



# Education, Girls' Education and Climate Change

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## About this report

The K4D Emerging Issues Report series highlights research and emerging evidence to policy-makers to help inform policies that are more resilient to the future. K4D staff researchers work with thematic experts and the UK Government's Foreign, Commonwealth & Development Office (FCDO) to identify where new or emerging research can inform and influence policy.

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## Overview and introduction

This Emerging Issue Report (EIR) explores research and evidence on the relationship between education, girls' education and climate change.

There is scientific consensus that climate change is real, manifested through increasing temperatures, changing rainfall patterns and increasing frequency and severity of extreme weather events, including drought, flooding and cyclones (IPCC, 2012, 2014). Climate change, environmental degradation and climate vulnerability are closely linked (IPCC, 2019). Climate change exacerbates environmental and land degradation, especially in areas with drylands and permafrost, river deltas and low-lying coastal areas. There is high confidence that people living in areas affected by environmental degradation are experiencing an increase in the negative effects of climate change (IPCC, 2019). Gender, alongside other drivers of vulnerability and exclusion, is a key determinant of an individual's vulnerability to the effects of climate change and environmental degradation, and influences how climate change is experienced (Kwauk et al., 2019; Vincent et al., 2014; Muttarak & Lutz, 2014). It is estimated that at least 200 million adolescent girls living in the poorest communities face heightened risk from the effects of climate change (Atkinson & Bruce, 2015).

Although this report refers to women and girls throughout, it is important that they are not seen as a homogenous group due to a range of factors that influence identity, including poverty, age, ethnicity, disability, socioeconomic status, geographic location and HIV status, among others (Plan International, 2011; Djoudi et al., 2016). In addition, as this report highlights, women and girls should not be seen as passive victims of climate change, as this can obscure their role as powerful agents of change and may cause misinterpretation of the causes of vulnerability (Ravera et al., 2016).

Extreme weather events, such as floods and tropical cyclones, can disrupt learning in a variety of ways. The direct and immediate impacts of extreme weather include damage and/or destruction to education infrastructure; however, indirect and secondary impacts can last much longer (Kousky, 2016; Anderson, 2019). These include, but are not limited to: damage to road and transport links, obstructing access to school and learning; adolescent girls' unwillingness to attend school if water, sanitation and hygiene (WASH) facilities are not quickly rehabilitated; inability to pay for school fees and/or learning materials; displacement of families; and reduced capacity for learning because of malnutrition or trauma (Kousky, 2016; Anderson, 2019; Nordstrom & Cotton, 2020; Chuang et al., 2018; Siriwardhana et al., 2013).

Evidence and commentary on the role of education, and girls' education, to address climate change through adaptation, resilience and mitigation is limited, albeit growing. This EIR identifies and summarises evidence and key commentary around the following themes:

1. Links between education, particularly girls' education, and climate change.
2. How climate and environment matter for achieving gender equality.
3. Why securing girls' education is an important strategy in addressing climate change.

The EIR draws on academic research and literature from low- and middle-income countries (LMICs), as well as policy frameworks and grey literature, media articles and blogs from the climate, education and gender fields.

This report was commissioned as part of a wider Education, Climate and Environment, and Infrastructure Learning Journey, which explores the complex relationship between those sectors. The Learning Journey brings together a coalition of partners, including the United Kingdom's Foreign, Commonwealth & Development Office (FCDO), the European Commission, the Global Partnership for Education, Knowledge, Evidence and Learning for Development (K4D),<sup>1</sup> and the Australian Council for Educational Research (ACER) to harness multi-disciplinary approaches in embedding climate and environment into educational programming. The Learning Journey has developed a suite of forthcoming learning products, including:

- Mapping of education, climate and environment programmes.
- Consolidation of guidance on good practice for educational infrastructure.

Key findings are given below for each theme.

### **Links between education, girls' education and climate change**

It is estimated that environmental threats, which include weather-related disasters, disrupt the education of approximately 37.5 million learners across the globe each year (Theirworld, 2018). There are several ways in which climate change can disrupt – and is disrupting – education. Damage to infrastructure and transport links or displacement can disrupt learners' physical access to education facilities (Education Cannot Wait, 2020; IDMC, 2020b). And there are negative effects of disasters – including weather-related ones – on children's physical and mental health and wellbeing, which can impact children's physical and neurological development and ability to concentrate (Kousky, 2016; Peek et al., 2018).

The consequences for livelihoods, food security and household income can be particularly destabilising in low-income contexts and influence decisions on schooling (Nordstrom & Cotton, 2020). These decisions include withdrawing children from education to support household chores, finding alternative income or arranging marriages. If children are not withdrawn from school, their learning and progress may still be negatively impacted by increases in household responsibilities and less time available to study (Chuang et al., 2018; Kousky, 2016).

Extreme weather events, such as floods and tropical cyclones, can disrupt learning in a variety of ways. The direct and immediate impacts of extreme weather include damage and/or destruction to education infrastructure; however, indirect and secondary impacts can last much longer (Kousky, 2016; Anderson, 2019). These include, but are not limited to: damage to road and transport links, obstructing access to school and learning; adolescent girls' unwillingness to attend school if water, sanitation and hygiene (WASH) facilities are not quickly rehabilitated; inability to pay for school fees and/or learning materials; displacement of families; and reduced capacity for learning because of malnutrition or trauma (Kousky, 2016; Anderson, 2019; Nordstrom & Cotton, 2020; Chuang et al., 2018; Siriwardhana et al., 2013).

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<sup>1</sup> K4D is a consortium of leading UK-based knowledge institutions, which is led by the Institute of Development Studies and the University of Birmingham International Development Department. It is a five-year programme, running to September 2021, that supports the use of learning and evidence to improve the impact of development policy and programmes. It is funded by UK aid and is designed to assist the FCDO and other UK government departments and partners to be innovative and responsive to rapidly changing and complex development challenges. Education Development Trust is the education lead within this consortium and leads the Education, Climate and Environment, and Infrastructure Learning Journey.

Climate change therefore threatens to reverse developmental gains made in access to education over the past couple of decades, which is a growing risk as its effects become increasingly unpredictable and severe. The impact on children could potentially be long lasting.

Further, girls' educational access, attendance and learning outcomes risk being undone by climate change and environmental degradation (Chigwanda, 2016). Although research highlights an impact on all children, there seems to be a disproportionate impact on girls as barriers to their education are multiplied by the effects of climate change and environmental degradation, which can have long-lasting negative consequences (Chigwanda, 2016; Plan International, 2019a). A variety of factors can influence this, including an increase in household chores and responsibilities, which are typically allocated to girls in contexts where there are gendered norms; decisions to withdraw girls from education, prioritising their male siblings' education; and, in some contexts, difficulties in managing menstrual hygiene (Chigwanda, 2016; Le Masson et al., 2016; Atkinson & Bruce, 2015).

However, despite the vulnerability of the education sector and children to the effects of climate change and environmental degradation, there is growing evidence on the important role of education to support climate resilience, adaptation and mitigation. For example, research has identified direct and indirect effects of education on reducing vulnerability to climate change, thereby decreasing the negative impact of weather-related disasters (Muttarak & Lutz, 2014). Girls' education, particularly secondary education, has been identified as the most important socioeconomic determinant to reduce vulnerability to weather-related disasters and extreme weather (Streissnig et al., 2013, p. 5; Blankespoor et al., 2010, p. 12). The effects of weather-related disasters and extreme weather can be mitigated through effective, contextually relevant and child-centred disaster risk reduction education (Sellabos et al., 2011).

A number of authors have commented how, despite mutually reinforcing interlinkages between girls' education and positive climate outcomes, climate strategies are largely silent on girls and overlook the role of children and young people (Kwauk et al., 2019; Send my Friend to School, 2020). The importance of quality education that encourages global citizenship and enables participation and female environmental leadership has been propelled by the rise of Greta Thunberg, the Swedish schoolgirl who spearheaded the "school strike for the climate" movement across the globe and became the face of young people's demands for international leaders to address the climate crisis (BBC News, 2020). Greta has demanded that governments and the private sector take urgent action to meet climate targets; sailed across the Atlantic to attend the UN Climate Summit in 2019; and has galvanised around 4 million schoolchildren to join her protests across the world, which continue online due to COVID-19 restrictions (BBC News, 2020; McGrath, 2019; Thunberg, 2020). Malala Yousafzai, a Pakistani activist for girls' education who was attacked by the Taliban on her way to school, has also spoken of the importance of girls and their education as key to addressing the climate crisis (Kwauk & Braga, 2017a). However, youth-led school strikes have left teachers and school leaders in high-income countries in a dilemma about whether to support their pupils due to the risk of impacting students' test scores and teacher/school performance indicators (Kwauk, 2020b).

This also highlights the important role of young people – and girls in particular – in addressing the climate crisis. Both Malala and Greta, alongside many other youth climate activists across low-, middle- and high-income countries, have become role models for their peers and contributed to putting these issues on the global agenda (Amnesty International UK, 2020; McCarthy & Sanchez, 2019).

### **Climate, environment and gender equality**

Climate vulnerability reflects gender inequalities and exacerbates socially constructed power relations, norms and practices (Kwauk et al., 2019, p. 3; UNDP, 2016a). Therefore, climate change impacts are not gender neutral: women and men experience consequences of exposure to climate change and environmental degradation differently. In some contexts, climate change and environmental degradation exacerbate gender inequalities and impact the abilities of

individuals, households and communities to adapt. However, there is a need for more robust disaggregated data at global level to understand the connection between gender, age, inequality and exposure to disaster risk, and for greater nuance within existing evidence (UN Women & UNICEF, 2019; Rao et al., 2019).

There is some evidence to suggest that due to gendered responsibilities and household chores, women are more vulnerable to climate and environmental risks. In contexts where women and girls are responsible for running and feeding households, the labour burden associated with collecting fuel and water is likely to increase as a result of extreme weather. This can result in spending more time having to travel further or work harder to collect necessary resources (UNDP, 2016b). Therefore, in these contexts, women face heightened vulnerability to and risk from the longer-term effects of climate change.

Due to inequalities in society and drivers of vulnerability, women and girls are more likely to be impacted in the aftermath of weather-related disasters compared with their male counterparts (Vincent et al., 2014; Neumayer & Plümper, 2007; Le Masson et al., 2016; Atkinson & Bruce, 2015). This includes a heightened probability of female fatalities, female displacement, sexual assault and gender-based violence (Neumayer & Plümper, 2007; Le Masson et al., 2016; UNDP, 2016a). Coping strategies in response to weather-related disasters, extreme weather and subsequent reduced income include child and forced marriage, and sex work (Le Masson et al., 2016; Alston et al., 2014; Le Masson et al., 2018; Plan International, 2019b).

