



GLOBAL
CENTER ON
ADAPTATION



Case Studies on

Adaptation and Climate Resilience

in Schools and Educational Settings



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Centre for Environment Education

Case Studies on Adaptation and Climate Resilience in Schools and Educational Settings

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Disclaimer:

The information in this publication has been collated primarily through inviting case studies from the schools. While inviting the case studies schools have declared that the information being provided is accurate. Scrutiny of cases has been done as a joint process with FEE, CEE and GCA, to ensure a fair and representative selection. The images have been used with consent from the nominating schools as shared by them to represent their case. Wherever possible efforts have been made to verify the information through website and secondary sources, but CEE, FEE and GCA, do not have control over the relevance, timelines or accuracy of the materials collected and cannot be held responsible for any inaccuracy or misrepresentation of cases.

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Foreword

“Study what you most affect,” was advice first given from the stage of an Elizabethan theatre in London more than 400 years ago. Today it is more relevant than ever. This report takes Shakespeare's wise counsel to heart by presenting – and learning from – classroom adaptation and climate resilience projects.

Young people have an important role to play in shaping how we respond to and prepare for the increasing impacts of our changing climate. Their engagement in what is rapidly becoming an existential dilemma is vital, not just for their futures but for the planet. The greatest lesson to be drawn from this report is that education, when grounded in practical exercises which benefit local communities directly, is a powerful tool of transformation.

The 6th Assessment Report of the Intergovernmental Panel on Climate Change warned that the climate impacts are already been felt across every region of the world. Our report, *State and Trends in Adaptation 2021*, explained how Africa is especially vulnerable to climate extremes, with its average temperature rising faster than the global average. These extremes are expected to hit in the second half of this century. They will affect today's school pupils and students, and future generations even harder.

Nearly half of Africans are under the age of 15 and better educated than any of their continent's previous generations. The challenge for governments is how to bridge the gap between the skills that higher and wider education provide and create the jobs of the future. Giving young people the tools to get involved in climate adaptation is a valuable step in that journey.

Working with our partners in the Africa Adaptation Acceleration Program, we have a goal to give a million young Africans the money and skills they need to pursue jobs and careers in climate adaptation. By unlocking the business opportunities that exist for young innovators and entrepreneurs in adaptation, this generation will be sowing the seeds of a green and climate-resilient future.

My sincere thanks to the Centre for Environment Education and Foundation for Environmental Education for their outstanding collaboration in the preparation of this report. I am full of admiration for the young people and their schools that you will find featured in these pages. I am confident that their example will inspire others to follow suit and to take charge of adapting their communities to climate change.

Patrick Verkooijen

Chief Executive Officer

Global Center on Adaptation

Glossary

Term/acronym	Definition
Adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects.
ACE	Action for Climate Empowerment
Apiculture	Apiculture is the scientific rearing of honey bee for the commercial production of honey.
Aquaponics	A food production system that couples aquaculture (raising aquatic animals such as fish, crayfish, snails or prawns in tanks) with hydroponics (cultivating plants in water) whereby the nutrient-rich aquaculture water is fed to hydroponically-grown plants, where nitrifying bacteria convert ammonia into nitrates.
CEE	Centre for Environment Education
Climate Change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, conomic, and environmental losses and impacts.
ESD	Education for Sustainable Development (ESD) empowers learners with knowledge, skills, values and attitudes to take informed decisions and make responsible actions for environmental integrity, economic viability and a just society.
FEE	Foundation for Environmental Education
GCA	Global Center on Adaptation
GDP	Gross Domestic Product
Hydroponics	Hydroponics is a type of horticulture and a subset of hydroculture which involves growing plants (usually crops) without soil, by using mineral nutrient solutions in an aqueous solvent.
IPCC	Intergovernmental Panel on Climate Change
Mitigation	A human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs).
NGO	Non-Governmental Organisation
Resilience	The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.
RiSC	Resilient Schools Consortium
SDG	Sustainable Development Goal
SRWHP	Schools Rainwater Harvesting Project
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Climate change is the defining crisis of our time. Its impacts on our children will be even more profound. Yet its impacts are unevenly weighted against the most vulnerable: African nations, Small Island Developing States, and Least Developed Countries. Africa's burgeoning population estimated at 1.3 billion in 2020 is the youngest globally, with 60% under 25 years and a third aged between 15 and 34 years. Moreover, Africa's youth population is rapidly growing and expected to double to over 830 million by 2050. Climate change is reshaping the world they are due to inherit.

Preparing younger generations in Africa and worldwide is fundamental for building a climate resilient future. Education encourages people to change their attitudes and behavior, and enables them to be part of the solutions, while also empowering them to make informed decisions. Climate change education in classrooms helps young people understand the impact of global warming and learn how to adapt to climate change, and can motivate young people to take action.

Educational institutions can play an instrumental role in local level climate adaptation and resilience building. They create spaces for peer learning, innovative ideas, community awareness, and implement practical solutions. Sharing knowledge, best practices and concrete experiences on how to engage younger generations in climate adaptation, is fundamental to scale up action.

This publication documents 15 innovative ideas and actions adopted and implemented by educational institutes in Africa, and across the globe. The purpose of this knowledge product is to provide case study examples on adaptation and climate resilience in schools, to offer insights to schools based in Africa, and to amplify real life climate adaptation actions, designed and implemented in different countries across the world.

This selection of case studies featuring school-led adaptation and resilience building actions, represents diversity in thematic focuses, stakeholder groups, methodology and geography. The case studies showcased cover a range of sectors including agriculture, biodiversity, disaster risk reduction, forestry, and water management. The document showcases how student-led climate resilience projects integrated within the education system can adopt a holistic approach and exemplify adaptation action at the community level.

The publication is the result of a unique partnership among three organizations: the Global Center on Adaptation (GCA), which works as a solutions broker to accelerate action and support for adaptation solutions; the Centre for Environment Education (CEE), which is an internationally renowned organization in the field of Education for Sustainable Development (ESD) with proven capacities to evolve innovative pedagogical approaches to ESD, capacity building and materials development; and the Foundation for Environmental Education (FEE), which has a global network of eco-schools that have been implementing various school level environmental projects including projects on climate change.

Key Messages

From the global case studies received in response to a call for case studies on school-led adaptation and resilience for this publication a total of 45 case studies received.

