringing Vulnerability Indicators Together

Participatory tools such as resource and hazard mapping, developing a seasonal calendar, assembling an impact matrix, adaptive capacity scoring, and prioritizing solutions can be used in the climate-gender-health space. For example, researchers used participatory three-dimensional modeling (P3DM) to facilitate community conversations and integration of scientific and local knowledge about sea-level rise in the Solomon Islands (Leon et al. 2015) For guidance on implementing these approaches, see Module 3 and Handout 13 of ARROW's *Training Manual on Gender and Climate Change Resilience* (Chauhan 2021) as well as CARE Vietnam's *Planning for Resilience: A Practitioner's Manual to Support Community Based Adaptation to Climate Change* (Care International, Vietnam 2015).

Problem trees can be used to link interacting contextual factors, trends, vulnerabilities, and strengths in order to identify areas for action (Dupar and Velasco 2021).

Stakeholder mapping can be used to identify key players at the climate-health space and their organizational methodology, including strategies around policymaking power, financial, awareness raising, purchasing-procurement, networking, media, advocacy, education, and knowledge generation (Issa et al. 2021).

Rich Pictures and Influence Models based on gendered variables around health and climate can be developed to identify context-specific gendered pathways of risk, vulnerability, and resources to climate change (Ganguli 2021).

Riskscapes are conceptual models for understanding the spatial, temporal, and social elements that influence risk (Müller-Mahn, Everts, and Stephan 2018). They have been applied to evaluated gendered and other intersectional risk differences in the context of climate-linked disasters in Indonesia and can be a useful tool for modeling the linkages between risk and resilience (Tickamyer and Kusujiarti 2020).

Learn More: Measuring Strengths and Vulnerabilities

	THEME	LEARNING RESOURCE	LINK
	**Measuring climate change and sexual and reproductive health and rights**	For an example of how climate vulnerability and sexual and reproductive health can be assessed in tandem, see *Linking Sexual and Reproductive Health and Rights, Population, Health, Environment and Climate Change Initiatives: A scoping study on women and fishers in the Philippines* (Castro and Hernandez 2015). The study also includes focus group and interview guides.	https://arrow.org.my/publication/philippines-scoping-study-climate-change-srhr/

THEME	LEARNING RESOURCE	LINK
Measuring vulnerability	For an overview of the major approaches to measuring vulnerability and an example of how they were customized for households in Bangladesh, see *Livelihood Cycle and Vulnerability of Rural Households to Climate Change and Hazards in Bangladesh* (Alam 2017)	https://doi.org/10.1007/s00267-017-0826-3
	For an overview of vulnerability indicators appropriate to use in assessments of climate, gender, and health, see Table 1 in *Gender dimension of vulnerability to climate change and variability: Empirical evidence of smallholder farming households in Ghana* (Alhassan, Kuwornu, and Osei-Asare 2018)	https://doi.org/10.1108/IJCCSM-10-2016-0156
	For a review of qualitative and quantitative metrics and models for measuring vulnerability, including examples of mixed methods approaches and measurement frameworks, see *Vulnerability as Concept, Model, Metric, and Tool* (Wisner 2016)	https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-25
Evaluating gender in information and communication technology	USAID's Gender and ICT survey toolkit (Highet, Skelly, and Tyers 2017)	https://www.usaid.gov/sites/default/files/documents/15396/Gender_and_ICT_Toolkit.pdf
Measuring gender, agriculture, and climate vulnerability	*Reflection on the Use of Mobile Phones for Monitoring Gender Indicators Related to Climate-smart Agriculture Practices* discusses challenges, consideration, and indicators used in a mobile phone pilot to assess gendered differences in use and perception of CSA practices (tested in Colombia) (García et al. 2019)	https://cgspace.cgiar.org/bitstream/handle/10568/106120/REFLECTION_ON_THE_USE_OF_MOBILE_PHONES_FOR_MONITORING_GENDER_INDICATORS_RELATED_TO_CSA_PRACTICES-hd_comp.pdf?sequence=2&isAllowed=y
	Diagnosing Climate Adaptation Constraints in Rural Subsistence Farming Systems in Cameroon: Gender and Institutional Perspectives includes an example of a survey tool used in rural Cameroon for evaluating gender, agriculture, and climate change (Nchu, Kimengsi, and Kapp 2019)	https://www.mdpi.com/2071-1050/11/14/3767
Evaluating climate vulnerabilities in health care facilities	WHO's *Checklists to Assess Vulnerabilities in Health Care Facilities in the Context of Climate Change* (WHO 2021b)	https://www.who.int/publications/i/item/9789240022904

	THEME	LEARNING RESOURCE	LINK
	**Using a socio-ecological framework to evaluate vulnerability**	Salgueiro-Otero and Ojea's guidelines on common indicators, assessing interactions across scales, and bridging both cultural and ecological variables (Salgueiro-Otero and Ojea 2020)	https://www.sciencedirect.com/science/article/pii/S0308597X20300440
	**A review of water vulnerability assessment tools**	*A review of 80 assessment tools measuring water security* primarily orients around experiential-based or resource-based metrics (Octavianti and Staddon 2021)	https://wires.onlinelibrary.wiley.com/doi/pdf/10.1002/wat2.1516
	**Measuring gender and transportation**	Section 4 of *Addressing the Linkages between Gender and Transport in Low- and Middle-Income Countries* covers approaches to measuring gender and transportation (Uteng and Turner 2019)	https://doi.org/10.3390/su11174555
		A Preliminary Analysis on Gender Aspects in Transport Systems and Mobility Services (Pirra et al. 2021) includes descriptions of focus group and survey design.	https://doi.org/10.3390/su13052676
	**Digital storytelling**	See CARE's Community Digital Storytelling Guide	https://careclimatechange.org/cdst-in-vietnam/

Climate-Gender-Health Impact Indicators

"Impact" indicators are those around how climate change may impact both the health of populations and health care systems, both presently and in the future (Ebi et al. 2018). This can also include broader impacts on communities, ecosystems, and society.

Part of measuring climate impact involves ongoing monitoring of meteorological data to as part of understanding environmental exposures. For example, this may include tracking weather patterns such as temperature, precipitation, or storms.

Ecological indicators are highly context specific. Even when climate terms have clear definitions from intergovernmental organizations such as the IPCC, strategies for measuring climate-associated ecological events and trends can vary widely. For example, in a review of recent studies of the effects of heat exposure on health, researchers noted that there was no single consistent definition of heatwave or extreme heat, and studies used various measures of temperature (maximum or mean temperature), intensities (75th, 90th, 95th, or 98th percentile of mean temperature), length (2, 3, or 4 days), or the number of heatwaves (Dalugoda et al. 2022). This means that selecting appropriate measures of climatic events requires assessing both available resources for ecological measurements in a given context as well as evaluating recent approaches in the literature. However, best practices have often been compiled for specific ecosystems.

Impact Assessment Toolkits

GOAL	TOOLKIT	LINK
Measuring the gendered effect of a changing climate	*The UN Women Model Questionnaire* is designed to evaluate gender and environment, and includes questions around mental and physical health	https://data.unwomen.org/publications/model-questionnaire-measuring-nexus-between-gender-and-environment
Integrating climate risks and sustainable development	IIED's toolkit *From what works to what will work. Integrating climate risks into sustainable development evaluation – a practical guide* offers six steps for integrating climate risks into sustainable development evaluations	https://www.iied.org/21026iied
Using gender analysis tools in disaster management	See *The Gender Analysis Tools Applied in Natural Disasters Management: A Systematic Literature Review* (Sohrabizadeh, Tourani, and Khankeh 2014)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3958564/

Impact Models and Indices

GOAL	MODEL/INDEX	LINK
Evaluating climate impacts and risk projections	*The Community Demographic Model (CDM)* is an open-access model for simulating population, climate, and sociodemographic changes from the Population Council. Projections can evaluate resilience, vulnerability, and adaptive capacity.	https://cdm.popcouncil.org/
	In *The Double Hurdle Model*, the first hurdle is the ability of a person to perceive climate change, and the second hurdle is the impact of that climate change (Ojo and Baiyegunhi 2021; Asrat and Simane 2018).	https://www.sciencedirect.com/science/article/pii/S0959652621015924
	See also: the Action Spotlight on identifying local climate risks at the beginning of Chapter 1, Part 1 of this Solutions Guide	
Calculating agricultural emissions	*The Global Livestock Environmental Assessment model (GLEAM-i)* is an interactive tool developed by the World Bank for measuring emissions associated with animal husbandry and livestock.	https://gleami.apps.fao.org/
Evaluating climate change's impact on mental health	*The Climate Change Anxiety Scale* links climate change and climate anxiety with well-being, validated in English, Polish, French, Italian, Filipino, Finnish, and German (Clayton and Karazsia 2020).	https://www.sciencedirect.com/science/article/pii/S0272494419307145
	The Climate Change Worry Scale is an alternative approach (Stewart 2021)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7826965/

Impact Indicator Themes

These indicator themes for evaluating climate impacts on health and gender are oriented around strengths and vulnerabilities are oriented around three categories: impact on health and health systems, impact on environment and ecosystems, and impact on socioeconomic systems. Monitoring climate change's effects may be beyond the scope of many projects and therefore data from existing monitoring systems may be paired with programmatic data around impact during climate-related crises, perceptions of climate impacts, and observed trends in communities. Changes in strengths and vulnerability indicators associated with climatic trends may also be used to indicate the impact of climate on gender and health.