Therefore, the consequences of gender differences and inequalities not only influence the vulnerability of individuals to the effects of climate change, but undermine progress towards gender equality and inclusive societies.

### **Girls' education as an important strategy in addressing climate change**

Evidence on the importance of securing girls' education – especially secondary education – to address climate change is limited, albeit growing. As highlighted above, the link between education, girls' education and gender equality as a strategy to reduce climate vulnerability is important. This is further supported by emerging evidence on the environmental benefits of transformative education for girls that develops their leadership skills, and empowers political and civil society participation and engagement (Lv & Deng, 2019; Norgaard & York, 2005; Nelson, 2019).

Education that encourages participation and empowerment has been found to increase voice and agency, and consequently support collective action on the impacts of climate change (Rao et al., 2019). In addition, it is expected that building girls' green skills, through science, technology, engineering and mathematics (STEM) education will enable the transition to a green and low-carbon economy, and support diversification in this sector (UNICEF, 2020; Kwauk, Kwauk, 2020b).

Some studies claim that girls' education, coupled with sexual health and reproductive rights education and access to family planning services, is one of the most effective strategies in reducing carbon emissions, through slowing population growth (Wheeler & Hammer, 2010; Project Drawdown, n.d.; Kharas, 2016). These conclusions have received considerable criticism for overemphasising the role of girls' education as a climate mitigation strategy for two main reasons (Kwauk, 2020a).

Firstly, there is a risk that these findings have over-simplified the complex causal chain between girls' education, family planning, population size and a reduction in carbon emissions, as a variety of factors outside of education influence not only women's family planning decisions, but also the reduction of carbon emissions. Furthermore, a general inconsistency in evidence on the

link between education and sexual and reproductive health in LMICs has been identified (Psaki et al., 2019). Therefore, further research is needed to fully understand this causal chain and the role of external variables.

Secondly, and related in part to the role of external variables in the causal chain of girls' education and climate mitigation, Kwauk (2020a) and Plan International (2019a) have warned that promoting this view could distract attention from the need to take action in wealthier countries and regions with low rates of population growth but significantly higher levels of carbon emissions per capita. To effectively address climate change and environmental degradation, there is a need to understand "patterns of emission" rather than the "number of emitters" (Kwauk, 2020a).

## **Evidence on the links between education, girls' education and climate change**

The evidence on the links and interrelationship between these two areas can be broadly grouped into two themes: the impact of climate change on education, including girls' education; and the role of education in addressing climate change.

Despite strong suggestive evidence on the important role of education, and girls' education, in addressing climate change that is outlined in this section, climate strategies are largely silent on gender and overlook the role of children and young people (Kwauk et al., 2019; Holvoet & Inberg, 2014). A recent analysis of 160 nationally determined contributions (NDCs)<sup>2</sup> found that countries can do significantly more to embed gender and education into their climate strategies (Kwauk et al., 2019). This study also highlighted that countries could better reflect the spirit of the Paris Agreement (UN 2015) by ensuring that climate action attends to issues of fairness, equity and justice. The NDCs position education in a passive role, with some general activity; for example 'public education' or 'awareness raising,' rather than explicitly describing the role of children and young people in mitigation and adaptation efforts. Kwauk et al. (2019) argue that the passive positioning of education within NDCs discourages the participation of actors in the education sector who could provide invaluable support for deepening the integration of climate and education strategies. In addition, Dazé & Dekens (2017) highlight that adaptation efforts will neither be effective nor sustainable without adequately addressing gender; by applying a gender-blind lens these processes risk exacerbating existing gender inequalities or contributing to new ones (p. 2).

### **The impact of climate change on education**

IPCC (IPCC, 2012, 2014) recognises the role of climate change in increasing the frequency and severity of extreme weather events, including drought, flooding and cyclones. Globally, it is estimated that environmental threats, including weather-related disasters and disease outbreaks, disrupt the education of approximately 37.5 million learners each year (Theirworld, 2018). The direct and immediate impacts of extreme weather include damage and/or destruction to education infrastructure; however, indirect and secondary impacts can last much longer (Kousky, 2016; Anderson, 2019). Much of this literature refers to children, or children and young people,

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<sup>2</sup> NDCs are country-level climate strategies to reduce emissions and adapt to the effects of climate change.



and although some sources disaggregate data by gender, there is a lack of disaggregation by age, race or disability (Peek et al., 2018).

### **Physical and mental health and wellbeing, and reduced learning capacity**

The effects of climate change and environmental degradation, including through weather-related disasters, can be detrimental to children's physical and mental health, which in turn can negatively impact their educational outcomes (Kousky, 2016). With regards to weather-related disasters, extreme weather or sudden shocks, there is a correlation between the severity of the disaster and the size of the effect on a child; however, negative effects are generally greater in developing countries and for those from low socioeconomic backgrounds. In the aftermath of a disaster, children may experience malnutrition due to a family's loss of food crops or income to spend on food; or face a heightened risk of illness from infectious diseases, including diarrhoea and cholera, due to unhygienic conditions and lack of safe drinking water (Kousky, 2016, pp. 78–79). Malnutrition caused by the impacts of weather-related disasters and extreme weather conditions can hinder children's learning ability through their decreased ability to concentrate and stunted neurological development (Kousky, 2016; Chigwanda, 2016).

Children's mental resilience in response to experiencing weather-related disasters is dependent on an array of contextual and individual variables (Kousky, 2016). However, a number of studies have identified a causal chain between a child's experience of a weather-related disaster; an increase in post-traumatic stress, anxiety and other psychological symptoms; and declining educational outcomes (Siriwardhana et al., 2013; Kousky, 2016; Peek et al., 2018). For example, Peek et al. (2018) highlighted the experience of disasters as a key influence on children's ability to focus on schoolwork and poor classroom behaviour. A study from Sri Lanka found increased levels of school absenteeism in children who had a traumatic experience following the tsunami in 2004 (Siriwardhana et al., 2013). A growing number of studies examine the secondary impact of disasters, which include a heightened risk of child abuse and exploitation (Peek et al., 2018).

Several other studies have found that increased exposure to air pollution (including while in the womb) can be detrimental to children's educational outcomes, which could be intensified by increasing levels of pollution (Persico, 2019; Marcotte, 2016). For example, in Chile exposure to outdoor air pollution negatively impacted children's cognitive performance by "exacerbating respiratory illnesses, fatigue, absenteeism and attention problems" (Miller and Vela, 2013, p. 4). A long-term study from a high-income country on exposure to pollution and educational outcomes found that children living within two miles of a hazardous waste site that omitted high levels of pollutants had a 23% increase in cognitive disabilities (e.g. learning disabilities, autism, speech and language impairments), and were more likely to be suspended from school and to repeat a grade (Persico, 2019).

A multi-sectoral coordinated approach is therefore required to adequately address the negative impacts of climate change and environmental degradation on children's educational outcomes. This includes, but is not limited to, increased psychosocial support, safeguarding and access to health services, which may also be under increased strain because of changing rainfall patterns and increased extreme weather events.

### **Household impacts**

The impact of climate change and environmental degradation on livelihoods, household finances and food security is widely recognised. This can have consequences on household resource

allocation and schooling decisions (Nordstrom & Cotton, 2020). It can be particularly destabilising for low-income households and those reliant on good weather for their livelihoods, including in agriculture and tourism. To supplement reduced incomes or protect unstable incomes, some families may pull children out of education to work, or arrange marriages for their daughters (Chuang et al., 2018; Kousky, 2016; Post-Cyclone Idai Cabinet for Reconstruction, 2019, pp. 107–108).

However, research conducted on the impact of drought on education using data from the UK Aid Direct-funded Girls' Education Challenge in Zimbabwe found that girls in drought-affected locations were more likely to be enrolled in school the year following the drought than those in areas unaffected by drought (Nordstrom & Cotton, 2020). The data also indicated that girls spent less time working for their family farm or business as a result of drought. Despite increases in school enrolment and attendance, learning outcomes and leadership skills decreased, which suggests that school participation does not necessarily result in improvements in learning and that other impacts of drought, including on mental health, can offset these improvements.

A study on the effect of drought on 300 smallholder farmers in Iran found a negative relationship between farm income and education expenditure, meaning that smallholders affected by drought increased expenditure on their children's education (Khalili et al., 2020). In drought-affected communities, girls were more likely to be pulled out of university education than boys; however, there were no significant differences between girls' and boys' enrolment in basic education (Khalili et al., 2020). This therefore adds nuance and complexity to previously held assumptions that girls are more likely to be pulled out of education before their male counterparts as a result of stress on household income.

### **Damage to infrastructure**

There is limited evidence on the medium- to long-term impact of destruction of school facilities caused by weather-related disasters in LMICs (Kousky, 2016). However, several organisations have highlighted the short-term consequences of specific extreme weather events on education infrastructure (Theirworld, 2018; Education Cannot Wait, 2020).

For example, severe cyclones in 2019 across southern Africa damaged or destroyed over 2,000 schools in Malawi, Zimbabwe, Mozambique and the Comoros, and were estimated to have disrupted the education of over 435,000 learners (Education Cannot Wait, 2020). In Malawi, learners self-reported additional disruptions to their education in the aftermath of Cyclone Idai in 2019. These included, but were not limited to: difficulties in concentrating caused by stress and trauma; disruption to transport and electricity supplies, impacting their ability to get to class and study remotely; damage to learners' homes, making completing homework difficult; and lost learning materials, school uniforms, identification, certificates and other documentation, posing barriers to returning to education (Haneef & Tembe, 2019; Post-Cyclone Idai Cabinet for Reconstruction, 2019). The cost of the education sector's recovery following this cyclone was estimated at USD 122 million (Post-Cyclone Idai Cabinet for Reconstruction, 2019, p. 111).