- **There is a need to equip children, young people, and educators with tools to foresee the upcoming risks and prepare for both short-term needs and long-term solutions.**
- Almost half involved participatory eco-initiatives, with particular emphasis on issues such as pollution, waste management and reducing the carbon footprint. This indicates that in **the larger domain of school level 'eco-activities', adaptation and resilience building efforts are often not prioritized as much as mitigation actions.**
- **Children and young people in schools have demonstrable strength to act as ambassadors of climate change adaptation.** Young students have enormous potential to take classroom as well as on-campus learnings and skills to the community, which has proved instrumental in reducing climate vulnerabilities.
- **Educational institutes function as 'learning and demonstration centers'** for knowledge on adaptation and risk preparedness for students as well as their families to become climate resilient, for instance, through school-led projects and replication of initiatives at the household level.
- **Participatory approaches and intergenerational dialogues are crucial to climate adaptation.** In some cases, when students are involved in eco activities at schools, they partner with the community to design and implement the projects, resulting in an increase in their adaptive capacity that also brings economic benefits to the community.
- **Promotion of local traditional knowledge through cross-learning platforms between teachers, students and experts from the community led by schools may further help build resilience to climate change.** Sharing indigenous wisdom is of the utmost importance so that their undocumented knowledge can be passed on to younger generations.
- **Adaptation education needs to be contextualized to address local climate change impacts that learners can easily connect with.** Most of the cases show that adaptation solutions do not just rely on technology but require a deeper understanding of socio-cultural aspects and connections with the community.
- **The significant impacts of climate change on livelihoods make knowledge of alternative employment opportunities critical, particularly for young people.** Young people have the potential to transfer the skills to engage in climate-resilient and alternative livelihoods to their families and to community members, thereby strengthening their adaptive capacity.
- **Nature-based Solutions are among the most efficient 'no regret' measures to adaptation.** School-led adaptation initiatives help children understand, appreciate, and value nature as well as natural processes in their formative years. Most importantly, experiencing nature first-hand makes children more connected to it and more driven towards nature-based solutions. There is a need to strengthen the understanding of climate adaptation among all stakeholders, particularly children and youth, to develop their skills to adapt to the changing climate, which in turn helps enhance community resilience.
- **There is a need for large scale interventions focused on detailing what constitutes adaptation and adaptation education to enhance awareness in the teaching community and the education system.**
- **Guidance resources and capacity building initiatives targeting youth and teachers are essential components of climate adaptation and are much required in schools.** They serve as enabling factors to promote adaptation and resilience projects, while enhancing the engagement of young people and school staff to implement resilience building initiatives.
- **School-led adaptation needs financial support.** The small-scale funding presently available to schools, limits further replication and outreach, and often result in discontinuation of projects.

Introduction

Climate Change Education

Climate change impacts the lives and livelihoods of millions across the globe. The collective response and solutions to deal with the negative impacts of climate change are set to shape the future of humankind. Education serves as one of the fundamental mechanisms to effectively respond to the challenges we all face due to climate change (FEE, 2018). The Intergovernmental Declaration on Children, Youth and Climate Action recognizes that children face heightened as well as specific risks due to climate change and their role as 'agents of change' is instrumental in tackling the climate emergency (UNICEF, 2019).

Climate Change Education (CCE) has emerged as a fundamental solution to cultivate awareness about responding to climate change (Park, N., et al., 2020). Recognizing the importance of CCE in achieving the Sustainable Development Goals during the Decade of Education for Sustainable Development (DESD), UNESCO launched Climate Change Education for Sustainable Development (CCESD) as one of the four themes of Education for Sustainable Development (ESD). UNESCO's ESD aims to promote the knowledge, skills, attitudes and values necessary to shape a sustainable future. Elaborating further on what climate change education should be in the context of ESD, UNESCO presents four organizing principles (Delors, J., et al., 1996).

- Learning to know, which includes understanding causes and consequences
- Learning to do, which aims to provide transversal/cross-cutting skills
- Learning to live together through collective action and our inherent interdependence
- Learning to be, aimed at individual responsibility and leadership

In contrast to Environmental Education, where the goal is to foster citizens who act to protect and improve the environment, CCE refers to processes aimed at improving the degree to which an education system is prepared for, and is responsive to, the challenges of climate change (Mochizuki Y., Bryan A., 2015). CCE particularly promotes learning about the causes and effects of climate change as well as possible responses, providing a cross-curricular and multidisciplinary perspective (UN CC: Learn, 2013).

The role of Climate Change Education has been especially recognized in the United Nations Convention on Climate Change (UNFCCC) in Article 6, known as Action for Climate Empowerment (ACE). The goal of ACE is to educate, empower and engage all stakeholders and major vulnerable groups. ACE aims to empower all members of society to engage in climate action, through education, training, public awareness, public participation, public access to information, and international cooperation and thereby advance the global response to climate change. The Paris Agreement reiterates the importance of ACE in its Article 12, where Education is the first of six elements.

Adaptation Education for Climate Action

Mitigation and Adaptation are two complementary pathways to address the climate change crisis. While mitigation aims to address the causes of climate change through actions that result in the reduction of greenhouse gas (GHG) emissions, adaptation deals with reducing the impacts of climate change and enhancing the resilience of humans and socio-ecological systems. Despite global efforts to curb GHG emissions, the ramifications of climate change have intensified in recent years, manifesting in extreme events around the world—hence, widespread adaptation action has emerged as the need of the hour.

Young people are a significantly growing force at the forefront of the climate crisis. They are also going to experience the repercussions of climate change impacts. Climate-related disasters directly impact

educational infrastructure and forced displacement affects children's ability to attend school. Climate-induced livelihood losses result in school dropouts. In order to cope with economic losses, young people either join the labor force with their parents or support domestic activities so that parents can pursue paid work. Economic deprivation, malnutrition, hunger and health issues posed by climate change also affect children's education globally. As GCA's State and Trends in Adaptation Report 2021: Africa shows, continual expansion and upgrading of the education system is required to achieve transformative growth of the economic system.

There is a need for educational institutes, especially in vulnerable regions, to become 'learning and demonstration centers' for climate knowledge sharing and skills building so that students can become climate resilient, and therefore help their families adapt to an uncertain climate and related disasters.

Feinstein and Mach (2020) identify three roles of adaptation education: creating adaptive infrastructure, general education that builds adaptive capacity by reducing inequalities, and adaptation learning support (Chan, S., et al., 2021). The increased awareness and inclusion of climate change education in school curricula will also support the enhanced engagement of children and young people in climate resilience building within their communities, to drive adaptation action.

Hypothesis

The publication is written based on the following hypotheses:

- Education for adaptation action is key to driving climate action. Locally-contextualized educational efforts on climate adaptation generate a deeper understanding and connection with the learners, who can then take the lead in climate action, thereby addressing the local impacts.
- A 'solutions-based approach' to climate adaptation through curriculums and extra-curricular activities at schools leads to enhanced engagement of children and youth in adaptation action, both at home and at the community-level.

Challenges to Adaptation Education

In spite of the urgent need for widescale adaptation action, global climate change education discourses still focus disproportionately on mitigation education and discussing the causes of climate change. This leads to ambiguous interpretations of what constitutes adaptation versus what constitutes mitigation and the required environment management strategies in each case. According to a study conducted by All European Academics (ALLEA) to understand CCE initiatives in the European Union, 78 percent of initiatives focused on addressing the causes of climate change (Murphy, C., et al., 2020).