Impact on Health and Health Systems

Indicator Theme	**Source**
Ability of health systems to continue providing care during and after climate events	Romanello et al. 2022
Changes in incidence, range, and or seasonality of climate-linked infectious diseases	Ebi et al. 2018; Romanello et al. 2022
Direct injury and death	Romanello et al. 2022
Excess and/or premature mortality due to climate-related exposures (e.g. high temperatures, air pollutants, wildfires)	Ebi et al. 2018; Romanello et al. 2022
Exposure measures	Esplin et al. 2019
Lethality of extreme weather events	Romanello et al. 2022
Mental health	Romanello et al. 2022
Models of DALYs or disease burden associated with climate-related exposures or extreme weather	Ebi et al. 2018
Morbidity and mortality (all-cause and cause-specific) associated with climate-related exposures or extreme weather	Ebi et al. 2018
Undernutrition (stunting) associated with climate-related exposures or extreme weather	Ebi et al. 2018
Perceived effect of a climate threat one one's health*	Esplin et al. 2019
Perceived level of risk to one's health due to a climate threat*	Esplin et al. 2019
Vulnerability to mosquito-borne disease	Romanello et al. 2022

*Originally written for heat and adapted to be more generalizable

Impact on Ecosystems

Indicator Theme	Source
Air pollution and aeroallergens	Romanello et al. 2022
Temperature rise	Romanello et al. 2022
Seasonal change	Romanello et al. 2022
Sea-level rise	Romanello et al. 2022
Flood and drought	Romanello et al. 2022
Heatwaves	Romanello et al. 2022
Wildfires	Romanello et al. 2022
Biodiversity loss	Romanello et al. 2022
Ecosystem change	Romanello et al. 2022
Microbial change	Romanello et al. 2022

Impact on Socioeconomic Systems

Indicator Theme	Source
Change in agricultural and aquaculture productivity	Romanello et al. 2022
Change in earnings from changes in heat-related labor capacity	Romanello et al. 2022
Change in labor and physical capacity	Romanello et al. 2022
Costs of health impacts of air pollution	Romanello et al. 2022
Costs of heat-related mortality	Romanello et al. 2022
Displacement	Romanello et al. 2022
Economic losses due to climate-related extreme events	Romanello et al. 2022

Learn More: Measuring Impact

	THEME	LEARNING RESOURCE	LINK
	**Integrating gender into environmental indicators**	UN Women is leading expansion of gender integration in key environmental indicators through the Making Every Woman and Girl Count program. The program also supports integration of health, geospatial, and demographic data with these surveys	https://data.unwomen.org/data-portal
	**Reviewing gender analysis tools in disaster management**	See *The Gender Analysis Tools Applied in Natural Disasters Management: A Systematic Literature Review* (Sohrabizadeh, Tourani, and Khankeh 2014)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3958564/
	**Integrating climate futures into evaluation**	For more on evaluation in the climate space, see *Integrating climate futures into evaluation* (Marsac et al. 2022)	https://www.iied.org/sites/default/files/pdfs/2022-09/21136iied.pdf

	THEME	LEARNING RESOURCE	LINK
	**Identifying environmental health indicators**	For more on criteria for identifying and selecting environmental health indicators see *A Review of Frameworks for Developing Environmental Health Indicators for Climate Change and Health* (Hambling, Weinstein, and Slaney 2011)	https://www.mdpi.com/1660-4601/8/7/2854
		For other sources for indicator sets for exposure pathways that link climate and health, Liu et al. recommend drawing from large-scale reports such as the US Global Change Research Program (GCRP) and the Intergovernmental Panel on Climate Change (IPCC) (Liu et al. 2021)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8670724/
	**Identifying ecological indicators**	See the journal *Ecological Indicators*	https://www.sciencedirect.com/journal/ecological-indicators
		See the journal *Environmental and Sustainability Indicators*	https://www.sciencedirect.com/journal/environmental-and-sustainability-indicators
	**Measuring mangrove ecosystems**	See *Guidance on Mangrove Indicators* from Save Our Mangroves Now (Save Our Mangroves Now 2021)	https://www.iucn.org/sites/dev/files/guidance_on_mangrove_indicators_in_post-2020gbf_v.1_aug_2021.pdf
	**Evaluating climate change's impact on mental health**	For a review of methods for measuring and studying climate change and mental health, see *Quantitative methods for climate change and mental health research: current trends and future directions* (Massazza et al. 2022)	https://projects.iq.harvard.edu/files/climate-smart/files/quantitative_methods_for_climate_change_and_mental_health.pdf

Climate-Gender-Health Adaptation and Resilience Indicators

Broadly, adaptation and resilience indicators are those around how populations and health systems are adapting and collaborating (Ebi et al. 2018). Adaptation indicators within this framework should consider see adaptation as both a process and an outcome (Ebi et al. 2018).

Measuring resilience hinges on what type and level of resilience is most relevant, e.g., social, economic, institutional, infrastructural, or community resilience at the physical, ecological, social, city, community, or individual level (Doorn 2017). For example, in their report *Climate Change and Health: Vulnerability and Adaptation Assessment,* the WHO assesses climate resilience across a range of domains, including leadership and governance, the health workforce, health information systems, essential medical products, service delivery, and financing (World Health Organization 2021). When measuring resilience and adaptive capacity, it's important to stay attuned to intrahousehold vulnerabilities as well as other non-economic forms of resilience, which may be missed through proxy approaches like livelihood diversity and the Human Development Index (HDI) (Andersen, Verner, and Wiebelt 2017; O'Neill et al. 2020). Though universal resilience indicators can be useful tools for comparison across contexts, they may miss important individualized, localized, or subjective aspects of resilience and vulnerability that are critical for effective mitigation and adaptation approaches (Doorn 2017). For example, while livelihood diversity is often correlated with adaptive capacity, it is important to recognize that short-term adaptive capacity does not necessarily produce well-being, particularly because of the increased labor burdens – especially for women – that livelihood diversification can produce (Cohen et al. 2016). Thus, measures of resilience and adaptative capacity can be made more robust with through more diverse evaluation approaches.

In order to ensure that resilience indicators integrate and move towards justice, they should measure both availability and impact; for example, implementation of a flood warning system is a positive step, but the system must also perform effectively for the community in a way that is accessible, functional, and meaningful (Doorn 2017). It's also important to recognize that sometimes, the way adaptive capacity is conceptualized or theorized in research and programming does not necessarily align with how local communities understand capacity to adapt and innovate (Cohen et al. 2016).

Existing indicators may also be limited by breadth of previous work. For example, in research on resilience in Africa, researchers noted that several key resilience indicators were beyond the scope of this work, such as "capacity to learn and reorganize from past experiences, develop coping strategies, anticipate and prepare for disruptions, create space for iterative experimentation, and adopt flexible and decentralized government policies on natural resources," nor could they assess dynamic or conflicting aspects of

resilience (Perez et al. 2015). This represents an important area for future consideration when measuring resilience.

Measuring resilience often involves leveraging cross-sectoral indicators to evaluate difficult-to-measure markers in the climate-gender-health space, as well as assessing gendered trends in knowledge, participation in leadership, benefit distribution, and resource access (Sorensen, Murray, et al. 2018; Chauhan 2021). These contextual indicators can provide important insights into co-benefits of programming, engagement, and other aspects of vulnerability that reach beyond measures of gender equity, health, or environment individually.

In all of this, justice and equity should be considered alongside reach and efficacy. As Franks and Schreckenberg argued, measuring the *effectiveness* of conservation outcomes should occur alongside measuring the *equity* of those conservation outcomes (Franks and Schreckenberg 2016). This approach can translate across a range of climate-related work.