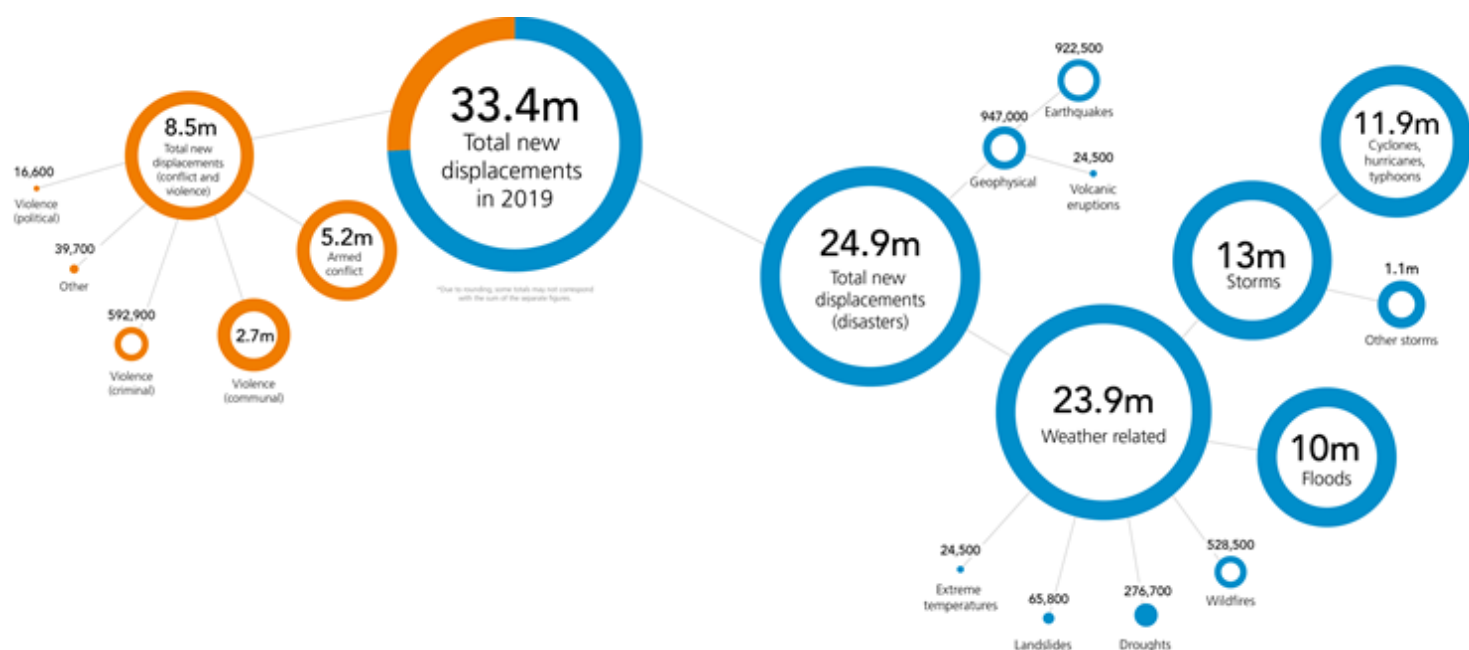
### **Forced displacement**

Disasters brought about by extreme weather events, such as floods and tropical cyclones, can lead to displacement. However, patterns of displacement are very much dependent on the nature of the disaster or effect of climate change, socioeconomic status of the household and gender divide (Le Masson et al., 2016). Internal displacement can intensify impacts on children's physical and mental health and wellbeing, through exclusion to social services and interruptions to accessing familiar school environments (IDMC, 2020b). Children who are displaced and out of

school for an extended period tend to experience higher rates of dropout, lower test scores, and higher incidence of educational and behavioural issues (Peek et al., 2018). However, comprehensive research is needed on the impact and relationship between climate change, displacement and education (IDMC, 2020b).

The scale of this disruption is highlighted in figures from the Internal Displacement Monitoring Centre (IDMC), which show that 75% of newly recorded displacements (23.9 million people) in 2019 were caused by weather-related events, including storms, cyclones, hurricanes and typhoons, floods, wildfires, droughts and landslides (Figure 1). UNICEF and UNESCO (2020) highlighted that between 2018 and 2019, UNICEF assisted 10 million children in complex and protracted emergencies related to climate change.

Figure 1: Displacements reported by IDMC in 2019



Source: IDMC, 2020a, pp. 9-10.<sup>3</sup>

## The role of education in addressing climate change and environmental degradation

The role of education in addressing climate change and environmental degradation can be generally grouped into two areas: climate adaptation and resilience; and climate mitigation. The former can be broadly defined as education to address the **effects** of climate change and environmental degradation, which focuses on reducing the vulnerability of systems (human, natural and education) to the effects of climate change and adapting to the changing climate. The latter focuses on education to address the **causes** of climate change and environmental degradation, which can include building skills, knowledge, competencies and behaviours to reduce greenhouse gas concentrations and emissions, conserve forests and protect the planet

<sup>3</sup> From “Global Report on Internal Displacement”, by IDMC, 2020. © 2020 IDMC. Reprinted under Creative Commons BY 3.0 IGO licence, in line with IDMC’s Terms of Use.

(Anderson, 2012). Despite a growing body of literature on these areas, the evidence base on the role of education to mitigate climate change remains limited, especially in LMICs.

This section first highlights evidence on the role of education, and girls' education, in supporting climate adaptation and resilience, including through disaster risk reduction (DRR). It then outlines the evidence and key commentary associated with education and climate mitigation.

### **Education, climate adaptation and resilience**

Education plays important direct and indirect roles in reducing the negative effects of weather-related disasters, climate change and environmental degradation by reducing the vulnerability of individuals and their communities (Muttarak & Lutz, 2014). There are growing calls for more research on the impact of children's resilience on their wider communities, as it is expected that there is a positive correlation between individual children's resilience and preparedness for disaster, and their schools' and communities' resilience (Peek et al., 2018).

Peek et al. (2018) used evidence from LMICs from Asia, Africa, and Central and South America to demonstrate that formal education directly supports the development of cognitive and problem-solving skills, knowledge and risk perception. As a result, educated individuals are more likely to respond better in the event of weather-related disasters, including through addressing and coping with the risks associated with disaster. Indirectly, education contributes to reducing vulnerability through poverty reduction, access to information and social capital. Educated individuals are associated with: implementation of disaster preparedness measures; evacuation at times of emergency; diversified and better access to useful information (including weather forecasts and warnings); and greater social capital, including social support and networks. At community level, this results in populations that are more adaptive and resilient in the preparation for, immediate response to and aftermath of weather-related disasters.

Girls' education, particularly secondary education, has been identified as the most important socioeconomic determinant in reducing vulnerability to weather-related disasters and extreme weather (Streissnig et al., 2013, p. 5; Blankespoor et al., 2010, p. 12). A World Bank study by Blankespoor et al. (2010) reached this conclusion by focusing on the role of socioeconomic development and strengthening climate resilience through female education and empowerment (p. 23). A later study that used quantitative regression analysis, which covered data from 125 developing countries from 1980 to 2010, emphasised the role of education in reducing the impact of natural disasters as being "the single most important social and economic factor associated with a reduction in vulnerability" (Streissnig et al., 2013, p. 5). Furthermore, the study estimated that by 2050, deaths due to natural extreme events in sub-Saharan Africa could be reduced by 60% if 70% of women aged 20–39 years completed lower secondary school (Streissnig et al., 2013, p. 6).

This argument is further supported by more recent evidence that identifies a strong positive association between the average number of years' schooling a girl receives in her country and the country's ND-GAIN index,<sup>4</sup> a measure of a country's resilience to climate disasters (Kwauk and Braga, 2017c). This study found that for every additional year of schooling for a girl, her country's resilience to climate disasters could be expected to improve by 3.2 points (p. 19).

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<sup>4</sup> <https://gain-new.crc.nd.edu/ranking>.

However, as Blankespoor et al. (2010) highlight, girls' education offers more and wider benefits in strengthening climate resilience, which may increase value for money more than direct investment in emergency preparedness. This is because of the contribution of girls' education to sustainable development, the role of female education in advancing gender equality and the knock-on benefits that gender equality has in reducing climate vulnerability.

## **Disaster risk reduction**

DRR is an approach and practice to reduce the risk and damage caused by climate hazards (e.g. floods, droughts and monsoons) through systematic identification, analysis and management of the factors associated with these events (INEE, n.d.). This includes: reducing exposure to hazards; identifying and mitigating the vulnerability of facilities and people; effective land management; and ensuring preparedness for hazards. Embedding DRR in education sector planning is essential and common practice in many countries that are vulnerable to natural hazards and climate shocks such as floods, monsoons and earthquakes. A recent evaluation of UNICEF's DRR programming in education in East Asia and the Pacific found that DRR should more actively support out-of-school children (Reed & Blariaux, 2020).

Evidence suggests that child-centred DRR programmes support the ability to reduce risk at household and community levels, and emphasises the role and capacity of children and young people to "mobilise adults and external policy actors to effect change on wider determinants of risk and vulnerability" (Sellabos et al., 2011, p. 35). When child-centred DRR is introduced to and practised by young children, research indicates that what they learn is integrated into their adult lives and even benefits subsequent generations. As a result, investment in child-centred DRR may yield higher benefits and savings than when these skills are introduced in adult life.

The Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector in 2017 launched the Comprehensive School Safety Framework.<sup>5</sup> The contents of the Comprehensive School Safety Framework overlap with other international agreements and frameworks. These include the Sendai Framework for Disaster Risk Reduction 2015–2030, which mandates the collection of data disaggregated by sex, age and disability to inform disaster risk modelling and preparedness (United Nations Office for Disaster Risk Reduction, 2015). In addition, the Paris Agreement demonstrates a strong commitment to gender equality and human rights.<sup>6</sup>

However, as an education-specific framework on DRR, the following section summarises the three main pillars within the Comprehensive School Safety Framework that are required to ensure the safety of learners and protect their access to education.

### **1. Safe learning facilities**

The physical safety of schools is paramount to avoid disruption to educational services and undue harm to learners. Safe learning facilities require cooperation and coordination across and beyond the education and infrastructure systems to ensure sites to construct new schools are safe; that safety features are accessible for people with disabilities; that mitigation measures are in place

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<sup>5</sup> The Comprehensive School Safety Framework, Targets and Indicators are being reviewed and updated in 2021.

<sup>6</sup> See section 7.5, 11.2 [https://unfccc.int/sites/default/files/english\\_paris\\_agreement.pdf](https://unfccc.int/sites/default/files/english_paris_agreement.pdf)

for natural hazards; and that construction, rehabilitation or refurbishment and maintenance of buildings are climate smart (UNDRR & GADRRRES, 2017). These stakeholders include, but are not limited to, school leaders and middle-tier education leaders, community members, local authorities, NGOs, architects, engineers and builders.

## **2. School disaster management**

Disaster management for schools requires vertical and horizontal coordination across all levels of education leadership and administration to ensure:

- Clear policies are set at national level for ongoing multi-hazard assessment (of structural, environmental and social risks) and clear response and contingency plans based on the International Network for Education in Emergencies' Minimum Standards for emergency preparedness, response and recovery (INEE, 2012; UNDRR & GADRRRES, 2017).
- School leaders, teachers and committees receive necessary training for identifying, analysing and mitigating hazards, and understanding local vulnerabilities to climate shocks. This includes, but is not limited to, knowing how to react to early warning systems (UNDRR & GADRRRES, 2017).
- Local schools work together to share risk mapping and mitigation planning for an effective response that is shared with local communities to support children who are not in school and children with disabilities (UNDRR & GADRRRES, 2017).
- Schools work with children and their families so that they understand the necessary procedures in response to an emergency (UNDRR & GADRRRES, 2017).