This was also obvious from the global case studies received in response to a call for case studies on school-led adaptation and resilience initiatives for this publication, announced jointly by the Global Center on Adaptation (GCA), the Centre for Environment Education (CEE) and the Foundation for Environmental Education (FEE). Out of a total of 45 case studies received, almost half involved participatory eco-initiatives, with particular emphasis on issues such as pollution, waste management and reducing the carbon footprint. This indicates that in the larger domain of school level 'eco-activities', adaptation and resilience building efforts are often not prioritized as much as mitigation actions.

Another key challenge to the implementation of adaptation education is that, to engage students in the most efficient manner, it needs to focus on local climate impacts. **Adaptation education is a solution- and action-oriented process that also requires enabling learners to acquire new skills and knowledge that will equip them to better respond to local climate impacts. In this context, the capacity building of facilitators (teachers/educators should focus on local climate impacts and solutions from local traditional knowledge as well as new scientific advances.** Several other studies highlight the need for climate-focused educational resources and capacity building support for teachers. In a few regions, adaptation actions such as building compost pits, rainwater harvesting and organic farming are hindered by a lack of financial resources and community support.

Knowledge about climate change is essential yet not sufficient to build adaptive capacity (Graulich, D., et al., 2021). Climate vulnerability studies need to look beyond identifying adaptation strategies and address the limitations that hinder implementation of adaptation measures and related decision-making.

Further evidence suggests that the overwhelming nature of climate change can incite a sense of helplessness among children (Waldron, et al., 2016), which could be addressed through initiatives that focus on climate solutions and collective actions as means to decreasing eco-anxiety while fostering a sense of urgency.

Climate Change and adaptation challenges in Africa

As GCA's State and Trends in Adaptation Report 2021: Africa shows, Africa has the largest youth population in the world and is the region suffering the most from climate change impacts, in spite of its minimal contribution to global warming. 43% of Africa's population is under the age of 15. The number of floods in Africa has increased five-fold since the 1990s, and many floods are more extreme. The continent carries a heavy burden of climate impacts in the form of increased climate change threats to human health, food and water security, and socio-economic development. Life-threatening temperatures above 41C are projected to increase by 50 to 200 additional days by mid-century. The projected changes in climate are likely to cause devastating impacts across the continent.

The State and Trends in Adaptation Report 2021: Africa also finds that the majority of African youth live in rural areas and engage in agriculture. The agricultural sector will be particularly hit by climate change, and yet it is the leading sector for synergies across development and climate action, delivering simultaneously on Sustainable Development Goals, national growth and food security goals, and climate adaptation and mitigation. National economies, however, do not appear to be well-equipped to rise to the challenge, a situation that could result in devastating consequences for the continent's youth. Local adaptation efforts and youth-led as well as community-based actions are crucial in complementing national initiatives to build the resilience of the enormous population at risk.

In response to the increasing vulnerability of the African continent, this publication prioritizes case studies from educational institutions located in Africa. One-third of case studies featured in this reflect students' adaptation and resilience initiatives focused on natural resource management, water and food security in Tanzania, Mauritius, Seychelles, Madagascar and Kenya.

Method of compilation

The case studies highlight school-led initiatives from 11 different countries across four continents, with a focus on Africa. They were collected through an open call for submissions announced jointly by GCA, CEE and FEE. The call was widely shared across CEE and FEE's network of schools by national operators, partners, and on social media platforms.

A total of 45 case studies were received, of which 22 prominent school initiatives were shortlisted for submission of detailed cases. After reviewing the detailed case studies, the 15 best cases were selected and summarized to be featured in the publication. The case studies broadly answer two key questions: **1) How does climate change education lead to adaptation action by students and 2) What impacts have the school-led projects had in building community resilience?**

The nature of adaptation interventions varied across age groups. While the initiatives by younger aged children focus on 'experiencing nature', for instance, through kitchen gardens, nature-based play areas, and climate-friendly campuses, the adaptation actions by middle and high school students are more project-oriented and in partnership with their communities. The latter initiatives are better connected to local issues while also building on local knowledge, as evidenced by projects that promote salt resistant paddy varieties, bee keeping, school agriculture and forestry.

The Way Forward

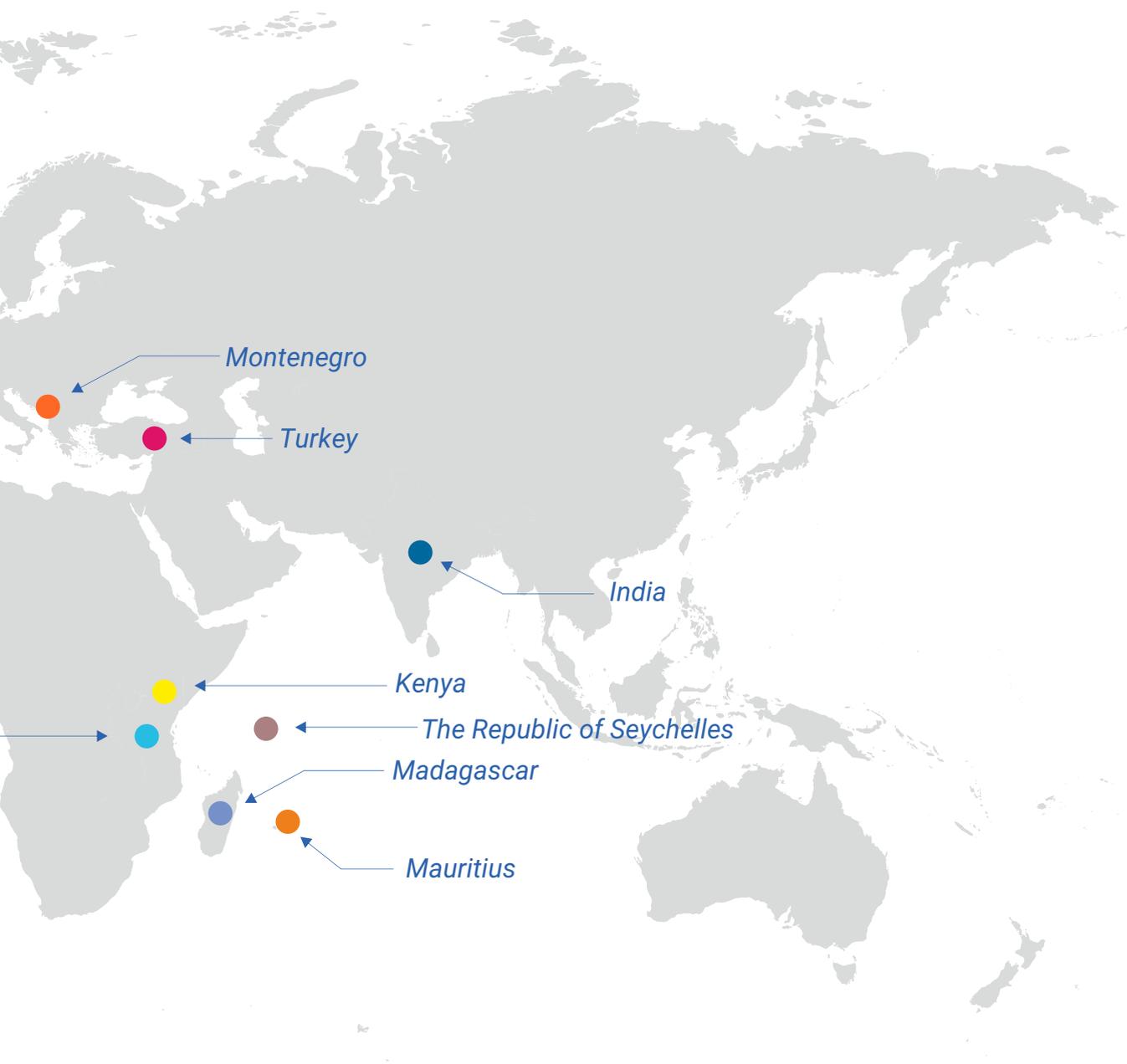
Education is a fundamental element in the implementation of effective and inclusive climate change adaptation. Educational institutes have a vast potential to serve as effective 'learning and demonstration centers.' Young people can be agents of change to advance adaptation in their communities and around the world (UNFCCC, 2021). Children and young people can serve as ambassadors of climate change adaptation knowledge and skills, setting off a multiplier effect that benefits entire families and communities when they share what they have learned.