Adaptation and Resilience Assessment Toolkits

GOAL	TOOLKIT	LINK
Measuring gendered, local-level resilience	ODI/ActionAid's *Assessing People's Resilience Toolkit*	https://odi.org/en/publications/assessing-peoples-resilience/
	CARE's Resilience Marker	https://careclimatechange.org/cares-resilience-marker/
Evaluating effectiveness of climate adaptation efforts	The *Tracking Adaptation and Measuring Development* (TAMD) framework uses a "twin track" approach to evaluate 1) how effectively countries and institutions manage climate change and 2) how effective adaptation efforts are in reducing vulnerability to climate change	https://www.iied.org/10100iied
	BRAC has a checklist for evaluating how strategies, programs, and interventions could contribute to climate resilience, available in Annex 3 (page 44) of their Climate Resilience Framework (Nasir et al. 2020)	https://brac.net/downloads/Resilience-Framework.pdf
Evaluating urban adaptation efforts	The *GAMMA methodology* (Gender Assessment and Monitoring of Mitigation and Adaptation) is a policy-oriented approach to evaluating urban climate mitigation and adaptation (GenderCC 2021)	https://www.gendercc.net/resources/gamma.html

	**Measuring resilience across scales**	The PEOPLES framework measures resilience across scales and different types of resilience using seven dimensions: population and demographics, environmental and ecosystem, organized governmental services, physical infrastructures, lifestyle and community competence, economic development, and social-cultural capital (Cimellaro et al. 2016). This report includes a review of key indicators that can be found within each dimension	https://ascelibrary.org/doi/full/10.1061/%28ASCE%29ST.1943-541X.0001514
	**Measuring resilience around food and nutrition**	FSIN issued guidance on measuring resilience, particularly around food and nutrition, in *A Common Analytical Model for Resilience Measurement*, that includes models as well as a helpful analysis of taking a characteristics versus a capacity approach to resilience (FSIN 2014)	https://www.fsinplatform.org/sites/default/files/paragraphs/documents/FSIN_TechnicalSeries_2.pdf
	**Measuring climate and environments**	The Global Environment Facility (GEF) maintains several tools for measuring climate adaptation, climate mitigation, biodiversity, forestry, land degradation, and other key climate-related markers	https://www.thegef.org/documents/tracking-tools-results-frameworks
		The Green Climate Fund has several policies and frameworks for monitoring and evaluating climate programming	https://www.greenclimate.fund/about/policies/results-monitoring-evaluation
	**Participatory approaches**	CARE's rticipatory Monitoring, Evaluation, Reflection and Learning (PMERL) Manual is designed for participatory evaluation of adaptive capacity in community-based adaptation projects	https://careclimatechange.org/pmerl/

Adaptation and Resilience Assessment Models and Indices

GOAL	MODEL/INDEX	LINK
Measuring women's empowerment	*The W+ Standard* measures economic development or environmental projects' impact on women's empowerment across six domains: time, income and assets, health, leadership, education and knowledge, and food security	https://www.wplus.org/
	The *Women's Empowerment in Agriculture Index* (WEAI) can also be used to study aspects of gender, climate, and agriculture (Lau et al. 2021). It has been applied to study migration and agriculture in Bangladesh (de Brauw, Kramer, and Murphy 2021). See also recent research from Nepal on how the WEAI can be improved to include context-specific understandings of empowerment (O'Hara and Clement 2018). For an additional example of the WEAI in practice in Bangladesh see (De Pinto et al. 2020)	https://view.ceros.com/ifpri/which-weai/p/1 https://www.sciencedirect.com/science/article/pii/S0305750X18300408 https://doi.org/10.1007/s10584-020-02925-w
Using an index approach to proxy adaptive capacity	*The Human Development Index* has been used as a proxy for adaptive capacity (O'Neill et al. 2020) and forwards a view of development that looks beyond economic growth	https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

Adaptation and Resilience Indicator Themes

In addition to the indicator themes described below, the effect of adaptation and resilience efforts may also become visible through changes in assessed vulnerabilities and strengths.

Access to Resources

Indicator Theme	Source
Access to and use of agricultural training and technical support	Perez et al. 2015
Access to and use of credit	Perez et al. 2015
Access to and use of land, water, and forest resources	Chauhan 2021, citing GEF 2018; Perez et al. 2015
Access to and use of price information services on a regular basis	FAO 2017, adapted from FAO, IFAD, World Bank 2016; Nelson and Huyer 2015

Indicator Theme	Source
Access to and use of services dealing with climate adaptation, including credit services*	FAO 2017, adapted from FAO, IFAD, World Bank 2016
Access to and use of technology and inputs	Perez et al. 2015
Access to and use of weather and climate information services/early warning systems on a regular basis	Dupar and Velasco 2021, citing UNDP 2020; FAO 2017, adapted from FAO, IFAD, World Bank 2016; Nelson and Huyer 2015
Community access to external resources and knowledge	Perez et al. 2015
Dependence on diverse natural resources	Perez et al. 2015
Different economic opportunities	Perez et al. 2015
Equal access to resources for individuals	Perez et al. 2015
Equitable distribution of wealth and assets	Perez et al. 2015
Food security	Perez et al. 2015
Land ownership in their name (e.g., land titles and tenure security)	Chauhan 2021, citing GEF 2018
Levels of technology	Perez et al. 2015
Off-farm economic opportunities (e.g., migration, remittances)	Perez et al. 2015
Schools	Perez et al. 2015
Soil quality	Perez et al. 2015
Strength of natural resources	Perez et al. 2015
Wealth	Perez et al. 2015

*Originally written as an indicator for climate smart agriculture and adapted to be more generalizable

Adaptive and Innovative Practices: Use and Scale

Indicator Theme	Source
Adaptive infrastructure, e.g. electric fence to reduce human wildlife conflict*	WWF 2017
Availability of gender-responsive technologies applicable for local climate adaptation, both broadly and developed by research activities*	FAO 2017, adapted from FAO, IFAD, World Bank 2016; Nelson and Huyer 2015
Capacity of community groups, e.g. capacity of natural resource management groups for biodiversity conservation*	WWF 2017

Indicator Theme	Source
Capacity of health system, such as frequency of updates to adaptation assessments, alignment with NAPs and NDCs, training of health staff on climate, learning/knowledge management strategies, integration with other sectors	Ebi 2018
Carbon intensity of the energy system/zero-carbon emission electricity	Romanello et al. 2022
Clean household energy	Romanello et al. 2022
Climate-adaptive enterprises supported with technical assistance*	Nelson and Kuriakose 2017
Coal phase-out	Romanello et al. 2022
Community mobilization, e.g. through Community Learning and Action Centers (CLAC)*	WWF 2017
Diet	Romanello et al. 2022
Employment in low-carbon and high-carbon industries	Romanello et al. 2022
Establishment of community bodies for natural resource management, e.g., community based anti-poaching units*	WWF 2017
Equal employment opportunity policy and practices for staff and contractors (core labor standards, equal pay for work of equal value, occupational health and safety, and separate sanitation facilities)	Nelson and Kuriakose 2017
Flexibility in adaptive practices	Cohen 2016
Implementation of natural resource management plans, e.g., sub-watershed management plans*	WWF 2017
Integration of climate resilience into existing programs (extent and efficacy)	Ebi 2018
Participation in associations or groups as a result of the project, e.g. market cooperative, producer association, or natural resource management *	FAO 2017, adapted from FAO, IFAD, World Bank 2016; Nelson and Huyer 2015; WWF 2017
Participation (providing labor) in the implementation of a climate-adaptive practice*	García et al. 2019

Indicator Theme	Source
Participation in organized workshops and training opportunities within the program or project, e.g. climate-smart agriculture-related Farmer Field Schools, farmer-to farmer extension services, trainings on land-rights issues such as land titles and land security	Chauhan 2021, citing GEF 2018; Ebi 2018; FAO 2017, adapted from FAO, IFAD, World Bank 2016
Participation in the decision to start using a climate-adaptive practice*	García et al. 2019
Participation in the decision to stop using a climate-adaptive practice*	García et al. 2019
Procedures for responding to complaints are publicly available and accessible to women; standards for responding to complaints are implemented and monitored	Nelson and Kuriakose 2017
Research, monitoring and/or conservation of focal species (number of plant and animal species)	WWF 2017
Strengthened governance of climate adaptive groups, e.g. natural resource management groups*	WWF 2017
Urban green space	Romanello et al. 2022
Use of clean energy cooking facilities	Nelson and Kuriakose 2017
Use of climate adaptive practices or technologies following participation in training and adoption of that approach as a consequence*	Dupar and Velasco 2021; Nelson and Kuriakose 2017
Use of climate-adaptive practices or technology*	Nelson and Kuriakose 2017; Romanello et al. 2022
Use of low emission or 'clean' public transport	Dupar and Velasco 2021, citing UNDP 2020

*Originally written as sector-specific indicator and adapted to be more generalizable