In a context of increasing frequency and severity of extreme weather events and the need for comprehensive coordination for effective disaster management, there are perhaps interesting and useful lessons to learn from education in emergency settings, which tend to be more adaptive and resilient to disruption. Education in emergencies can stimulate rapid collaborations between governments, the private sector, NGOs and education institutions to support continuity of access to learning; accelerate data collection to support system-level analysis and policymaking; support informal learning; and often includes elements of psychosocial support to protect learners' wellbeing (Hallgarten et al., 2020).

School disaster management plans could go even further to ensure that, should disruption to schooling occur, necessary measures are in place to encourage vulnerable children back to school. It is especially important that the same lessons are captured in education systems' preparation for the effects of climate change as natural hazards and climate shocks become increasingly unpredictable due to abnormal weather patterns, and threats associated with natural hazards are amplified due to the effects of climate change.

## **3. Risk reduction and resilience education**

Teachers, learners, the curriculum and the wider school community are the focus of risk reduction and resilience education (UNDRR & GADRRRES, 2017).

Contextually specific information and learning that is embedded into the curriculum can be life-saving for children and their wider community, which highlights the important role that local community leaders can play in shaping the curriculum. However, the content of the curriculum must also be delivered in a way that is age appropriate and contextually relevant to learners. In South East Asia, the International Federation of Red Cross and Red Crescent Societies

advocates that schools and families engage their children with risk reduction and resilience education through play, to ensure that children remain calm and relaxed while learning, and that learning does not become abstract (IFRC, 2010). This can include short exercises during risk and hazard assessments, as well as longer-term project-based activities for older children, all of which can be translated into local languages.

### **Bangladesh – learning to swim as a life-saving skill**

In Bangladesh, in low-lying areas close to river banks that are prone to flooding during the monsoon season, the government has made swimming lessons compulsory in schools to prevent children from drowning in waterways (BBC News, 2015; Rashin, 2013; Hammadi, 2016). In Dhaka, classes are held in portable swimming pools; however, in rural areas classes are held in local waterways that are cordoned off using bamboo structures. The lessons are also used to teach vital survival skills, including how to rescue someone who is experiencing difficulty in water or drowning, and how to administer cardiopulmonary resuscitation. Although this may not be climate change education or education for sustainable development in the traditional sense, it is a clear example of using education to teach life(-saving) skills in response to local climate conditions.

## **Education and climate mitigation**

Education is widely recognised as a powerful tool to create change and has been a central element in numerous behaviour change initiatives (Bayley, n.d.; Duncan, 2013). It has been argued that education is an essential component to foster shared understanding of the nature and impact of climate change, which is critical in supporting national and international climate action (Stern, 2007 p. xxi; Bangay & Blum, 2010). This has been highlighted in recent years with the role of youth activism in promoting climate action and mitigation, led by young female role models including Greta Thunberg, Malala Yousafzai and others. However, there is a general lack of evidence-based research on the impact of climate change education (CCE) or education for sustainable development (ESD) on behaviour change, especially in LMICs (Anderson, 2012). Evidence from elsewhere has found that CCE and ESD – including climate science and literacy, environmental education and education for sustainable lifestyles – improve individuals' understanding of climate change, which can support greater awareness of environmental issues and a stronger sense of responsibility to take action (Anderson, 2012, p. 197).

However, both ESD and CCE have received challenges to their ability to transform society due to shortcomings in encouraging individuals to embed environmentally responsible behaviour into their daily lives (Silova et al., 2018). For example, information on the environment tends to be presented at system level and can create disengagement at individual or community levels; not only can systemic information be difficult to relate to, but communities have little control over influencing outcomes at this level (Dutta & Chandrasekharan, 2018). This is corroborated by wider literature and studies that indicate teaching children about the environment is not enough to influence their behaviour or values in relation to climate change (Boeve-de Pauw & van Petegem, 2013). Additionally, in countries where universal access to basic education has yet to be achieved and where levels of literacy and numeracy are low, embedding ESD or CCE into the curriculum may not be a priority (Kwauk, 2020a; Silova et al., 2018).

These arguments and research on effective CCE interventions highlight the importance of contextualising ESD and CCE to ensure content is accessible and relevant to the needs of individuals and communities, which could in turn support buy-in from local education stakeholders (Anderson, 2012). All actors across the education system, especially teachers and school leaders, must be supported in embedding ESD and CCE into their practice. Teacher education, empowerment and ongoing professional development are essential to provide quality ESD and CCE (Ledley et al., 2017). This is highlighted by characteristics that have been identified in successful school-level interventions to foster more sustainable behaviour in learners behaviour, which have connected active learning with children's participation in school decisions and local problem-solving (Cincera & Krajhanzl, 2013; Ledley et al., 2017). Equally, ESD and CCE must be understood as subjects that go beyond the school walls and formal education; for example, through outdoor learning, tertiary education and community-based learning (Zhang et al., 2019).

## Evidence on how climate and environment matter for achieving gender equality

Climate vulnerability reflects gender inequalities and exacerbates socially constructed power relations, norms and practices (Kwauk et al., 2019, p. 3; UNDP, 2016a). Disparities in certain groups' access to resources and capabilities often results in increased likelihood of poverty, decreased likelihood of accessing education and being involved in decisions at the community and household levels that affect their lives, which intensifies disadvantage and climate vulnerability (Neumayer & Plümpner, 2007; UNDP, 2016a; Djoudi et al., 2016; Kaijser & Kronsell, 2013). Therefore, the effects of climate change and environmental degradation are generally not gender neutral, typically affecting women and girls more than their male counterparts (Kwauk et al., 2019; UNDP, 2016a; Ashraf & Azad, 2015; Centre for Gender and Disaster, 2020; Rao et al., 2019). Risks to girls are further intensified when they face multiple forms of marginalisation, including, for example, girls with disabilities (Plan International, 2019a).

However, research and literature on gender and climate change have been criticised for oversimplifying the determinants of vulnerability, that stated 'facts' have not always been empirically rigorous, and that gender is presented in a static way that distracts attention from inequalities and the need for a contextualised approach and intersectional understanding (Arora-Jonsson, 2010; Rao et al., 2019).

A recent study and policy brief published by UN Women and UNICEF (2019) highlighted the need for stronger disaggregated data at the global level to understand the connection between gender, age, inequality and disaster risk, which is mandated in the Sendai Framework (UNDRR, 2015, p. 4). In particular, data are not mainstreamed for the most vulnerable populations, including minority and marginalised groups. The study found that data on differential impacts are context and event specific, which highlights the need to avoid making binary distinctions between women and men, and assume that women are always more vulnerable than their male counterparts. It is therefore important to avoid overgeneralising the findings outlined below, as specific contexts will be influenced by different inequalities and drivers of vulnerability.

In some contexts, women and girls are exposed to additional risks to their physical health as primary collectors of fuel and water for their households and communities, which can sometimes result in having to carry heavy loads (UNDP, 2016b, p. 3). In contexts where cultural norms dictate that men receive more food and water than women and girls, women with highly physical



workloads are more susceptible to illnesses including anaemia, perinatal mortality and postnatal complications. The consequences of their household responsibilities include 'time poverty', which can prevent them from pursuing education or other income-earning opportunities and is exacerbated by other household duties. As natural resources become more depleted, it is expected that these individuals will spend more time collecting fuel and water as a result of travelling further afield. However, research from Brazil has found that improving access to modern sources of energy alleviates some of these responsibilities for women and girls. As a result, UNDP notes that girls in rural areas in Brazil with access to electricity were 59% more likely to complete primary education than those without (UNDP, 2016b, p. 3).

Poorer women also tend to be involved in the informal economy, which is heavily dependent on biomass as its main energy source (UNDP, 2016b). Burning biomass releases pollutants and carbon dioxide, which create health hazards. It also contributes to soil degradation by reducing the amount of organic matter that creates nutrients for sustainable agriculture (Schröder, Beckers & Daniels, 2018; Ravindranath and Usha Rao, n.d.). Although not necessarily a risk related to climate change, UNDP estimates that 2 million women and children die prematurely each year due to illnesses caused by indoor smoke pollution, which is primarily due to smoke produced while cooking with solid fuels (2016a, p. 5).

### **Climate change as a threat to gender equality**

There is evidence to highlight existing and future threats to gender equality that differentiated vulnerability to the effects of climate change poses, which reinforces inequalities. Chigwanda (2016) highlights this by arguing that investments and gains made in girls' educational access, retention and learning outcomes risk being undone by climate change and environmental degradation. In addition, Plan International (2011) highlights that climate justice will never be achieved without first addressing the gender dimensions within climate change and environmental degradation.

It is widely acknowledged that, due to inequalities in society and drivers of vulnerability, women and girls are more likely to be affected in the aftermath of weather-related disasters compared to their male counterparts (Vincent et al., 2014; Neumayer & Plümper, 2007; Le Masson et al., 2016; Atkinson & Bruce, 2015). Analysis of data from 141 countries over the period 1981–2002 found that in societies where women have few socioeconomic rights and low socioeconomic status compared with men, natural disasters reduce women's life expectancy by more than their male counterparts (Neumayer & Plümper, 2007). The study also found a positive correlation between the effect on the gender gap in terms of life expectancy and the size and impact of the disaster. These findings are corroborated by other studies and statistics on natural disasters. For example, 65% of fatalities caused by the 2004 tsunami in Aceh province were female, and women represented 61% of fatalities caused in 2008 by Cyclone Nargis in Myanmar (Atkinson & Bruce, 2015).

In addition, there is a heightened probability of female displacement (an estimated 80% of people displaced by climate change are women), sexual assault and gender-based violence following a natural disaster (Le Masson et al., 2016; UNDP, 2016a). Although data on gender-based violence are generally underreported, research shows violence increases after disasters (Le Masson et al., 2016). In families where men migrate to find work, self-reported data from the wives of migrant workers that female-headed households experience increases in workload and discrimination, and a decrease in mobility (Le Masson et al., 2016). However, it is important to

note that these data vary depending on context; regional research from Ethiopia found contrasting findings.