Education encourages people to change attitudes and behaviors, helping them make informed decisions and schools have a central role in forming climate-conscious, responsible citizens.

This publication documents 15 innovative ideas and actions adopted and implemented by educational institutes featuring school-led adaptation and resilience building using various approaches. The publication highlights the need to strengthen the understanding of climate adaptation among all stakeholders, particularly children and youth, to develop their skills to adapt to the changing climate, which in turn helps enhance community resilience.

Case Studies Overview Map





Map used for representative purpose only

Executing Water Harvesting for Water Security



St. Michael's Holy Unit Academy, Nairobi, Kenya

The slums of Kibera are grappling with issues of domestic violence, child labour, crime, and the lack of basic necessities such as electricity, clean water access, sanitation, and employment opportunities. Residents have low purchasing power and a high mortality rate. The school provides education to the vulnerable youth and orphans. This densely populated area suffers from flooding during the rainy season due to poor drainage systems and weak infrastructure and suffers from water scarcity during dry months. To mitigate these climatic pressures, the school has initiated a water harvesting project during the rainy season.

The water harvesting project showcases a successful model of locally-led resilience and adaptation action by installing water tanks and sanitation infrastructure on building rooftops to harvest water during the rainy season. This activity involved 24 teachers and 730 students between the ages of 16-21 who were further supported by families and community members.

For water scarce Nairobi, this project has helped establish access to water for many people living in the Kibera slums. It has given them the confidence to explore further opportunities such as water harvesting using local workmanship and sustainable farming practices using sacks within their residential areas. The project has been recognized by the area's government officials and NGOs working within the slums. Additional funding is required to make this project a permanent feature in the slums and establish water security among the residents in the long run.





Societal and climatic pressures faced by the children. Lack of access to electricity, safe drinking water, sanitation and poor economy.

Water is central to climate adaptation. Decentralized locally-led models of water harvesting provide an affordable and scalable solution for water resilience for poor and vulnerable communities.



Rainwater Harvesting in Schools
to minimize local flooding during rainy season and create water storage for drier months.



Project helped increase water availability and establish access to water for many people living in the community

Resilience through Locally Grown Food



Antafotenia Primary School, Ifanadiana Municipality, Madagascar

Antafotenia Primary School is located in southeast Madagascar, an area that lacks basic facilities such as electricity. The region has a tropical climate with a hilly terrain prone to frequent flooding. Students are predominantly from farming families who practice rain-fed farming. Rice is a major crop along with banana and cassava, other dietary needs such as fresh vegetables must be purchased. While diversified farming and new methods can help the community become more climate resilient, there is a lack of awareness, skills and readiness to adopt alternative crops such as vegetables which may provide additional income while helping to reduce the burden on the forests.

As a way of preparing students to be changemakers who learn about climate impacts, as well as the importance and skills needed for vegetable farming, the school conducts a vegetable farming competition among different grade levels. Every class is given a patch of land to cultivate vegetables. Students receive a variety of vegetable seeds and compost from their parents, and the school is also planning to make its own compost. Towards the end of the growing season, children harvest their produce, sell it, or cook a community meal. Teachers guide students throughout the process, and the school has allocated time to work in the garden as part of their curricula. During this time, children are responsible for taking care of their plots through watering, fertilising with manure, etc.

During the school year over 190 children from 90 families are involved in this project. The project helps the children, their families and the whole community to better understand how climate change is impacting their lives and helps them to develop greater resilience through locally grown food which may help in meeting their needs for a balanced diet while reducing damage to the forest.



 Alloted farming time in curricula



High poverty
High cost of living
No basic facilities like electricity
Malaria, Diarrhoea
Lack of clean drinking water

Low educational level
Lack of technical support
Lack of crop diversification
Exploitation of forest resources

1



2



Community meal events

School led local action to increase resilience and reduce vulnerability to Climate Change

3



Income generation

90 Families involved



7
Classes

190
Students

6
Types of
vegetables

140 kg
Harvest
(2 seasons)

20,000 Ar.
(approx. 5 USD)
Average earnings
per class

140,000 Ar.
(approx. 35 USD)
Average earnings
in total

Reconnecting with Nature through Climate-Responsible Consumption and Food Production



Loreto College, Curepipe, Mauritius

Loreto College is in the town of Curepipe in the Plaine Wilhems district of Mauritius. This region experiences a cool climate due to higher altitude, with waste management, water scarcity, and food security identified as key vulnerabilities of the area. The school aims at sensitizing both students and parents about the importance of healthy living and protecting the nature for a climate-resilient future.

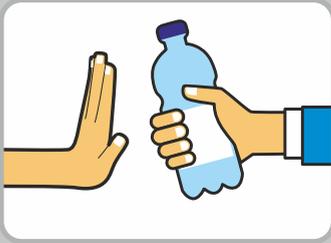
Through imparting climate education and promoting sustainable lifestyles, the school has been able to drive behavioural change and implement a school wide Zero Waste Campaign. The campaign engages students in refusing to use unsustainable products, reducing wastage, reusing materials, enhancing recycling, and composting. Students now lead several individual and community-level handprint actions like usage of cloth for wrapping food, carrying their own water bottles and reusing paper.