Benefit from Adaptive Practices, Technologies, and Programs

Indicator Theme	Source
Ability to articulate change in resilience due to the project	Dupar and Velasco 2021
Access to and use of climate-adaptive technology or practices, e.g. renewable energy sources* or air conditioning	Nelson and Kuriakose 2017; Romanello et al. 2022
Adaptive capacity	Ebi 2018
Benefit from economic activities (skills training, green enterprises, on- and off-farm activities) due to program interventions*	WWF 2017
Benefit from participation in program or project activities, including poor households that receive benefits	Chauhan 2021, citing GEF 2018
Benefit from receiving/accessing financial investments due to program interventions	Chauhan 2021, citing GEF 2018
Benefit from receiving/accessing tools and resources due to program interventions	Chauhan 2021, citing GEF 2018
Change in crop yield per hectare and year due to program interventions*	Dupar and Velasco 2021, citing UNDP 2020; FAO 2017, adapted from FAO, IFAD, World Bank 2016; Nelson and Huyer 2015
Change in emissions	Romanello et al. 2022
Change in property (e.g. land, livestock, trees) owned and controlled by users of climate adaptive technology or practice	FAO 2017, adapted from FAO, IFAD, World Bank 2016
Change in the labor or time burden due to program interventions (perceived and measured, e.g. time spent on unpaid domestic and care work, collection of biomass/fuel, collection of water, etc.)*	Dupar and Velasco 2021, citing UNDP 2020; FAO 2017, adapted from FAO, IFAD, World Bank 2016; García et al. 2019; Nelson and Kuriakose 2017
Compensation received compared with the value of assets lost due to the project*	Nelson and Kuriakose 2017
Decision-making power, including 1) participation in the decision over how to use the income earned or benefits from the climate adaptive practice or technology and 2) perceived decision-making power in the household compared to before adopting the climate adaptive technology or practice*	Chauhan 2021, citing GEF 2018; García et al. 2019; Nelson and Kuriakose 2017

Indicator Theme	Source
Effectiveness of climate adaptive practice or technology (perceived and measured, including usefulness, assistance with adaptation to climate variability, benefits that accrue from its adoption, etc.)	Chauhan 2021, citing GEF 2018; Ebi 2018; FAO 2017, adapted from FAO, IFAD, World Bank 2016; García et al. 2019
Employment in climate-adaptive businesses supported by the project*	Nelson and Kuriakose 2017
Expenditure on purchasing fuel for household energy needs	Nelson and Kuriakose 2017
Food security, intake, and/or dietary diversity	Dupar and Velasco 2021
Health co-benefits of mitigation and adaptation actions	Romanello et al. 2022
Income received from operating a climate-adaptive enterprise, as a climate-adaptive service provider or technician, or by implementing a climate-adaptive practice or technology*	Dupar and Velasco 2021; Nelson and Kuriakose 2017
Livelihood diversification, indexed using the income proportion from each income source	Ganguli 2021; Andersen, Verner, and Wiebelt 2017
Perceived benefit (e.g. in terms of livelihood, income, food security, food access, nutrition, wellbeing, social status, empowerment etc.) due to the climate adaptive practice or technology*	FAO 2017, adapted from FAO, IFAD, World Bank 2016; García et al. 2019; Nelson and Huyer 2015
Perceived change in access and control over income compared to before adopting the climate adaptive technology or practice*	Nelson and Kuriakose 2017
Perceived change in access to climate adaptive services, e.g., renewable energy services*	Nelson and Kuriakose 2017
Perceived change in access to time-saving climate-adaptive or practices technologies*	Nelson and Kuriakose 2017
Production and consumption based attribution of CO2 and PM2.5 emissions	Romanello et al. 2022
Satisfaction with climate-adaptive services, practices, or technologies, e.g., fuel-efficient stoves or clean public transport*	Dupar and Velasco 2021, citing UNDP 2020; Nelson and Kuriakose 2017

Indicator Theme	Source
Satisfaction with compensation, transitional support, special assistance, and resettlement, or other support and services*	Nelson and Kuriakose 2017
Sustainable and healthy transport	Romanello et al. 2022

*Originally written as sector-specific indicator and adapted to be more generalizable

Community

Indicator Theme	Source
Cooperation and coordination within communities based on trust, norms, and networks	Perez et al. 2015
Existence of mechanisms for collaboration across sectors (MOUs)	Ebi 2018
Extent of coordination across sectors, measured with social network analysis	Ebi 2018
Strength of community organizations	Perez et al. 2015
Strength of organizations outside the community	Perez et al. 2015

Financing, Subsidies, and Incentives

Indicator Theme	Source
Access to/receipt of financing for climate-adaptive enterprises*	Nelson and Kuriakose 2017
Access to/receipt of financing for climate-adaptive technologies*	Nelson and Kuriakose 2017
Access to/receipt of subsidies for climate-adaptive technologies*	Nelson and Kuriakose 2017
Clean energy investment	Romanello et al. 2022
Funds divested from fossil fuels	Romanello et al. 2022
Health adaptation-related funding	Romanello et al. 2022
Incentives designed to recruit women, increase their capacity, and provide career development in climate-adaptive sector agencies and service providers*	Nelson and Kuriakose 2017

Indicator Theme	Source
Incentives used to encourage women's entry into the climate-adaptive markets market (e.g. finance packages, tax benefits and rebates, pilot schemes, partnerships with financial institutions, the private sector or women's associations)*	Nelson and Kuriakose 2017
Net values of fossil fuel subsidies and carbon prices	Romanello et al. 2022

*Originally written as an indicator for renewable energy and adapted to be more generalizable

Governance

Indicator Theme	Source
Biodiversity policy support (strategy, protocol, plan)	WWF 2017
Compatibility of fossil fuel company strategies with the Paris Agreement	Romanello et al. 2022
City-level climate risk assessment	Romanello et al. 2022
Communities' shared rights and responsibility for natural resource management	Perez et al. 2015
Detection, preparedness, and response to health emergencies	Romanello et al. 2022
Extent of governmental commitments to adaptation in plans and budgets	Ebi 2018
Government engagement in health and climate change	Romanello et al. 2022
Government-recognized community control over natural resources	Perez et al. 2015
Local governments capable of planning for, preventing, and responding to risks	Perez et al. 2015
Ministry of Women's Affairs (and/or other relevant ministries) participated in design and implementation of project	Nelson and Kuriakose 2017
National policies promote durable natural resource management	Perez et al. 2015
National assessments of climate change impacts for health and national adaptation plans for health	Romanello et al. 2022

Knowledge

Indicator Theme	Source
Awareness of the climate-adaptive practice (among non-users of the practice)*	García et al. 2019
Climate information for health	Romanello et al. 2022
Combing local and scientific knowledge	Perez et al. 2015
Education, skills, knowledge levels	Perez et al. 2015
Extent of systematic assessment and management of climate-related health risks	Ebi 2018
Desire for more information about the climate-adaptive practice (among current users and non-users of the practice)*	García et al. 2019
Indigenous local ecological knowledge used in management of resources	Perez et al. 2015
Knowledge of how to implement the climate-adaptive practice (among current users and non-users of the practice)*	García et al. 2019
Knowledge of laws relating to areas of intervention	Chauhan 2021, citing GEF 2018
Perceived ability to learn	Cohen 2016; Perez et al. 2015
Previous experience with implementing the climate-adaptive practice (previous users)	García et al. 2019
Public knowledge and actions around climate and health	Ebi 2018

*Originally written as an indicator for climate smart agriculture and adapted to be more generalizable

Participation and Voice

Indicator Theme	Source
Engagement in leadership positions 1) with regard to land, water, forest, and other biological resources (e.g., entrepreneur, manager, lead farmer, etc.), 2) in the community, and/or 3) relating to the areas of the intervention or in the project context	Chauhan 2021, citing GEF 2018; Dupar and Velasco 2021, citing UNDP 2020; FAO 2017, adapted from FAO, IFAD, World Bank 2016
Individual engagement in health and climate change	Romanello et al. 2022
Media coverage of health and climate change	Romanello et al. 2022

Indicator Theme	Source
Participation in community decision-making	Dupar and Velasco 2021, citing UNDP 2020; FAO 2017, adapted from FAO, IFAD, World Bank 2016; Perez et al. 2015
Participation in decision-making relating to project activities, climate adaptation user groups, local bodies, or in the project context	Dupar and Velasco 2021, citing UNDP 2020; Chauhan 2021, citing GEF 2018; Nelson and Kuriakose 2017
Participation in planning and consultation meetings, workshops, and committee meetings, either for the project specifically or more broadly	Chauhan 2021, citing GEF 2018; Nelson and Kuriakose 2017
Participation in the selection process for a climate-smart practice or technology	FAO 2017, adapted from FAO, IFAD, World Bank 2016
Perceived agency	Cohen 2016
Scientific engagement in health and climate change	Romanello et al. 2022
Corporate sector engagement in health and climate change	Romanello et al. 2022