Another negative coping strategy as a consequence of climate change is child marriage (Le Masson et al., 2016; Alston et al., 2014; Brides of the Sun, 2020). UNICEF (2014) estimated that more than 700 million women alive at the time of the report were married before their eighteenth birthday. Child marriage is especially prevalent in countries most vulnerable to the effects of climate change and environmental degradation (Girls Not Brides, 2017). This seems to be driven by financial factors, either to reduce the size of the household and the number of mouths to feed, or to use the dowry provided by the groom's family as a source of capital (Alston et al., 2014; Le Masson et al., 2016; Girls Not Brides, 2017). In Bangladesh, the dowry tends to be paid by the bride's family, which increases in value with the age of the girl. A three-year study found evidence that suggested economic hardship caused by climate change and environmental degradation creates incentives and an increase in child and forced marriage when dowries are not worth as much (Alston et al., 2014).

Other exploitative survival strategies have been identified as a consequence of crises, such as those exacerbated by climate change, including sex work and transactional sex, where livelihoods and economic security have been negatively affected (Le Masson et al., 2018; Plan International, 2019b). Evidence suggests that in the aftermath of weather-related and other natural disasters, women and girls have sought to remedy immediate shelter and food needs through sex work.

These consequences of climate change and environmental degradation, among others, have been found to have negative impacts on girls' access to basic education, which is key to achieving gender equality (Le Masson et al., 2016; Girls Not Brides, 2017; Atkinson & Bruce, 2015; Plan International, 2011; Chigwanda, 2016). Although evidence discussed elsewhere in this report highlights the disruption to and impact on all children's education outcomes, the literature highlights a disproportionate impact on girls as barriers to their education are multiplied by the effects of climate change and environmental degradation, which can have long-lasting negative consequences (Chigwanda, 2016; Plan International, 2019a). For example, there is an increased likelihood of girls' dropping out of school; or declining educational performance because of an increase in responsibilities to collect fuel, food or water, which are driven by traditional gender roles and household expectations (Chigwanda, 2016). In Botswana, a study on droughts and the vulnerability of children and young people found that 70% of children taken out of school were girls, and over 50% of girls reported an increase in travelling further to collect resources for their household (Chigwanda, 2016).

There is also some evidence to suggest that the economic impact of climate change on livelihoods and household finances has negatively impacted the funding of girls' education and school-related expenses (Chigwanda, 2016). In some cases, girls have been withdrawn from school to seek alternative ways to generate income. For households with multiple children in education, it has been found that the factors that influence the decision to prioritise one child's education over another's includes the sex of the child (usually prioritising boys over girls), or the level of education – with some preferring to support a child in secondary education and others preferring to support younger children so that their older siblings can take on more responsibilities. A study from Zimbabwe identified four key coping strategies to mitigate the effects of drought on household finances: borrowing money from lenders to purchase food; withdrawing children from school; begging for food from neighbours; and using savings to buy food, with the last being most predominant (Chigwanda, 2016).

Lastly, water scarcity caused by drought can negatively impact adolescent girls' education outcomes due to challenges in managing menstrual hygiene, which can prevent them from going to school (Chigwanda, 2016). In addition, impacts on livelihoods and household finances can result in sanitary products not being purchased.

### **Mitigating the risks to girls' education**

Despite the risk that climate change and environmental degradation poses to girls' education, there are ways to mitigate dropout and encourage re-enrolment, as highlighted below.

#### **Proactive mapping of vulnerable schools to protect education outcomes for girls**

To avoid disruption to schooling caused by natural disasters, the Population Council uses satellite imagery and remote sensors to collect data and map schools in Bangladesh that are vulnerable to natural hazards. The Population Council uses these data to support schools to develop action plans to mitigate against interruption to education provision and maintain contact with girls at risk of dropout during any disruption (Chuang et al., 2018).

#### **Flexible programme financing**

The study by Chigwanda (2016) draws heavily on programmatic data from the UK Department for International Development-funded Girls' Education Challenge in Zimbabwe, and quotes an education professional that highlights the lack of contingency within programme budgets to support responses to climate change, including drought (p. 8). As most donor-funded programming is contingent on achieving results and may not allow for contingency budgets to be redirected in the event of crises, programmes may face a low return on investment and risk not delivering benefits and impact to the target population. This could be driven by increased economic hardships encountered by individual girls, households, schools and wider communities. Chigwanda (2016) therefore advocates the need for girls' education programming to proactively address the barriers caused by, and coping mechanisms adopted in response to, climate change.

Arora-Jonsson (2011) identifies two key themes in the literature on gender and climate change, which present women as either victims or as being "virtuous", which includes being more open to behaviour change and strong policies on climate change (p. 744). This static perception assumes that women in LMICs and in the global South will experience the effects of climate change more acutely than their male counterparts, and that men in high-income countries and in the global North emit more pollutants than their female counterparts. For example, in India's 2008 National Action Plan on Climate Change, the only reference to gender was to highlight women's climate vulnerability. In India's Intended Nationally Determined Contribution (Prime Minister's Council on Climate Change, 2015), the only reference to gender was in acknowledgement of the many competing demands for resources, including to address gender inequality and female empowerment (p. 4). This study challenges previous research into gender and climate vulnerability and emphasises the importance of understanding climate vulnerability as a combination of various determinants, which include socioeconomic status, gender and cultural norms.

Arora-Jonsson (2011) further argues that this perception can distract attention away from consideration of gender inequalities and power relations, and consequently may result in increasing women's responsibility towards the climate without sufficient reward. For example, in

response to certain effects of climate change, in some contexts there are opportunities for women and men to transgress gender norms and roles through the distribution of household chores and responsibilities (Le Masson et al., 2016). For example, CARE programmes in Kenya observed men in agricultural roles that were traditionally allocated to women, or collecting water and fuel in response to drought. In Tanzania, a similar trend was observed; however, the purpose of men fulfilling these responsibilities was to create income by selling water or fuel, which implies a difference in the perceived value of men's and women's tasks. It can therefore be argued that to further gender equality in these contexts, it is important to increase women's access to economically productive roles that are usually allocated to men, rather than adding to their unpaid labour burdens.

## **Evidence on why securing girls' education is an important part of combatting climate change and environmental degradation**

There is emerging evidence on the importance of securing girls' education, especially secondary education, in addressing climate change, which goes beyond the evidence highlighted earlier in this report on climate resilience and adaptation. However, it is clear that more evidence is needed. This includes identifying and understanding key dependencies and variables, and what works in terms of pedagogical approaches.

As the previous sections of this report have demonstrated, there are clear and strong links that highlight the importance of pursuing girls' education as a strategy to advance gender equality and reduce climate vulnerability, which can be cost effective (Streissnig et al., 2013; Blankespoor et al., 2010). A number of studies further highlight the importance of girls' education to address climate change through alleviating societal inequalities and supporting female empowerment. Studies from a variety of regions identified a positive correlation between education, concern for and attitudes about the environment, and the development of skills that support environmentally beneficial decisions (Kwauk, 2020b, p. 2; Balls, 2016; Chankrajang & Muttarak, 2017; Clery & Rhead, 2013; Franzen & Vogl, 2013).

Evidence suggests that developing girls' leadership skills that empower them to engage in politics and participate in decision-making relating to their environment has environmental benefits. For example, a study of 72 countries during the period 1971–2012 found a positive correlation between women's civil society and political participation and beneficial environmental outcomes, including a reduction in carbon emissions (Lv & Deng, 2019). In addition, numerous studies have found that countries with higher proportions of women in parliament or government positions are more likely to ratify environmental treaties and create protected land areas than other countries (Norgaard & York, 2005; Nugent & Shandra, 2009). Private sector organisations and businesses with gender-diverse leadership teams are also more likely to adopt policies and procedures that are beneficial to environmental outcomes (Nugent & Shandra, 2009).

Equally, women and girls' participation in environmental programmes has been found to be more effective and to have better environmental outcomes than those with limited participation from women and girls. For example, research on forest conservation projects in Indonesia, Peru and Tanzania found that when gender quotas were introduced to groups, those groups conserved more trees than groups without gender quotas. In addition, the study found that payment for services was spread more equally in groups with gender quotas than those without (Cook, Grillos & Anderson, 2019).

On a more local level, women who have been empowered to develop their agency as informal leaders, or to participate in informal networks within a community, have been found to create beneficial change (AXA, 2019; Nelson, 2019; Kwauk, 2020a). Although these studies have mostly focused on women's engagement with health services and issues, there are transferable lessons for climate and environmental issues. This includes empowering women as a powerful vehicle to disseminate sustainable practice and activities to build resilience against the effects of climate change.

Lastly, the role of developing girls' green skills, including through STEM education, is beginning to be explored as a mechanism to equip them and their wider communities to be more resilient and adaptive to climate change (Kwauk et al., 2019; Kwauk & Braga, 2017b). It is also thought that STEM education, supported by digital literacy, will prepare girls to participate in green or low-carbon economies that are currently seen as male dominated (Kwauk et al., 2019; Kwauk & Braga, 2017; UNICEF, 2020). Developing skills that enable adaptation and participation in the green economy and gender diversification and expansion in technological workforces will enable the effective transition to a global green economy (UNICEF, 2020; Kwauk, 2020a; Kwauk, 2020b).

There is discussion and some discord about the evidence surrounding girls' education, sexual health and reproductive rights education and reductions in of carbon emissions. Several authors have found evidence that suggests 12–13 years of girls' education is an effective and economical strategy to mitigate carbon emissions, as girls with a secondary education are more likely to have better access to reproductive health care and experience economic, social and political empowerment (Wheeler & Hammer, 2010; Project Drawdown, n.d.; Kharas, 2016).

As a result of secondary education, coupled with sexual health and reproductive rights and family planning, the authors argue that women are more likely to have fewer and healthier children, which over time and across numerous regions will affect population growth. Wheeler & Hammer (2010) estimate that the costs of reducing carbon emissions via girls' education (increased enrolment) and family planning are much lower than those for other carbon emissions reduction solutions; for example, solar, wind and nuclear power, second-generation biofuels, and carbon capture and storage. However, this argument has been challenged and has received considerable criticism. The connections between population and climate change and environmental degradation are complex, with ongoing debates around population ethics and modelling of population dynamics for various climate models (Price, 2020).

Plan International (2019a) warned that the assumption of equating population increase with increased emissions can distract attention from wealthier countries and regions with low rates of population growth that tend to omit higher levels of emissions per capita (p. 3). Conversely, countries and regions with higher population growth tend to omit significantly lower carbon emissions per capita. However, Kwauk (2020a) highlights the need to distinguish between the number of "emitters" and "patterns of emission", and further challenges the oversimplification of evidence that identifies a causal chain between girls' education and climate change, by highlighting other variables that influence fertility and family planning, and the reduction of carbon emissions (Kwauk, 2020a; Kwauk & Braga, 2017b). These include, but are not limited to, a woman's control over her reproductive life, social norms, employment prospects and childcare, urbanisation and the average age of the population.