Participation in nature education in nearby farms has helped students discover various concepts including scientific (understanding crops), social (community interaction), ecological (learning about ecosystems), and environmental (observing nature's knowledge). This exposure has led to student skill enhancement and deeper understanding of the significance of nature.

Students at Loreto College are involved in building an aquaponic system to support nearby communities, which is a combination of aquaculture (raising fish) and hydroponics (soil-less growing of plants). The integrated system reflects the symbiotic relationship between fish and plants, where the fish waste acts as an organic food source for the plants, and the plants naturally filter the water for the fish. Students are trained to manage the system without the use of artificial chemicals. All the produce from the system is donated to local communities and needy families of some of the students, demonstrating a sustainable food production as well as resilience model.

Aquaponics established by the students represents an effective way to provide healthy food to local communities and contributes to the economic growth, while reducing the ecological footprint. The school also ensures eco-friendly options for pumping and recirculation of water.



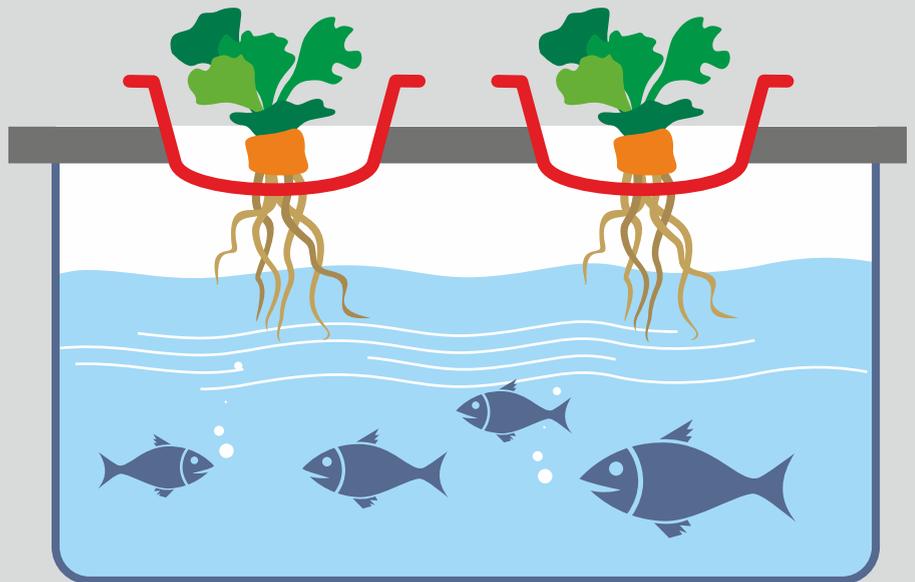


Zero Waste Campaign

Individual and community level activities and practicing reduce, reuse and recycle of everyday items for effective waste management

Aquaponic System

- Healthy Food
- Income Generation
- Reduced Ecological Footprint
- Recirculation of Water



Nature Educational Activities

- Scientific Knowledge
- Community Interaction
- Ecosystem Awareness
- Skill Enhancement

Beekeeping to Foster Resilience



Kanga Hill Secondary School, Morogoro, Tanzania

Forests act as carbon sinks and play a major role in stabilizing the climate. Deforestation has posed a major threat to forests, resulting in ecosystem and biodiversity loss as well as ecosystem services. Recognizing that forest restoration has vast potential to contribute towards reducing the impacts of climate change, a beekeeping initiative was initiated by Kanga Hill School students, located beside the Kanga Forest reserve in Tanzania's Nguru Mountains.

The school identified critical issues pertaining to low income, unsustainable use of forest products, biodiversity loss, and water scarcity through participatory environmental assessment, conducted by students with community support.

The project showcased a successful model of community-based adaptation through initial installation of 41 beehives adjacent to the forest reserve, jointly managed by students, teachers, and community members. The students worked with the community from the design stage to planning and preparation of beehives. The apiaries helped protect vegetation by discouraging people from entering the forests. The harvested honey is used for food, medicinal, and commercial purposes.

The overall initiative led to better management of forests and biodiversity as well as increase of income for the school and resident groups. The school believes this has potential to further increase forest cover and water security. The initiative also served as a learning hub for the students and demonstrated a partnership model for forest conservation. The project is now being adopted by other Tanzanian schools, as well as families, community members and active youth groups.



- Enhanced resilience through forest based alternative sustainable livelihoods
- Forest conservation efforts leading to enhanced ecosystem services for climate resilience
- Beekeeping: an excellent example of EbA (Ecosystem based Adaptation)



The initiative acts as a learning hub and demonstrates a partnership model of forest management



Increased income and forest cover



Installation of bee hives jointly managed by students, teachers and community members



Deforestation leading to biodiversity loss and increase in carbon emission



Education for Locally-led Adaptation



Digalama Primary School, Morogoro, Tanzania

The Digalama Primary school is surrounded by the Mkingu Nature Reserve. The area faces indiscriminate cutting of forests due to lack of awareness about the role of forests in providing essential ecosystem services, myths, and overexploitation. Under the changing climate conditions, this destruction of natural resources can reduce communities' capacity to adapt. To address these issues, the school has initiated environment conservation projects in the community where Education for Sustainable Development is playing a central role. An Environmental Committee involving students and community members was formed and performed the initial participatory evaluation of the climate and natural resource conditions, recognizing forest degradation and irregular precipitation as key concerns. The students created widespread awareness amongst the community on climate change and forest conservation.

To demonstrate the role forests can play in providing a sustainably managed additional income, especially during times of climate stress, a beehive project was initiated. The students, teachers, environmental committee, community members, and parents were also engaged during the various stages of the apiculture set up. The harvesting of the honey is done by selected members of the community and schools. The revenue from selling honey is reinvested in a fishing pond and banana farming.

Enhanced understanding of climate change amongst the community along with the presence of beehives which are a source of revenue in the forest, has resulted in forest conservation, and reduced burning of forest land. The beehive project, coupled with the fishing pond and banana farming, have led to a sustainable source of income for the school. Other community members are also now adopting apiculture as a source of sustainable livelihood activity that help in reducing their vulnerability to climate change.