Program Design

Indicator Theme	Source
Extent of incorporation of climate/socioeconomic models and projections into the program design, implementation, and evaluation	Ebi 2018
Extent of incorporation of learning and capacity building into program management	Ebi 2018
Project budget includes allocations related to gender mainstreaming, including hiring of gender experts, conducting gender analysis, and collecting sex-disaggregated data	Nelson and Kuriakose 2017

Expanded Impact

Indicator	Source
Starting/expanding other enterprises due to adoption of climate-adaptive technology*	Nelson and Kuriakose 2017
Indirectly employment by business accessing improved climate-adaptive technology*	Nelson and Kuriakose 2017

*Originally written as an indicator for renewable energy and adapted to be more generalizable

Learn More: Measuring Adaptation and Resilience

	THEME	LEARNING RESOURCE	LINK
	**Measuring adaptation**	Phan et al. used an adaptative capacity scale to study the adaptive capacity of rural women in Vietnam, using a structured questionnaire to assess adaptive capacity around human, social, financial, physical, and natural capital (Phan, Jou, and Lin 2019)	https://www.mdpi.com/2071-1050/11/5/1257
		For more on how "effectiveness" can be framed, understood, and measured in climate adaptation programs, see *Interrogating 'effectiveness' in climate change adaptation: 11 guiding principles for adaptation research and practice* (C. Singh et al. 2021)	https://doi.org/10.1080/17565529.2021.1964937
	**Measuring empowerment**	For a critique of approaches to measuring women's empowerment, see *Hitting the target and missing the point? On the risks of measuring women's empowerment in agricultural development* (Tavenner and Crane 2022)	https://doi.org/10.1007/s10460-021-10290-2
	**Measuring equity in conservation**	IIED examined strategies for evaluating equity in protected area conservation (universal equity scorecard, site-specific equity scorecard, in-depth social assessment and a site-specific equity score card, or in-depth governance assessment and a site-specific equity scorecard) in their issue paper *Understanding and Assessing Equity in Protected Area Conservation* (Franks, Booker, and Roe 2018)	https://pubs.iied.org/14671iied

THEME	LEARNING RESOURCE	LINK
Examples of metrics used in agriculture programs	For an example of metrics used in a climate and health program (agroforestry and clean cookstoves in Honduras), see *Women-led agroforestry and clean cookstoves in Honduras: Field evaluation of farmer-led gender-transformative strategies for low emissions agriculture* (Hottle 2015)	https://hdl.handle.net/10568/69448
	Full the full indicator set from the Perez et al. (2015) study from the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS), including household, village, and organizational surveys, see their data repository	https://ccafs.cgiar.org/resources/tools/ccafs-baseline-survey-data-and-materials#baseline_indicator

Measuring Challenge and Failure

Several gendered indicators have been identified as warning signs that climate resilience programming is increasing inequity or actively causing harm (Chauhan 2021). These trends are critical to monitor because shifts to alternative crop species can increase the labor burden for women and reduce their available time for other tasks, or new crop species may be co-opted and dominated by men such that women farmers are economically displaced or disadvantaged (Chauhan 2021). High livelihood diversity, which is commonly correlated with adaptive capacity, may put a greater labor burden on women, which highlights that factors that may promote adaptive capacity do not inherently translate to improved well-being (Cohen et al. 2016).

Warning indicators are often a matter of interpretation. For example, a study in India found that island households used more coping strategies (4-6 strategies) than households in other geographic contexts (1-3 strategies) (Mondal et al. 2022). But the use of *more* strategies does not necessarily equate to better coping, and coping strategies that can be effective for short-term household survival can have harmful long-term effects or pose additional risks. Therefore, it's useful to integrate both qualitative and quantitative measures for warning indicators, and to assess them over short, medium, and long terms.

Short-term: Monitor ongoing project activities

Warning indicators can be integrated within existing indicators using a gender monitoring matrix (Chauhan 2021):

Table 21. Gender monitoring matrix Source: Chauhan 2021

ACTIVITY	WHAT TO LOOK FOR	MEANS OF CHECKING	WARNING SIGNS	HOW TO CHECK	WHEN	ACTIONS TO ADDRESS WARNING SIGNS	WHO SHOULD TAKE ACTION
Community-based planning	Number of women participating	CBA meeting records	Less than 20% of participants are women	The person who finalizes the plan document should report the warning sign	Every quarter	Project funds based on such CBAs should not be released	Finance person
	Number of exercises conducted with women's groups	CBA document	No exercise conducted separately with women's group Results not separately documented and analyzed				
	Number of gender analysis exercises conducted	CBA document	No gender analysis conducted				

Source: Chauhan 2021

Note that this framework includes a full plan for recognizing inequities, frequency of assessment, and a clear plan for what kind of action should be taken, along with assigned responsibility for that action. This helps ensure that early warning signs do not fall through the cracks.

Medium-term: Triangulate data and use mixed-methods approaches

Warning indicators can also raise areas of program inefficacy. For example, in a recent study in Vietnam, rural women reported that their husbands would use their names to get lower-interest loans, raising important questions about the efficacy of these financial metrics as effective measures of women's resources and the prospective debt burden climate change-induced hazards could cause (Phan, Jou, and Lin 2019). Using mixed-

methods approaches to gain additional insights into program monitoring indicators can reveal potentially problematic trends that might not otherwise emerge until long-term program evaluation milestones.

Long-term: Monitor changes in key risk indicators or high-cost coping strategies

Changes in key risk indicators or potentially high-cost coping strategies can be assessed in the longer-term during programmatic baseline, midline, and endline assessments.

Indicator theme	Source
Time and labor burden on women	Chauhan 2021
Domestic violence and gender-based violence rates	Chauhan 2021
Economic displacement	Chauhan 2021
Well-being	Cohen et al. 2016
Amount of food consumed per meal	Mondal et al. 2022
Number of meals per day	Mondal et al. 2022
Going to sleep without eating	Mondal et al. 2022
Purchasing less expensive or less desirable food	Mondal et al. 2022
Food purchasing behavior (e.g., less food purchased from markets)	Mondal et al. 2022
Purchase of food on credit	Mondal et al. 2022
Borrowing of money (from lenders, NGOs, relatives, or friends)	Mondal et al. 2022
Reliance on casual labor	Mondal et al. 2022
Selling labor in advance	Mondal et al. 2022
Spending deposit money	Mondal et al. 2022
Migration	Mondal et al. 2022
Sale of assets such as livestock, lands, jewelry, etc.	Mondal et al. 2022

Additional Resources for Monitoring and Evaluation

Learn More: Spotlight on Measuring Gender, Climate, and Agriculture

THEME	LEARNING RESOURCE	LINK
Measuring gender, agriculture, and climate	*A gender-responsive approach to climate-smart agriculture: Evidence and guidance for practitioners* includes a sample of gender-integrated climate-smart agriculture indicators (Nelson and Huyer 2016)	https://hdl.handle.net/10568/73049
	The FAO's *Climate-Smart Agriculture Sourcebook* offers guidance on quantitative and qualitative indicators around gender and climate-smart agriculture	https://www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c6-gender/chapter-c6-5/en/
	The FAO's *Training Guide: Gender and Climate Change Research in Agriculture and Food Security for Development* offers additional guidance for evaluating climate and agriculture	https://www.fao.org/3/md280e/md280e00.htm
	For more on how to develop contextualized, equitable indicators around gender and sustainable agricultural intensification practices, see *Realizing Inclusive SAI: contextualizing indicators to better evaluate gender and intergenerational inequity in SAI processes and outcomes – cases from Southern and Western Africa* (Zulu et al. 2021).	https://doi.org/10.1080/14735903.2020.1737356
	Reflection on the Use of Mobile Phones for Monitoring Gender Indicators Related to Climate-smart Agriculture Practices discusses challenges, consideration, and indicators used in a mobile phone pilot to assess gendered differences in use and perception of CSA practices (tested in Colombia) (García et al. 2019)	https://cgspace.cgiar.org/bitstream/handle/10568/106120/REFLECTION_ON_THE_USE_OF_MOBILE_PHONES_FOR_MONITORING_GENDER_INDICATORS_RELATED_TO_CSA_PRACTICES-hd_comp.pdf?sequence=2&isAllowed=y
	Diagnosing Climate Adaptation Constraints in Rural Subsistence Farming Systems in Cameroon: Gender and Institutional Perspectives includes an example of a survey tool used in rural Cameroon for evaluating gender, agriculture, and climate change (Nchu, Kimengsi, and Kapp 2019)	https://www.mdpi.com/2071-1050/11/14/3767
Participatory climate, gender, and agriculture research	CGIAR's *Gender and Inclusion Toolbox: Participatory Research in Climate Change and Agriculture* offers guidance for participatory approaches in agriculture	https://ccafs.cgiar.org/resources/publications/gender-and-inclusion-toolbox-participatory-research-climate-change-and