In addition, a systematic review of the evidence of a causal link between education and sexual and reproductive health in LMICs found inconsistent evidence, which challenged previous

assumptions about the size of the effect of education on sexual and reproductive health (Psaki et al., 2019).

## Conclusion and recommendations

As an emerging issue, key trends are evolving around the relationship between education, girls' education and climate change. However, more robust research is needed to further understanding in this area. The available evidence can therefore inform the following recommendations that reinforce mutually positive outcomes for aligned climate, environment, gender and education planning. These have been broadly grouped into the following categories: climate, environment and gender; education, including girls' education; and disaster response and preparedness.

### Climate, environment and gender

**Design climate and environment programmes to be gender responsive.** Existing gender inequalities in relation to climate and environment must be identified to ensure that any potential differential implications of planned interventions for women and men are analysed and mitigated. Gender equality and prevention of gender-based violence should be priorities within climate and environment resilience programmes. Data collected in response to climate-related disasters or for monitoring purposes must be disaggregated by gender and disability. In the aftermath of a disaster, opportunities should be identified to shift gendered norms and promote women and girls' empowerment.

**Ensure that women and girls' voices are meaningfully represented in the design of, and decision-making processes for, climate and environment programmes.** A diverse group of women and girls will support planning in disaster preparedness, management, recovery and construction. A 'girl-centred' approach is required to prevent girls' protection and rights being rolled back and to ensure the ability of societies to bounce back after climate-related crises.

**Ensure that gender equality objectives are explicit during the design of climate and environment programmes.** It is important that climate and environment programmes ensure meaningful, equal participation of women and men throughout the project cycle; and that interventions are designed equitably to contribute to greater gender equality in outcomes.

### Education, including girls' education

**Support the integration of climate adaptation, mitigation and resilience into education.**

Climate education and education for sustainable development should engage learners and their wider communities in a way that is contextually relevant, age appropriate and action oriented. It should engage learners to be civically aware and active, and is likely to need to involve formal and non-formal interventions. Girls' education programmes must work to ensure girls transition to secondary education and encourage them to participate in STEM education.

**Invest in education programmes that develop girls' leadership skills and support girls to become agents of change within their communities.** Use safe spaces and girls' clubs to introduce girls to life skills, climate change and clean technologies. Empower girls to share their ideas and activities to support the resilience of themselves, their families and their communities.

## Disaster response and preparedness

**In response to crises and disasters, support local partners and governments to address the disproportionate burden of unpaid work that girls absorb.** This will protect girls' safety, wellbeing, and access to and enrolment in education.

**Support gender-inclusive and -transformative DRR and disaster preparedness initiatives that work to limit the disproportionate impacts of disasters on vulnerable and marginalised groups.** These include child-centred DRR that can support longer-term risk reduction and adaptation for children and their wider communities.

**In the context of the ongoing COVID-19 pandemic, work with local partners and governments to ensure that girls return to school as schools reopen, especially vulnerable girls and those who have become pregnant during the period of school closures.** This is important as girls' climate vulnerability is intensified when they face multiple forms of marginalisation. To achieve this, cross-sector collaboration is required, especially among education, health and social protection services (Naylor & Gorgen, 2020; Quak, 2020). This includes addressing girls' economic barriers to education; providing safe spaces for girls for protection and learning during school closures; and ensuring distance learning programmes are gender responsive and accessible to marginalised girls.

## References

- Alston, M., Whittenbury, K., Haynes, A., & Godden, N. (2014). Are climate challenges reinforcing child and forced marriage and dowry as adaptation strategies in the context of Bangladesh? *Women's Studies International Forum*, 47, 137–144.
- Amnesty International UK. (2020). *Five young women of colour fighting climate change worldwide*. Retrieved from: <https://www.amnesty.org.uk/climate/five-women-colour-fighting-climate-change-worldwide>
- Anderson, A. (2019, 17 September). Building resilience in education to the impact of climate change. *Brookings*. Retrieved from: <https://www.brookings.edu/blog/education-plus-development/2019/09/17/building-resilience-in-education-to-the-impact-of-climate-change/>.
- Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, 21, 744–751. Retrieved from: <https://doi.org/10.1016/j.gloenvcha.2011.01.005>.
- Ashraf, M.A., & Azad, A.K. (2015). Gender issues in disaster: Understanding the relationships of vulnerability preparedness and capacity. *Environment and Ecology Research*, 3(5), 136–142. Retrieved from: <http://www.hrpub.org/download/20150930/EER4-14004224.pdf>.
- Atkinson, H.G., & Bruce, J. (2015). Adolescent girls, human rights and the expanding climate emergency. *Annals of Global Health*, 81(3). Retrieved from: [https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1449&context=cc\\_pubs](https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1449&context=cc_pubs).
- AXA. (2019). *The key to improving women's health in developing countries*. Retrieved from: <https://www.axa.com/en/magazine/the-key-to-improving-women-s-health-in-developing-countries>.
- Balls, E. (2016). Analysing key debates in education and sustainable development in relation to ESD practice in Viet Nam. *International Journal of Development Education and Global Learning*, 8(1), 21–37. Retrieved from: <https://files.eric.ed.gov/fulltext/EJ1167821.pdf>.
- Bangay, C., & Blum, N. (2010). Education responses to climate change and quality: Two parts of the same agenda? *International Journal of Educational Development*, 30(4), 335–450. Retrieved from: <https://discovery.ucl.ac.uk/id/eprint/1526915/1/Bangay2010Education359.pdf>.
- Bayley, S. (n.d.). *Education as a force for change*. British Council. Retrieved from: <https://www.britishcouncil.org/programmes/creative-play/education-as-force-for-change>.
- BBC News. (2015, 9 April). *Swimming lessons in Bangladesh made law to stop drownings*. Retrieved from: <https://www.bbc.co.uk/news/world-asia-32239442>.
- BBC News. (2020, 28 February). *Greta Thunberg: What does the teenage climate activist want?*. Retrieved from: <https://www.bbc.co.uk/news/world-europe-49918719>.
- Blankespoor, B., Dasgupta, S., Laplante, B. & Wheeler, D. (2010). *Adaptation to climate extremes in developing countries: The role of education*. Policy Research Working Paper no. 5342. World Bank. Retrieved from:



<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/328491468340475205/adaptation-to-climate-extremes-in-developing-countries-the-role-of-education>.

- Boev-de Pauw, J., & van Petegem, P. (2013). The effect of eco-schools on children's environmental values and behavior. *Journal of Biological Education*, 47(2), 96–103. Retrieved from: <https://doi.org/10.1080/00219266.2013.764342>.
- Brides of the Sun. (2020). *How climate change is turning a generation of young girls into child brides*. Retrieved from: <https://bridesofthesun.com/brides-of-the-sun1>.
- Centre for Gender and Disaster. (2020). *Gender and disaster. Bibliography & reference guide* [Vol. 1]. UCL. Retrieved from: [https://www.ucl.ac.uk/risk-disaster-reduction/sites/risk-disaster-reduction/files/gender\\_disaster\\_reference\\_guide\\_vol\\_1.pdf](https://www.ucl.ac.uk/risk-disaster-reduction/sites/risk-disaster-reduction/files/gender_disaster_reference_guide_vol_1.pdf).
- Chankrajang, T., & Muttarak, R. (2017). Green returns to education: does schooling contribute to pro-environmental behaviours? Evidence from Thailand. *Ecological Economics*, 131, 434–448. Retrieved from: <https://doi.org/10.1016/j.ecolecon.2016.09.015>.
- Chigwanda, E. (2016). *A framework for building resilience to climate change through girls' education programming*. Center for Universal Education at Brookings: The 2016 Echidna Global Scholars Policy Brief. Brookings. Retrieved from: <https://www.brookings.edu/wp-content/uploads/2016/12/global-20161202-climate-change.pdf>.
- Chuang, E., Pinchoff, J., & Psaki, S. (2018, 23 January). How natural disasters undermine schooling. *Brookings*. Retrieved from: <https://www.brookings.edu/blog/education-plus-development/2018/01/23/how-natural-disasters-undermine-schooling/>
- Cincera, J., & Krajhanzl, J. (2013). Eco-schools: what factors influence pupils' action competence for pro-environmental behaviour? *Journal of Cleaner Production*, 61, 117–121.
- Clery, E., & Rhead, R. (2013). *Education and attitudes towards the environment*. Paper commissioned for the EFA Global Monitoring Report 2013/4, Teaching and Learning: "Achieving quality for all". UNESCO. Retrieved from: <https://unesdoc.unesco.org/ark:/48223/pf0000225928>.
- Cook, N.J., Grillos, T., & Andersson, K.P. (2019). Gender quotas increase the equality and effectiveness of climate policy interventions. *Nature Climate Change*, 9(4), 330–334.
- Dazé, A., & Dekens, J. (2017). *A framework for gender-responsive National Adaptation Plan (NAP) processes*. NAP Global Network. Retrieved from: <https://napglobalnetwork.org/wp-content/uploads/2017/07/napgn-en-2017-a-framework-for-gender-responsive-nap-processes.pdf>
- Djoudi, H., Locatelli, B., Vaast, C., Asher, K., Brockhaus, M., & Sijapati, B.B. (2016). Beyond dichotomies: Gender and intersecting inequalities in climate change studies. *Ambio*, 45, 248–262. Retrieved from: <https://link.springer.com/article/10.1007/s13280-016-0825-2>.
- Duncan, A. (2013, 23 April). Education: The most powerful weapon for changing the world. *USAID*. Retrieved from: <https://blog.usaid.gov/2013/04/education-the-most-powerful-weapon/>.