Over exploitation of forest resources leading to climate stress



489
Students

6
Teachers

Touching
lives of
1250
villagers



20 Litres of
honey produced
per month

USD \$ 87
Income
generated
per month

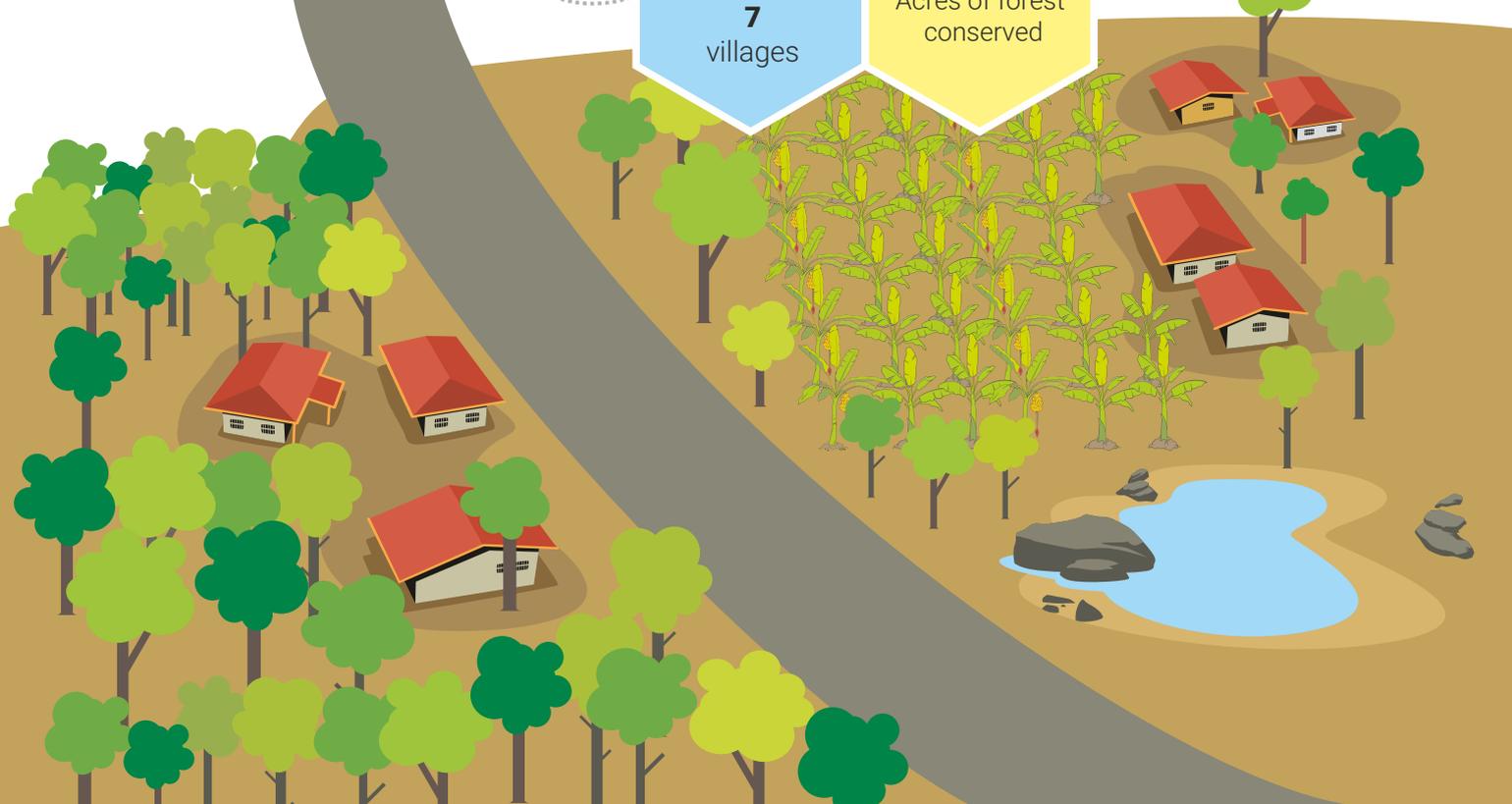
Income
invested in
fish pond and
banana farming

More
food and
cash crops
grown



Model
replicated by
7
villages

5000
Acres of forest
conserved



Reconnecting with Nature through Rain Water Harvesting



Multiple Schools (7), The Republic of Seychelles

The Seychelles is particularly vulnerable to climate change challenges (sea level rise, temperature increase, and changes in rainfall patterns). These impacts have led to water scarcity, which is further compounded by increased demand for water due to economic and social development and population growth.

The Schools Rainwater Harvesting Project (SRWHP) was initiated in 2010 by the Ministry of Education and the Department of Environment with seven primary and secondary schools with support from donors. The objective is to harvest rainwater from the roof of the schools for its use and educate the students and, by extension, local communities on climate change impacts and how rainwater harvesting can be utilised as a means of adapting to water scarcity.

Participating schools collect and store over 2000 litres of rainwater, which is the key water source, especially during water stress conditions. The project provides significant savings to schools through reduction in monthly water bills. Several schools recovered the installation cost from the accrued savings in the first year.

Capacity building activities and educational resources for students, teachers and parents were developed on climate change, reducing water consumption, and rainwater harvesting to develop a sense of ownership and ensure effective participation throughout the process. The harvested rainwater is used in school gardening, irrigation, and for personal hygiene.

Local organizations used project schools as demonstration centres, and the project soon moved from schools to communities and its success has created opportunities for other climate change adaptation initiatives. The rainwater harvesting system is now integrated at the design stage of the construction of new schools and is also being replicated by other schools, communities, and organisations.



Extreme events:
Sea level rise, temperature
increase and change in
rainfall patterns

**Lack of drinking and
daily need water**

Seychelles Island

Project initiated by
7 schools involving **400**
teachers and non-teaching staff and
their students

Collected **2000**
litres of rainwater
monthly, as a key
water source

Educate students and communities
on rainwater harvesting as
adaptation for climate change and to
address water scarcity

Rainwater harvesting
system made part
of school design structure

Harvested rainwater used for
school gardening, irrigation
and personal hygiene



Replicated by other schools,
communities and organisations



Water bill cost saving
up to USD\$ 178



Harvested water serves
as the major source of water
during drought

Building a Climate Resilient School Ground (Klimaatspeelplaats)



Sint-Paulus Primary School, Kortrijk, Belgium

Climate action projects in schools serve as a great tool not only for resilience education but also as a very powerful mechanism to educate the wider community. The school campus itself can serve as a demonstration of a climate-friendly micro - community/microcosm.

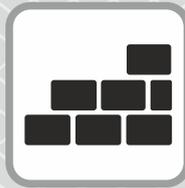
Sint-Paulus Primary School is in the Flanders region of Belgium where drought is a major problem. Issues such as poor air quality and heat stress are common in the region. Typically, city school playgrounds in Flanders are made of heat-emitting concrete blocks, leaving little space for greenery or rainwater percolation. To demonstrate ways to adapt, the school initiated a project called 'dream playground' which is climate and nature friendly. In a participatory process, the pupils and teachers dreamt of playgrounds where design was in harmony with nature and used natural elements. A plan was developed to remove 4000 square meters of concrete to allow excess rainwater infiltration in the soil optimally via an infiltration basin under the sports fields. This allows 145,000 litres of rainwater to be collected and reused. At the same time, the old sewers were completely renewed and installed separately. Many external partners from government, the community, and technical experts assisted in the implementation phase.