THEME	LEARNING RESOURCE	LINK
Toolkits and databases for climate, gender, and agriculture MEL	CGIAR maintains a database of tools, methods, and manuals for evaluating and investigating gender in food and agricultural systems (such as indices for women's empowerment in agriculture and livestock, time tracking tools, community mobilization measures, tools for measuring gender equity in new crop development, mapping tools, etc.).	https://gender.cgiar.org/tools-methods-manuals
	The CGIAR Monitoring, Evaluation and Learning Support Pack is an interactive tool that recommends documents based on the user's role and needs.	https://melsp.cgiar.org/
Policy indicators for gender and agriculture	**CGIAR** issued guidance on developing gender-integrated climate change and agricultural policy indicators, see *From sub-IDOs to Impact: A Guide to Developing Gender-related Policy Indicators in CCAFS* (Tavenner et al. 2020)	https://cgspace.cgiar.org/bitstream/handle/10568/110832/Tavenner_report.pdf?sequence=1&isAllowed=y
National level indicators for gender, climate, and agriculture	**CGIAR** focuses on national level indicators around climate, gender, and health in the report *National level indicators for gender, poverty, food security, nutrition and health in Climate-Smart Agriculture (CSA) activities*	https://cgspace.cgiar.org/bitstream/handle/10568/80722/WP%20195.pdf

Learn More: Additional Evaluation Tools and Databases

THEME	LEARNING RESOURCE	LINK
Databases of evaluation tools	MEASURE Evaluation maintains a database of evaluation tools	https://www.measureevaluation.org/resources/tools/tools-by-title.html
Evaluating gender	MEASURE Evaluation's *Guidelines for Integrating Gender into an M&E Framework and System Assessment*	https://www.measureevaluation.org/resources/publications/tr-16-128-en.html
	CARE's Monitoring Evaluation & Learning Framework for Social Analysis & Action (SAA), one of their participatory gender transformation approaches	https://www.care.org/wp-content/uploads/2020/08/saa_mel_framework.2jan.pdf
Monitoring population, health, and environment programs	MEASURE Evaluation's *Guide for Monitoring and Evaluating Population-Health Environment Programs*	https://www.measureevaluation.org/resources/publications/ms-18-131.html

Chapter 5: Moving Forward towards a Healthy, Equitable, and Climate Resilient Future

Call to Action

Climate change is an urgent and serious threat – and we already have many of the tools we need to mitigate harm and adapt to changing environments.

"Addressing the social and gender dimensions of climate change poses many challenges that are not insurmountable. It requires gender mainstreaming in climate change response activities, sustainable and equitable development, a clear focus on adaptation and mitigation, a strong commitment of resources, and empowerment of individuals to build their own resilience." – (World Health Organization 2014)

Here are four ways we can take action around climate, gender, and health:

1. Keep building a collective path forward.

Building community-led, collective, collaborative programming at the nexus of climate, gender, and health requires ongoing conversations about values, definitions, goals, needs, and priorities. Boiling a collective path forward means making an effort to share your success, share your challenges, and keep being a voice for systemic change along the way.

A critical part of this is engaging with women, seeing their social roles and potential as an opportunity for developing more effective climate solutions (Sorensen, Murray, et al. 2018).

"Ensure participation: Recognizing women's roles as educators, caregivers, holders of knowledge, and powerful agents of social change positions women to effectively design and implement culturally acceptable interventions where they are needed most. Women should be empowered as key stakeholders at the outset of any project with the understanding that combining scientific data and community knowledge will yield better results." – (Sorensen, Murray, et al. 2018)

But having more women in positions of power alone will not automatically produce improvements in programs, policies, or governance (H. C. P. Brown 2011). Transformative change takes time and effort across scales (van Eerdewijk, Bråten, and Danielsen 2021). Fostering women's resilience and women's networks, as well as inclusive resources, housing, and advocacy spaces, is a critical aspect of community recovery from climate impacts (World Health Organization 2014; Simmonds et al. 2022).

Given the scope of the threat that climate change poses, and, ultimately, the insufficiency of individual-level actions, joining in with the wider climate movement and advocating for systemic, societal change is imperative (Issa et al. 2021; Giudice et al. 2021; Swinburn et al. 2019).

2. Keep learning through action.

While there is a continued need for gender-sensitive research, we already have enough data to support committing resources to gender mainstreaming within climate resilience, mitigation, and adaptation programming as part of efforts to move towards equity, empowerment, and sustainable development (World Health Organization 2014). Integrating gender into climate change responses would create whole-of-society benefits (Romanello et al. 2021). Yet in 2016, UNDP found that only 0.01% of worldwide funding went to initiatives that supported both women and climate (Habtezion 2016).

As we take action in this space, it's important to know that gender mainstreaming in the climate sector isn't enough, however: climate programming should pay attention to gendered aspects of health care, too (World Health Organization 2021; Sorensen, Murray, et al. 2018). From developing accessible, gender-responsive health services for the poorest and most vulnerable populations to gender-inclusive post-disaster healthcare to reducing emissions and waste within health facilities, there is high potential to develop impactful shifts at the climate-gender-health nexus (Roos 2022; World Health Organization 2014; Simmonds et al. 2022). BRAC, for example, forwards learning through action across the breadth of their climate resilience and climate integration process (Nasir et al. 2020).

Robust documentation of what we learn in this process is critical. This requires developing effective strategies and mechanisms for collecting and analyzing data (Sorensen, Murray, et al. 2018). In particular, in research and monitoring and evaluation in this space, it is critical to build our evidence base around climate adaptation to evaluate not only the technical efficacy of policies and interventions but also how they address gender and social inequalities as well (van Eerdewijk, Bråten, and Danielsen 2021; Jerneck and Olsson 2008; Resurrección et al. 2019; Deering 2019). There is also a need to conduct gender-sensitive research around the health impacts of climate change (both broadly and in response to extreme events) to better understand how climate-gender-health interactions, and the data we collect should be disaggregated along important markers of identity and difference to allow us to examine how gender diversity, geography, age, race, ethnicity, and other contextually-specific markers shape outcomes and engagement (World Health Organization 2014; Sorensen, Murray, et al. 2018).

3. Embrace difference.

Differences aren't just a point of vulnerability – they can also be a source of strength. Shifting to strengths-based frameworks helps to leverage existing capacity and reveal the resources and assets that different groups of people already have (Simmonds et al. 2022).

"Equity and social justice cannot be achieved without recognizing the differences in vulnerability and strengths of women and men, and the various factors that contribute to vulnerability. Recognizing these differences is a necessary and important component of any prospective attempts to address the gendered health consequences of climate change." (World Health Organization 2014)

Recognizing and embracing difference is critical for developing contextually-appropriate, locally-led programming, rather than casting community members as victims or cultural values as obstacles (Chauhan 2021; Lindgren 2020)

4. Keep innovating.

Climate change is exacerbating problems we're familiar with, and it's generating problems we've never seen before. But in order to solve problems we've never seen, we need solutions we haven't tried yet. This can mean developing climate mitigation policies that provide health co-benefits, and developing climate adaptation strategies that account for gender differences, while paying attention to relative and different capacities, power, resilience, vulnerabilities, resource, and gender norms (World Health Organization 2014).

"Capacities to adapt and innovate to be shaped by a range of related socio-institutional factors, in particular, pressure to conform to social norms, willingness to bear risks, need for evidence, power structures embedded in social relationships and organisation and access to information. In practice there may be trade-offs, synergies and conflicts between generic adaptive capacity and adaptive capacity for specific risks or hazard." – (Cohen et al. 2016)

Innovation is risky. But it is also a very hopeful practice. When we are innovating, we are optimistic, and creative, and active in our efforts to generate positive change. Innovation and experimentation are at the heart of resilience.