- Dutta, D., & Chandrasekharan, S. (2018). Doing to being: farming actions in a community coalesce into pro-environment motivations and values. *Environment Education Research*, 24(8), 1192–1210.
- Education Cannot Wait. (2020). *Stronger together in crises: 2019 annual results report*. Retrieved from: <https://www.educationcannotwait.org/annual-report/pdfs/ECW2019-Annual-Results-Report.pdf>.
- Franzen, A., & Vogl, D. (2013). Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, 23(5), 1001–1008. Retrieved from: <https://doi.org/10.1016/j.gloenvcha.2013.03.009>.
- Girls Not Brides. (2017). *Thematic brief: Child marriage in humanitarian settings*. Girls Not Brides. Retrieved from: <https://www.ohchr.org/Documents/Issues/Children/HumanitarianSituations/GirlsNotBrides.pdf>.
- Hallgarten, J., Gorgen, K., & Sims, K. (2020). *Overview of emerging country-level response to providing education continuity under Covid-19: What are the lessons learned from supporting education in conflicts and emergencies that could be relevant for EdTech-related responses to Covid-19?* Education Development Trust. Retrieved from: <https://edtechhub.org/wp-content/uploads/2020/05/supporting-education-conflict.pdf>.
- Hammadi, S. (2016, 28 July). Teaching children swimming and CPR to save lives in Bangladesh. *The Guardian*. Retrieved from: <https://www.theguardian.com/global-development-professionals-network/2016/jul/28/teaching-children-swimming-and-cpr-to-save-lives-in-bangladesh>.
- Haneef, C., & Tembe, M. (2019). *CARE rapid gender analysis. Cyclone Idai Response: Sofala Province, Mozambique April 2019*. CARE International Secretariat. Retrieved from: [https://reliefweb.int/sites/reliefweb.int/files/resources/RGA\\_Sofala\\_Mozambique\\_Apr2019.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/RGA_Sofala_Mozambique_Apr2019.pdf).
- Holvoet, N., & Inberg, L. (2014). Gender sensitivity of sub-Saharan Africa national adaptation programmes of action: Findings from a desk review of 31 countries. *Climate and Development*, 6(3), 266–276. Retrieved from: <https://doi.org/10.1080/17565529.2013.867250>
- IDMC (2020a). *Global report on internal displacement*. Internal Displacement Monitoring Centre (IDMC). Retrieved from: <https://www.internal-displacement.org/sites/default/files/publications/documents/2020-IDMC-GRID.pdf>.
- IDMC (2020b). *The impacts of internal displacement on education in sub-Saharan Africa*. Paper commissioned for the 2020 Global Education Monitoring Report, Inclusion and Education. UNESCO. Internal Displacement Monitoring Centre (IDMC). Retrieved from: <https://www.internal-displacement.org/sites/default/files/publications/documents/2020%20background%20paper%20FINAL%20IDMC.pdf>.
- IFRC. (2010). *Children in disasters – Games and guidelines to engage youth in risk reduction*. International Federation of Red Cross and Red Crescent Societies (IFRC). Retrieved

from: <https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2016/03/South-East-Asia-DRR-Education-Guideline.pdf>.

- INEE. (n.d.). *Disaster Risk Reduction*. International Network for Education in Emergencies (INEE). Retrieved from: <https://inee.org/collections/disaster-risk-reduction>.
- INEE. (2012). *Minimum standards for education: preparedness, response, recovery*. International Network for Education in Emergencies (INEE). Retrieved from: [https://inee.org/system/files/resources/INEE\\_Minimum\\_Standards\\_Handbook\\_2010%28HSP%29\\_EN.pdf](https://inee.org/system/files/resources/INEE_Minimum_Standards_Handbook_2010%28HSP%29_EN.pdf).
- IPCC. (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change (IPCC) [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.)]. Cambridge University Press.
- IPCC. (2014). *Climate change 2014: Impacts, adaptation and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the fifth assessment report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change (IPCC) [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea and L.L. White (Eds.)]. Cambridge University Press.
- IPCC. (2019). *Summary for policymakers*. In P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, & J. Malley (Eds.). *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Intergovernmental Panel on Climate Change (IPCC). In press.
- Kaijser, A., & Kronsell, A. (2013). Climate change through the lens of intersectionality. *Environmental Politics*, 23(3), 417–433. Retrieved from: <https://doi.org/10.1080/09644016.2013.835203>.
- Khalili, N., Arshad, M., Farajzadeh, Z., Kächele, H., & Müller, K. (2020). Effect of drought on smallholder education expenditures in rural Iran: Implications for policy. *Journal of Environmental Management*, 260(110136), 1–11. Retrieved from: <https://doi.org/10.1016/j.jenvman.2020.110136>
- Kharas, H. (2016, 16 February). Climate change, fertility and girls' education. *Brookings*. Retrieved from: <https://www.brookings.edu/blog/future-development/2016/02/16/climate-change-fertility-and-girls-education/>.
- Kousky, C. (2016). Impacts of natural disasters on children. *The Future of Children*, 26(1), 73–92. Retrieved from: <https://muse.jhu.edu/article/641235/pdf>.

- Kwauk, C. (2020a, 6 April). Opinion: Girls' education as a solution to climate change is about more than fertility. *DEVEX*. Retrieved from: <https://www.devex.com/news/opinion-girls-education-as-a-solution-to-climate-change-is-about-more-than-fertility-96867>.
- Kwauk, C. (2020b). *Roadblocks to quality education in a time of climate change*. Center for Universal Education at Brookings. Retrieved from: <https://www.brookings.edu/wp-content/uploads/2020/02/Roadblocks-to-quality-education-in-a-time-of-climate-change-FINAL.pdf>
- Kwauk, C., & Braga, A. (2017a, 21 April). Acting on Malala's message: Girls' education can lead to a healthier planet. *Brookings' Education Plus Development*. Retrieved from: <https://www.brookings.edu/blog/education-plus-development/2017/04/21/acting-on-malalas-message-girls-education-can-lead-to-a-healthier-planet/>.
- Kwauk, C., & Braga, A. (2017b, 23 October). *Green skills for girls in a green economy*. *Brookings' Education Plus Development*. Retrieved from: <https://www.brookings.edu/blog/education-plus-development/2017/10/23/green-skills-for-girls-in-a-green-economy/>.
- Kwauk, C., & Braga, A. (2017c). *Three platforms for girls' education in climate strategies*. Brooke Shearer Series Number 6, September 2017. Brookings. Retrieved from: <https://www.brookings.edu/wp-content/uploads/2017/09/platforms-for-girls-education-in-climate-strategies.pdf>.
- Kwauk, C., Cooke, J., Hara, E., & Pegram, J. (2019). *Girls' education in climate strategies: Opportunities for improved policy and enhanced action in nationally determined contributions*. Brookings. Retrieved from: <https://www.brookings.edu/wp-content/uploads/2019/12/Girls-ed-in-climate-strategies-working-paper-FINAL.pdf>.
- Ledley, T.S., Rooney-Varga, J., & Niepold, F. (2017). Addressing climate change through education'. *Oxford Research Encyclopedia, Environmental Science*. Retrieved from: <https://oxfordre.com/environmentalscience/view/10.1093/acrefore/9780199389414.001.001/acrefore-9780199389414-e-56?print=pdf>
- Le Masson, V., Benoudji, C., Soleto Reyes, S., & Bernard, G. (2018). *Violence against women and girls and resilience: Links, impacts and perspectives from the Chadian contexts*. BRACED. Retrieved from: <https://www.odi.org/sites/odi.org.uk/files/resource-documents/12011.pdf>.
- Le Masson, V., Lim, S., Budimir, M., & Podboj, J.S. (2016). *Disasters and violence against women and girls Can disasters shake social norms and power relations?* ODI Working Paper. ODI, p. 11. Retrieved from: <https://www.odi.org/publications/10644-disasters-and-violence-against-women-and-girls-can-disasters-shake-social-norms-and-power-relations#:~:text=Home-,Disasters%20and%20violence%20against%20women%20and%20girls%3A%20can%20disasters,social%20norms%20and%20power%20relations%3F&text=This%20working%20paper%20explores%20the,social%20relations%20affect%20people's%20resilience>.
- Lv, Z., & Deng, C. (2019). Does women's political empowerment matter for improving the environment? A heterogeneous dynamic panel analysis. *Sustainable Development*, 27(4), 603–612. Retrieved from: <https://doi.org/10.1002/sd.1926>.

- Marcotte, D.E. (2016). Something in the air? Air quality and children's educational outcomes. *Economics of Education Review*, 56, 141–151. Retrieved from: <http://iranarze.ir/wp-content/uploads/2017/02/E3468.pdf>.
- McCarthy, J., & Sanchez, E. (2019, 18 April). 12 Female climate activists who are saving the planet. *Global Citizen*. Retrieved from: <https://www.globalcitizen.org/en/content/female-activists-saving-planet/>
- McGrath, M. (2019). Why Greta Thunberg is one of the world's most powerful women. *Forbes*. Retrieved from: <https://www.forbes.com/sites/maggiemcgrath/2019/12/12/why-greta-thunberg-is-one-of-the-worlds-most-powerful-women/>.
- Miller, S. J., & Vela, M, A. (2013). The effects of air pollution on educational outcomes: evidence from Chile. *Inter-American Development Bank*. Retrieved from: <https://publications.iadb.org/publications/english/document/The-Effects-of-Air-Pollution-on-Educational-Outcomes-Evidence-from-Chile.pdf>.
- Muttarak, R., & Lutz, W. (2014). Is education a key to reducing vulnerability to natural disasters and hence unavoidable climate change? *Ecology and Society*, 19(1), 42–50. Retrieved from: <http://dx.doi.org/10.5751/ES-06476-190142>.
- Naylor, R., & Gorgen, K. (2020). *Overview of emerging country-level response to providing educational continuity under COVID-19: What are the lessons learned from supporting education for marginalised girls that could be relevant for EdTech responses to COVID-19 in lower- and middle-income countries?* Education Development Trust. Retrieved from: <https://edtechhub.org/wp-content/uploads/2020/05/marginalised-girls.pdf>.
- Nelson, E. (2019). A resource guide for community engagement and involvement in global health research. Institute of Development Studies. Retrieved from: <https://www.nihr.ac.uk/documents/researchers/manage-your-funding/NIHR-Community-Engagement-Involvement-Resource-Guide-2019.pdf>.
- Neumayer, E., & Plümper, T. (2007). The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, 97(3), 551–566. Retrieved from: [http://eprints.lse.ac.uk/3040/1/Gendered\\_nature\\_of\\_natural\\_disasters\\_%28LSERO%29.pdf](http://eprints.lse.ac.uk/3040/1/Gendered_nature_of_natural_disasters_%28LSERO%29.pdf).
- Nordstrom, A., & Cotton, C. (2020). *Impact of a severe drought on education: More schooling but less learning*. Queen's Economics Department Working Paper No. 1430. Queen's University, Department of Economics. Retrieved from: <http://hdl.handle.net/10419/230583>
- Norgaard, K., & York, R. (2005). Gender Equality and State Environmentalism. *Gender & Society*, 19(4), 506–522. Retrieved from: [www.jstor.org/stable/30044614](http://www.jstor.org/stable/30044614).
- Nugent, C., & Shandra, J. M. (2009). State environmental protection efforts, women's status, and world polity: A cross-national analysis. *Organization & Environment*, 22(2), 208–229.
- Peek, L., Abramson, D. M., Cox, R. S., Fothergill, A., & Tobin, J. (2018). Children and disasters. In H. Rodríguez, W. Donner, & J. Trainor (Eds.), *Handbook of disaster research. Handbooks of sociology and social research*. Springer. Retrieved from: [https://doi.org/10.1007/978-3-319-63254-4\\_13](https://doi.org/10.1007/978-3-319-63254-4_13).