The playground includes a recycling park for waste, a vegetable garden and greenhouse, a chicken coop, and 400,000 bees in six hives along with shade trees, making the playground a demonstration of a climate-friendly campus. Thus, the school has created the very first Klimaatspeelplaats in the country - a playground where softening, biodiversity, air quality and water are an opportunity to learn and play.





Heat stress region



Heat emitting concrete blocks



Little space for greenery



Minimum scope for rainwater percolation

Playground converted into **Dream Playground**, which includes

Soft ground for rainwater percolation

Vegetable garden and greenhouse

400,000 bees in six hives



40 teachers and
480 students involved



40 trees and
150 shrubs planted



Support from
Community and
Technical experts



4000 square meters
of concrete removed



145,000 litres
of rainwater collected

Climate Resilient Farming: Conserving Indigenous Rice Varieties



Krishna Suchitra Memorial Study Centre (Experimental School), Sagar Island, India

Sagar Island, located in Sunderbans in West Bengal, is highly vulnerable to cyclones and salinity issues severely affecting the local agriculture. A group of thirteen students at the study centre, under the leadership of XII grade student, Sakila, and with guidance from PUPA, a local NGO, undertook an innovative initiative to cultivate and revive indigenous rice varieties. A community member volunteered his small vineyard for the project that remained fallow after the devastating 2020 cyclone, Amphan, destroyed the vineyard. This land was used for seed production of traditional rice, suited to adapt to local climatic hazards. The students grew 62 different varieties of rice in holes/pits in the field to identify which varieties grew best in upland conditions surrounded by low saline water. The seeds were conserved for future use. The students also made organic compost and conducted rainwater harvesting on the field. The entire initiative was supported through community knowledge and technical expertise. Students were linked with a farmers' club to receive advice and two teachers of the study centre guided them throughout the process.

Conservation of indigenous rice varieties, some of which are salt-tolerant but not currently grown locally, is critical to sustain local agriculture as these salt-tolerant varieties can be grown successfully even if the field is flooded with low saline water. However, due to current intensive use of high-yielding-varieties, indigenous rice seeds are not readily available.

As a result of this initiative, there is a revived interest among the community members in traditional varieties and several of them have adopted the practice.





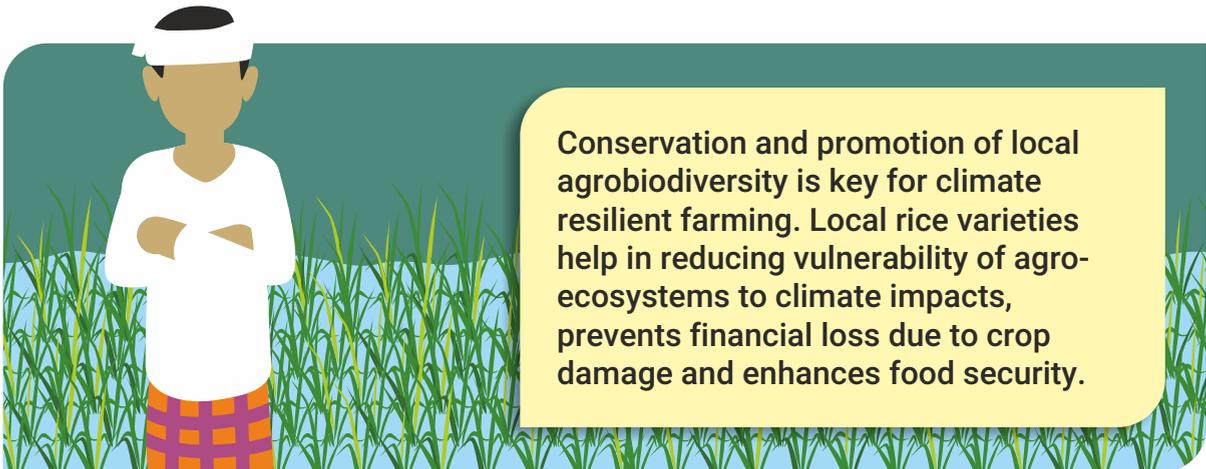
On field experiment by students to identify salt-resistant varieties



Seed bank for salt-resistant varieties created



Distributing seeds among farmers



Conservation and promotion of local agrobiodiversity is key for climate resilient farming. Local rice varieties help in reducing vulnerability of agro-ecosystems to climate impacts, prevents financial loss due to crop damage and enhances food security.

Salt-resistant varieties being grown by farmers

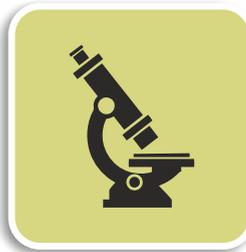
13 Students involved in the innovative process



63 Rice varieties grown and tested



15 Salt-resistant varieties identified



30 Farmers adopted growing salt-resistant varieties



Live Life Cleaner by Making Earth Greener

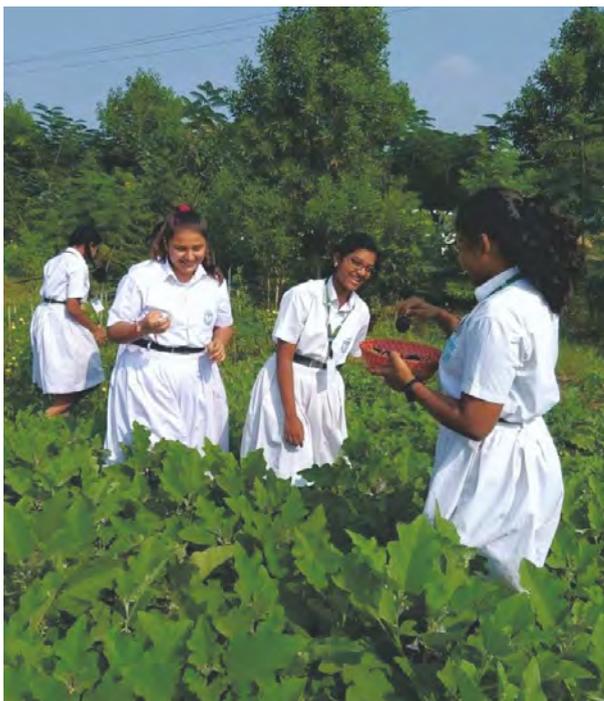


Delhi Public School, Hyderabad, India

Education is a key driver in enabling climate action. School campuses can play a tremendous role in enhancing understanding about climate impacts and ways to adapt among their students. Increasing temperature and its impact on human health and water availability are among the most directly felt climate impacts in urban areas. Planting native trees and increasing local biodiversity can play a significant role in enhancing urban resilience.