Resources for Further Learning

Training Toolkits and Trainer Packs

	THEME	LEARNING RESOURCE	LINK
	**Intersectional, participatory climate justice**	The CARE Climate Justice Center (and the CARE Climate & Resilience Academy) maintains a repository of tools, toolkits, and trainer packs for climate resilience, including evaluating climate vulnerability and capacity, gender integration, and planning for resilience	https://careclimatechange.org/explore/?filter_format=tool https://careclimatechange.org/academy/trainer-packs/
	**Gender and climate change training**	ARROW has a Training Manual on Gender and Climate Change Resilience, which includes gender assessments, vulnerability assessments, resilience indices, best practices/principles for community-based adaptation, examples of communication tools, a monitoring and evaluation framework, sample gender indicators and analyses, a gender monitoring matrix, and examples of different models for adaptation	https://arrow.org.my/publication/training-manual-on-gender-and-climate-change-resilience/
		UN Women Bangladesh, Bangladesh Centre for Advanced Studies (BCAS) and Christian Aid developed a training manual on climate adaptation for grassroots women-led civil society organizations *Empower- Women for Climate Resilient Societies*	https://www.empowerforclimate.org/en/resources/e/m/p/empower-women-for-climate-resilient-societies
		The British Council has a school resource kit for girls' education and climate change as well as additional climate-related classroom resources	https://www.britishcouncil.or.th/en/school-resource-pack https://www.britishcouncil.or.th/en/teacher-toolkit
	**Climate, gender, and health**	The World Health Organization created a toolkit of resources and trainings on climate and health	https://www.who.int/teams/environment-climate-change-and-health/climate-change-and-health/capacity-building/toolkit-on-climate-change-and-health
		Measure Evaluation published a toolkit on data use for gender-aware health programming	https://www.measureevaluation.org/resources/publications/ms-13-81.html

THEME	LEARNING RESOURCE	LINK
Population, health, and environment	Measure Evaluation published a Population, Health and Environment M&E Training Toolkit	https://www.measureevaluation.org/resources/tools/population-health-and-environment/population-health-and-environment-training-materials.html
	Knowledge Success and PRB produced a Population, Health and Environment (PHE) toolkit	https://toolkits.knowledgesuccess.org/toolkits/phe
Conservation	The Endangered Wildlife Trust has a toolkit for resources on conservation and biodiversity	https://www.ewt.org.za/conservation-resources/
	Blue Ventures maintains a repository of tools around marine conservation, community engagement in data, and building partnerships	https://blueventures.org/resources/toolkits/
Participatory and adaptive learning around climate, gender, and health	USAID Momentum produced a guide for integrating adaptive learning into maternal and reproductive health projects and produced an accompanying toolkit for developing programs that integrate adaptive learning	https://usaidmomentum.org/resource/adaptive-learning-guide/ https://usaidmomentum.org/resource/adaptive-learning-toolkit/
	The Huairou Commission maintains a repository of publications around their key learning tools, including grassroots academies, risk and vulnerability mapping, community monitoring, peer learning exchanges, and local-to-local dialogues	https://huairou.org/learning-tools/

Digital Resource Centers

THEME	LEARNING RESOURCE	LINK
Climate, gender, and health	WOCAN has a library on gender and climate, pooling publications from across sectors and organizations	https://www.wocan.org/resources/
	WEDO has a library of reports, fact sheets, and webinars on gender and climate	https://wedo.org/resources/
	ARROW ASK-us is ARROW's Digital Resource Center. Their publications include capacity needs assessments and research at the intersection of SRHR and climate in Asia	https://www.srhr-ask-us.org/
	Ipas Climate Justice hosts a digital site with case studies, media, and voices of women around gender and climate	https://ipasclimatejustice.org/
	Conservation International has a resource guide for approachable learning resources on gender and environment	https://www.conservation.org/blog/how-are-gender-environment-linked-start-here
	The Gender & Health Hub maintains a repository of research and reports around gender and health, including a subsection on climate and migration	https://www.genderhealthhub.org/
	The Huairou Commission maintains a repository of publications and case studies on their projects, including work on gender, resilience, and land use	https://huairou.org/publications/
Gender	UN Women maintains a digital library on gender and a repository of key publications and data	https://www.unwomen.org/en/digital-library https://www.unwomen.org/en/how-we-work/research-and-data/publications
Climate	The World Bank maintains a repository of tools and fact sheets for work around climate change, development, and health	www.worldbank.org/en/topic/climatechange
	The Care Climate Justice Center keeps a repository of publications on climate, health, and resilience	https://careclimatechange.org/explore/?filter_format=publication
	UNFCCC maintains a repository of climate-related technical assessments, policy documents, and other planning materials	https://unfccc.int/documents
	IIED maintains a database of resources and toolkits for climate and environment	https://www.iied.org/publications
	IPCC maintains a library of assessment, methodology, and technical reports, as well as additional supporting materials	https://www.ipcc.ch/library/

THEME	LEARNING RESOURCE	LINK
Agriculture and climate	CGIAR maintains a database of reports and publications around gender in food and agriculture, including work around climate and nutrition	https://gender.cgiar.org/publications-data
Health	The WHO maintains a library of publications on climate change and health, including guidance, country profiles, and policy briefs	https://www.who.int/publications/i?healthtopics=07b6b5da-4025-4288-bef1-cce0ea8b2569
Technical Guidance	Practical Answers is Practical Action's resource library, which includes technical briefs and learning resources across a range of topics, including climate adaptation, water, disasters and agriculture	https://answers.practicalaction.org/our-resources/
	K4D developed a resource guide for technical competencies around climate and the environment (Bolton 2021)	https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/CSW/66/EGM/Background%20Papers/Bernadette%20RESURECCION_CSW66%20Background%20Paper.pdf
	IIED's Participatory Learning and Action library is a repository of resources around participatory approaches, many of which are related to climate, gender, and/or health	https://pubs.iied.org/series/participatory-learning-and-action
Population, Health, and the Environment	People-Planet Connection maintains a repository of publications and videos on climate resilience, health, and other associated PHE topics	https://peopleplanetconnect.org/search-the-collection/
	Knowledge SUCCESS curated a list of twenty essential resources for population, health, and the environment	https://knowledgesuccess.org/2020/11/18/20-essential-resources-for-population-health-and-environment-phe/
	PRB maintains a page on population and the environment that includes links to videos, reports, and other resources	https://www.prb.org/what-we-do/focus-areas/environment-and-population/
Emerging infectious disease	The EcoHealth Alliance maintains a database of publications largely around emerging infectious diseases, with an eye towards how inequities, climate, and environment shape epidemiological trends	https://www.ecohealthalliance.org/publications
Disasters	The Global Facility for Disaster Reduction and Recovery (GFDRR) maintains a knowledge hub around disaster recovery	https://www.gfdrr.org/en/knowledge-hub

In-Person Learning

THEME	LEARNING RESOURCE	LINK
 **Training on gender and the environment**	The Margaret Pyke Trust offers bespoke training on sexual and reproductive health and climate	https://margaretpyke.org/srh-training/overview/
	WOCAN offers a 6 day course on leadership for gender equality and a 5 day course on gender integrated planning in environmental work	https://www.wocan.org/leadership-gender-training/

Apps and Interactives

THEME	LEARNING RESOURCE	LINK
 **Gender and climate updates**	The Gender Climate Tracker App is designed to provide practitioners with up-to-date information on research and actions around gender and climate change	https://wedo.org/tool-gender-climate-tracker-app/
 **Interactive guides**	PRB has an interactive guide on Family Planning and the Path to Resilience	https://interactives.prb.org/resilience/index.html
	The Pace Project has an interactive guide on youth engagement in Population, Health, and Environment	https://thepaceproject.org/phe-youth/index.html
	The Pace Project has an interactive guide on how family planning high impact practices can improve impact in population, health, and environment programs	https://thepaceproject.org/fp-HIPS-PHE
 **Mapping climate, gender, and health**	Carbon Brief has an interactive map that highlights how the disproportionate health effects of climate change on women's health	https://www.carbonbrief.org/mapped-how-climate-change-disproportionately-affects-womens-health
	People-Planet Connection maintains a map of project activities at the nexus of population, health, and the environment	https://www.arcgis.com/home/webmap/viewer.html?webmap=313ab68f6ed0435aa4c9d5268b1de842