- Persico, C. (2019, November 20). How exposure to pollution affects educational outcomes and inequality. *Brookings Brown Center Chalkboard*. Retrieved from: [https://www.brookings.edu/blog/brown-center-chalkboard/2019/11/20/how-exposure-to-pollution-affects-educational-outcomes-and-inequality/?utm\\_campaign=Brown%20Center%20on%20Education%20Policy&utm\\_source=hs\\_email&utm\\_medium=email&utm\\_content=79932610](https://www.brookings.edu/blog/brown-center-chalkboard/2019/11/20/how-exposure-to-pollution-affects-educational-outcomes-and-inequality/?utm_campaign=Brown%20Center%20on%20Education%20Policy&utm_source=hs_email&utm_medium=email&utm_content=79932610).
- Plan International. (2011). *Weathering the storm: adolescent girls and climate change*. Retrieved from: <https://plan-international.org/publications/weathering-storm#download-options>.
- Plan International. (2019a). *Climate Change: Focus on girls & young women*. Plan International Position Paper. Retrieved from: <https://plan-international.org/publications/climate-change-focus-girls-and-young-women#download-options>.
- Plan International. (2019b, 4 November). Sex-for-food: Girls face impossible choices in Southern Africa. *Plan International*. Retrieved from: <https://plan-international.org/news/2019-11-04-sex-food-girls-face-impossible-choices-southern-africa>.
- Post-Cyclone Idai Cabinet for Reconstruction. (2019). *Mozambique Cyclone Idai: Post Disaster Needs Assessment*. Retrieved from: [file:///C:/Users/ksims/Downloads/PDNA%2520Mozambique%2520Cyclone%2520Idai%2520-%2520Post-Disaster%2520Needs%2520Assessment\\_Full\\_Report.pdf](file:///C:/Users/ksims/Downloads/PDNA%2520Mozambique%2520Cyclone%2520Idai%2520-%2520Post-Disaster%2520Needs%2520Assessment_Full_Report.pdf).
- Price, R. (2020). *The linkages between population change and climate change in Africa*. K4D Helpdesk Report 900. Brighton: Institute of Development Studies. Retrieved from: <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/15835>.
- Prime Minister's Council on Climate Change. (2015). *National action plan on climate change*. Government of India. Retrieved from: [https://archivepmo.nic.in/drmanmohansingh/climate\\_change\\_english.pdf](https://archivepmo.nic.in/drmanmohansingh/climate_change_english.pdf)
- Project Drawdown. (n.d.). *Health and Education*. Retrieved from: <https://drawdown.org/solutions/health-and-education>
- Psaki, S.R., Chuang, E.K., Melnikas, A.J., Wilson, D.B., & Mensch, B.S. (2019). Causal effects of education on sexual and reproductive health in low and middle income countries: A systematic review and meta-analysis. *SSM – Population Health*, 8, 1–23. Retrieved from: <https://doi.org/10.1016/j.ssmph.2019.100386>.
- Quak, E. (2020, 29 June). Lessons from African champion countries for demographic transition. *K4D Opinion*. Retrieved from: <https://www.ids.ac.uk/opinions/lessons-from-african-champion-countries-for-demographic-transition/>.
- Rao, N., Lawson, E.T., Raditloaneng, D.S., & Angula, M.N. (2019). Gendered vulnerabilities to climate change: insights from the semi-arid regions of Africa and Asia. *Climate and Development*, 11(1), 14–26. Retrieved from: <https://doi.org/10.1080/17565529.2017.1372266>.
- Rashin, R. B. (2013, 10 October). In Bangladesh, children learn how to swim – and how to survive. *ReliefWeb*. Retrieved from: <https://reliefweb.int/report/bangladesh/bangladesh-children-learn-how-swim-and-how-survive>.

- Ravera, F., Martín-López, B.M., Pascual, U., & Drucker, A. (2016). The diversity of gendered adaptation strategies to climate change of Indian farmers: A feminist intersectional approach. *Ambio*, 45(3), S335–S351.
- Ravindranath, N.H., & Usha Rao, K. (n.d.). *Environmental Effects of Energy from Biomass and Municipal Wastes*. UNESCO Encyclopedia Life Support. Retrieved from: <https://www.eolss.net/sample-chapters/c09/E4-23-04-05.pdf>.
- Reed, S., & Blariaux, D. (2020). *Evaluation of UNICEF's disaster risk reduction programming in education (2103–2018) in East Asia and the Pacific*. Commissioned by UNICEF East Asia and the Pacific Regional Office (EAPRO). Retrieved from: [https://www.unicef.org/evaldatabase/files/EAPRO\\_DRR\\_Evaluation\\_Final\\_Report\\_Jan\\_28th.pdf](https://www.unicef.org/evaldatabase/files/EAPRO_DRR_Evaluation_Final_Report_Jan_28th.pdf).
- Schröder, P., Beckers, B., & Daniels, S. (2018). Intensify production, transform biomass to energy and novel goods and protect soils in Europe – A vision how to mobilize marginal lands. *Science of the Total Environment*, 616–617, 1101–1123.
- Sellabos, F., Tanner, T., Tarazona, M., & Gallegos, J. (2011). *Children and Disasters: Understanding Impact and Enabling Agency*. Institute of Development Studies. Retrieved from: <https://dmsw540.files.wordpress.com/2013/01/children-and-disasters.pdf>.
- Send My Friend to School. (2020). *The right climate to learn: Education in a changing climate*. Retrieved from: [https://sendmyfriend.org/wp-content/uploads/2020/12/TheRightClimateToLearn\\_SMF.pdf](https://sendmyfriend.org/wp-content/uploads/2020/12/TheRightClimateToLearn_SMF.pdf).
- Silova, I., Komatsu, H., & Rappleye, J. (2018, 12 October). Facing the Climate Change Catastrophe: Education as Solution or Cause? *Norrag Blog*. Retrieved from: <https://www.norrag.org/facing-the-climate-change-catastrophe-education-as-solution-or-cause-by-iveta-silova-hikaru-komatsu-and-jeremy-rappleye/>.
- Siriwardhana, C., Pannala, G., Siribaddana, S., Sumathipala, A., & Stewart, R. (2013). Impact of exposure to conflict, tsunami and mental disorders on school absenteeism: findings from a national sample of Sri Lankan children aged 12–17 years. *MBC Public Health*, 13. Retrieved from: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-13-560#citeas>.
- Stern, J. (2007). *The economics of climate change: The Stern review*. Cambridge University Press.
- Streissnig, E., Lutz, W., & Patt, A. (2013). Effects of educational attainment on climate risk. *Vulnerability Ecology and Society*, 18(1), 16–40.
- Theirworld. (2018). *Safe schools: The hidden crisis. A framework for action to deliver safe, non-violent, inclusive and effective learning environments*. Theirworld. Retrieved from: <http://s3.amazonaws.com/theirworld-site-resources/Reports/Theirworld-Report-Safe-Schools-December-2018.pdf>.
- Thunberg, G. (2020, 13 March) [@GretaThunberg]. *School strike week 82. In a crisis we change our behaviour and adapt to the new circumstances for the greater*. Twitter. Retrieved from: <https://twitter.com/GretaThunberg/status/1238377012235927554>.

- UN. (2015). Paris Agreement. United Nations (UN).
- UNICEF. (2014). *Ending Child Marriage: Progress and prospects*. United Nations International Children's Emergency Fund (UNICEF). Retrieved from: [https://www.unicef.org/media/files/Child\\_Marriage\\_Report\\_7\\_17\\_LR..pdf](https://www.unicef.org/media/files/Child_Marriage_Report_7_17_LR..pdf)
- UNICEF. (2020). *Towards an equal future: Reimagining girls' education through STEM*. United Nations International Children's Emergency Fund (UNICEF). Retrieved from: <https://www.unicef.org/media/84046/file/Reimagining-girls-education-through-stem-2020.pdf>.
- UNICEF and UNESCO. (2020). *Education, migration and climate change: How do we act now to deliver the best common future?* Online roundtable discussion hosted by United Nations International Children's Emergency Fund (UNICEF) and United Nations Educational, Scientific and Cultural Organization (UNESCO).
- UNDP. (2016a). *Gender and climate change: Overview of linkages between gender and climate change*. Issue Brief 1. United Nations Development Programme (UNDP). Retrieved from: <https://www.undp.org/content/undp/en/home/librarypage/womens-empowerment/gender-and-climate-change.html>.
- UNDP. (2016b). *Gender and climate change: Gender and sustainable energy*. Issue Brief 3. United Nations Development Programme (UNDP). Retrieved from: <https://www.undp.org/content/undp/en/home/librarypage/womens-empowerment/gender-and-climate-change.html>.
- UNDRR. (2015). *Sendai framework for disaster risk reduction 2015–2030*. United Nations Office for Disaster Risk Reduction (UNDRR). Retrieved from: [https://www.preventionweb.net/files/43291\\_sendaiframeworkfordrren.pdf](https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf).
- UNDRR & GADRRRES. (2017). *Comprehensive school safety: A global framework in support of the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector and the Worldwide Initiatives for Safe Schools*. United Nations Office for Disaster Risk Reduction (UNDRR) and Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES). Retrieved from: <https://resourcecentre.savethechildren.net/node/12691/pdf/css-framework-2017.pdf>
- UN Women and UNICEF. (2019). *Policy brief: Gender and age inequality of disaster risk*. UN Women and United Nations International Children's Emergency Fund (UNICEF). Retrieved from: [https://www.preventionweb.net/files/72229\\_bls19312unwriskpolicybrief008web.pdf](https://www.preventionweb.net/files/72229_bls19312unwriskpolicybrief008web.pdf)
- Vincent, K.E., Tschakert, P., Barnett, J., Rivera-Ferre, M.G. & Woodward, A. (2014). Cross-chapter box on gender and climate change. In *Climate change 2014: Impacts, adaptation and vulnerability. Part A: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea and L.L. White (Eds.)]. Cambridge University Press, 105–107. Retrieved from: <http://kulima.com/wp-content/uploads/2011/03/Cross-chapter-box-on-gender-and-climate-change.pdf>.



- Wheeler, D. & Hammer, D. (2010). *The Economics of Population Policy for Carbon Emissions Reduction in Developing Countries*. Center for Global Development Working Paper 229. Retrieved from: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1824442](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1824442).
- Zhang, W., Zhao, J., & Chen, J. (2019). Nature club programs promote adolescents' conservation behavior: a case study in China's biodiversity hotspot. *The Journal of Environmental Education*, 50(3), 192–207.