Videos

THEME	LEARNING RESOURCE	LINK
Database of films	The Woodrow Wilson International Center for Scholars maintains a database of films on topics including climate change and reproductive health	https://www.wilsoncenter.org/collection/films-and-podcasts
Sexual and reproductive health and climate	Population Action International (PAI) produced a short (9:33) documentary film, *Finding Balance: Forests and Family Planning in Madagascar*	https://player.vimeo.com/video/16028677
	PRB produced a short (7:59) video *Resilient Future: Climate Financing Strategies for Family Planning Program*	https://www.youtube.com/watch?v=11_8OIjJ54E&t=12s
	PRB produced a short (4:38) video *Promoting Resilience through Family Planning in Kenya* about drought and insecurity in Kenya	https://www.youtube.com/watch?v=eWEhi1-rxHM&feature=emb_imp_woyt
	The Penita Initiative produced a short (7:20) film, *The Women of Sarawak and Mindoro: The Invisible Battle of Climate Change* as part of a regional research initiative on sexual and reproductive health and rights and climate change	https://www.youtube.com/watch?v=3A8c6pMirpI
	PRB produced a short (4:21) video *Community of Hope: A Look at Pathfinder International's HoPE-LVB Project* in the Lake Victoria Basin	https://www.youtube.com/watch?v=pYWN4t7cPDI
Women responding to climate change	Ipas and MSI Reproductive Choices produced a short (3:10) video *Women and girls are on the frontlines of the climate crisis,* highlighting the voices of several women in Senegal, Bangladesh, and Mozambique	https://www.youtube.com/watch?v=qaEH1DsnPfY&ab_channel=Ipas
	Conservation International produced a short (3:43) video *Women Leading Conservation* highlighting women from Kenya	https://www.youtube.com/watch?v=4vQQWAwd0Wc
	Conservation International produced a short (12:29) video *Give a Woman a Fish* about women fishers in Cambodia	https://www.youtube.com/watch?time_continue=3&v=qPmd1W-sE88&feature=emb_title
	The Nature Conservancy produced a short (2:05) video *Women Guardians of the Mangroves* about the Mangoro Market Meri project in Papua New Guinea	https://www.youtube.com/watch?v=kcpYMXDSK5I&t=1s&ab_channel=TNCAsiaPacific

Webinars

THEME	LEARNING RESOURCE	LINK
Reproductive health and climate	FP2030 has a webinar on *Building Forward Better: Advancing SRHR for Climate Adaptation and Resilience*	https://fp2030.org/resources/building-forward-better-advancing-srhr-climate-adaptation-and-resilience
	Ipas, FIGO, and MSI Reproductive Choices produced a webinar, *Connecting the Dots: Climate change adaptation, reproductive justice, and resilient health care*	https://vimeo.com/645264760
	Family Planning High Impact Practices has a webinar on *How can Population, Health and Environment Projects Learn from Family Planning High Impact Practices*	https://fphighimpactpractices.org/how-can-population-health-and-environment-projects-learn-from-family-planning-high-impact-practices-webinar/

Podcasts

THEME	LEARNING RESOURCE	LINK
Climate	A Matter of Degrees addresses climate challenges and solutions with curiosity and storytelling. Season 2, Episode 10, *How Gender Equality Can Save the Planet* addressed gender.	https://www.degreespod.com/ https://www.degreespod.com/episodes/episode-19
	The Joy Report is a podcast about cliamte solutions and environmental justice from *The Intersectional Environmentalist*	https://open.spotify.com/show/41en5Yu2UdhUHrclIa07RK?si=654f51161b5a478e
Sexual and reproductive health and rights	The Next Gen Podcast from Pathfinder's Acacia Circle tackles critical topics in sexual and reproductive health and rights – including climate change, advocacy, and youth issues from around the world	https://open.spotify.com/show/1Vjn7YRPPMcGrxQIB5glW9?si=daf94c3383504d39

Communicating Climate, Gender, and Health

THEME	LEARNING RESOURCE	LINK
How to communicate about climate change	The Johns Hopkins Center for Communication Programs maintains a list of public communication tools that includes tools around gender and environment	https://ccp.jhu.edu/tools/
	The Yale Program on Climate Change Communication maintains a repository of research and visualizations around climate change attitudes and messaging	https://climatecommunication.yale.edu/

Glossary

Adaptation: "Actions by individuals or systems to avoid, withstand, alleviate adverse impacts, or take advantage of current and projected climate changes and impacts. Adaptation decreases vulnerability or increases resilience to impacts. It includes building the adaptive capacity of people and communities to climate change, including communicating climate change information, building awareness of potential impacts, maintaining well-being, protecting property or land, among others. Adaptation planning at the local, state, and national levels can limit the damage caused by climate change, as well as the long-term costs of responding to climate-related impacts that are expected to grow in number and intensity in the decades to come" (Mian 2017).

Adaptive Capacity: "The ability to design and implement effective adaptation strategies, or to react to evolving hazards and stresses so as to reduce the likelihood of the occurrence and/or the magnitude of harmful outcomes resulting from climate-related hazard" (Brooks and Adger 2005).

Climate Change: "A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.' The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes" (IPCC 2018).

Climate extreme (extreme weather or climate event): "The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes'" (IPCC 2018).

Disaster: "Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery" (IPCC 2018).

Gender: "Gender refers to the roles, responsibilities, characteristics, and behaviors that a given society associates with our identities as women, girls, men, boys, or non-binary people. Gender is socially and culturally constructed, so our understandings of gender differ across contexts and over time. Gender influences what is expected of each of us, the power we have in society, how we relate to others, and the norms to which we are expected to conform. Gender is a distinct concept and not the same as sex classification, which is typically assigned at birth" (Pathfinder International 2022).

Hazard: "A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Annotations: Hazards may be natural, anthropogenic or socionatural in origin. Natural hazards are predominantly associated with natural processes and phenomena. Anthropogenic hazards, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are socionatural, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change. Hazards may be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity or magnitude, frequency and probability. Biological hazards are also defined by their infectiousness or toxicity, or other characteristics of the pathogen such as dose-response, incubation period, case fatality rate and estimation of the pathogen for transmission. Multi-hazard means (1) the selection of multiple major hazards that the country faces, and (2) the specific contexts where hazardous events may occur simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects. Hazards include (as mentioned in the Sendai Framework for Disaster Risk Reduction 2015-2030, and listed in alphabetical order) biological, environmental, geological, hydrometeorological and technological processes and phenomena" (UNDRR 2022a).

Mitigation (of climate change): "A human intervention to reduce emissions or enhance the sinks of greenhouse gases." Mitigation measures "are technologies, processes or practices that contribute to mitigation, for example, renewable energy (RE) technologies, waste minimization processes and public transport commuting practices." A mitigation option is "a technology or practice that reduces GHG emissions or enhances sinks" (IPCC 2018).

Risk: "The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence." (IPCC 2018).

Resilience: "The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding to or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation period" (IPCC 2018). UNDRR defines resilience as "the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" (UNDRR 2022b). Resilience capacity is "the ability of communities to survive, adapt and progress in the face of stress, without distress or loss of assets, while improving their current level of livelihood and health status" (Chauhan 2021).

Shock: "Realizations of highly unexpected events that cause welfare losses… that encompasses: i) unexpectedness (i.e. the risky damaging fluctuation already happened, though it had low exante probability); ii) size, iii) high damage due to concentration on persons with high vulnerability and low resilience; iv) exogenousness in the source; and v) physical or psychological strain to one or more individuals due to that stress. Thus, the term climate shock would already cover what the disaster literature considers to be a natural disaster: those events that outstrip the capacity of a society to cope with it" (de la Fuente 2007).

Vulnerability: "A product of complex climate-society interactions across scale and cannot be reduced to questions of individual qualities. Rather, people's vulnerabilities to the impacts of climate change are highly contextual; these are shaped by the extent to which they can realize their basic human rights and by health of the ecological systems they depend on for their livelihoods and wellbeing. Alarmingly, the literature stresses that people who face the highest risk of biophysical changes and of experiencing the most severe impacts of climate change are those who already suffer from multi-dimensional inequalities in their lives. 'Both climate variability and change are considered to occur in the context of political, institutional, economic and social structures and changes, which interact dynamically with contextual conditions associated with a particular 'exposure unit'

[…] From this perspective, reducing vulnerability involves altering the context in which climate change occurs, so that individuals and groups can better respond to changing conditions. It also stresses the need to mitigate climate change on the basis of equity and justice' (O'Brien et al. 2007). This framing differs from conceptualizations of vulnerability as a result (outcome) of projected impacts of climate change only on a particular 'exposure unit'" (van Eerdewijk, Bråten, and Danielsen 2021).

Learn More: Key Terms

THEME	LEARNING RESOURCE	LINK
Climate terms	For additional terms and definitions around climate, see the IPCC glossary (IPCC 2018)	https://www.ipcc.ch/sr15/chapter/glossary/
Defining hazards	For detailed definitions of 302 identified hazards, see the *Hazard Information Profiles* (Murray et al. 2021)	https://www.undrr.org/publication/hazard-information-profiles-supplement-undrr-isc-hazard-definition-classification

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Pathfinder International is driven by the conviction that all people, regardless of where they live, have the right to decide whether and when to have children, to exist free from fear and stigma, and to lead the lives they choose. As a global health organization with locally led, community-driven programs, we support women to make their own reproductive health decisions. We work with local partners to advance contraceptive services, comprehensive abortion care, and young people's sexual and reproductive rights in communities around the world—including those affected by poverty, conflict, climate change, and natural disasters. Taken together, our programs enable millions of people to choose their own paths forward.

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