Delhi Public School is located at Nadergul in Hyderabad. Eco-clubs were formed by students under guidance from teachers to work on different environmental themes. Considering the role trees can play in controlling the local temperature and reducing urban heat island impacts, the school undertook a rigorous tree planting drive on campus and in the community. In 2016 when the school was established, there was just one tree on the campus. Today, 3,000 trees cover the campus grounds. The school has undertaken additional initiatives such as butterfly and pollinator garden, distribution of medicinal plants to students for planting at home and transforming a barren plot with plant cover to mitigate the impacts of rising temperature. In an interesting health-related initiative, a 'water bell' rung in-between classes reminds the children to drink water to keep themselves hydrated.

Other Eco-club activities at the school include installing rainwater recharge pits, composting of wet waste and use of bio-compost in school gardens, utilizing drip irrigation, starting a "save the sparrow" campaign to attract and support migratory birds, and planting vegetable and fruit gardens that are donated to nearby communities. These activities help raise student awareness and cultivate environmental values in the students, teachers and the community.





3000 plants
on the school campus helps
reduce heat-island effect



100 Teachers and **2000** Students



**Save the sparrow
initiative**



**Butterfly and
pollinator garden**



**Composting of
organic waste**



**Distribution of
medicinal plants**

Managing Water Resources through Campus Mapping



Gyan Mandir Public School, Delhi, India

Gyan Mandir Public School located in Delhi, India has been involved in several environment education and conservation activities such as moving towards being a zero-waste campus. Recognizing the water issues being faced by the region as well as across the globe, the school is attempting a systemic approach to manage water resources, with a goal of developing a model of water management as well as help students learn about managing local water resources. Managing water resources is one of the most crucial components of adapting to climate change.

The school has completed mapping of the campus, identifying various locations in the school where water is used, as well as the activities in those locations that require water. These are referred to as end uses. End-point consumption for various water uses was calculated and efforts were made to identify solutions for reducing water consumption. Tanks and water taps are periodically checked for any possible leakages. To ensure efficient use of available water resources, float valves have been installed in all the tanks to prevent overflow, a drip irrigation system was installed and is used to reduce water waste, water quality testing is being done, and a rooftop rainwater harvesting system was installed. The school conducts various awareness activities engaging students and in the nearby communities. Water conservation work of the Gyan Mandir Public school has also been recognized by several other organizations and some residents have begun household water management after being inspired by the success of the school's efforts.



28 Teachers



800 Students



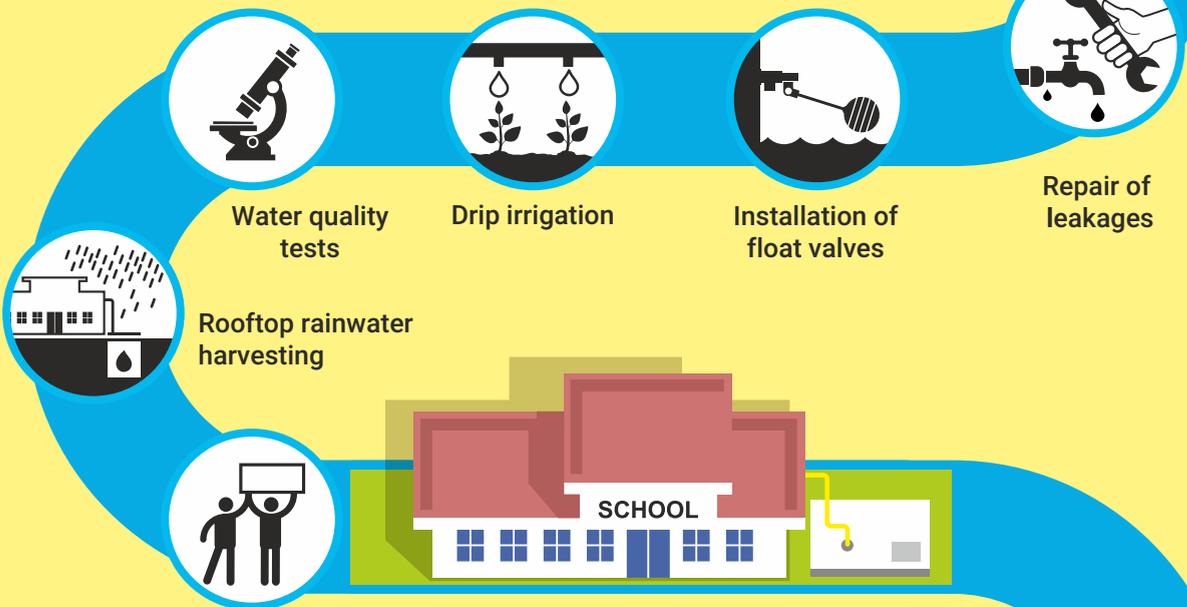
Mapping of water resources in the campus



Water usage

Water wastage and related issues

Systemic approach to manage and conserve water resources



Water quality tests

Drip irrigation

Installation of float valves

Repair of leakages

Rooftop rainwater harvesting

School and community level awareness activities for effective water management

Effective water management helped reduce water consumption from **55 Units to 36 Units** over a period of one year

Reducing the Impact of Climate Change



Branko Brinić School, Tivat, Montenegro

Branko Brinić School is in the coastal region of Montenegro. It has initiated several nature conservation and climate awareness activities, with an aim to protect their environment and help students to learn more about climate, its impacts, and various solutions as well as adaptation technologies. Drought, frequent forest fires, flood, and erosion are some of the major challenges in the area, that also gets amplified due to the climate impacts. The school is surrounded by forest which places it in an area of potential risk.

The school has taken several steps to become more climate resilient and has plans for many more. The school promotes the use of biodegradable materials (especially in packaging), beach cleaning, waste recycling, and lower chemical cleaning supplies. The students and school staff have initiated activities to reduce their electricity consumption and have solicited funds for the installation of solar panels, to use renewable energy for heating and cooling. The students have investigated wind energy potential for the school site. Afforestation and reforestation activities on campus and surrounding areas are being implemented by students and community members.

The area faces frequent forest fires especially during drought and hot dry weather. Students have developed small handouts, that educates tourists visiting forests to prevent breakouts of forest fires. Students interact with visitors to enhance their understanding about responsible tourist behavior. Several awareness programmes and workshops are also being planned for the students and community members to enhance their understanding of climate impacts and ways to address this issue.



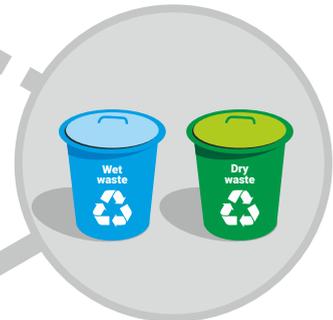
Awareness among tourists on prevention of forest fires



Planning to install renewable energy sources



Waste management



Reforestation initiatives



Conservation of electricity and water



Clean-up drives

Vegetable Cultivation to Meet the Need for Fresh Farm Produce



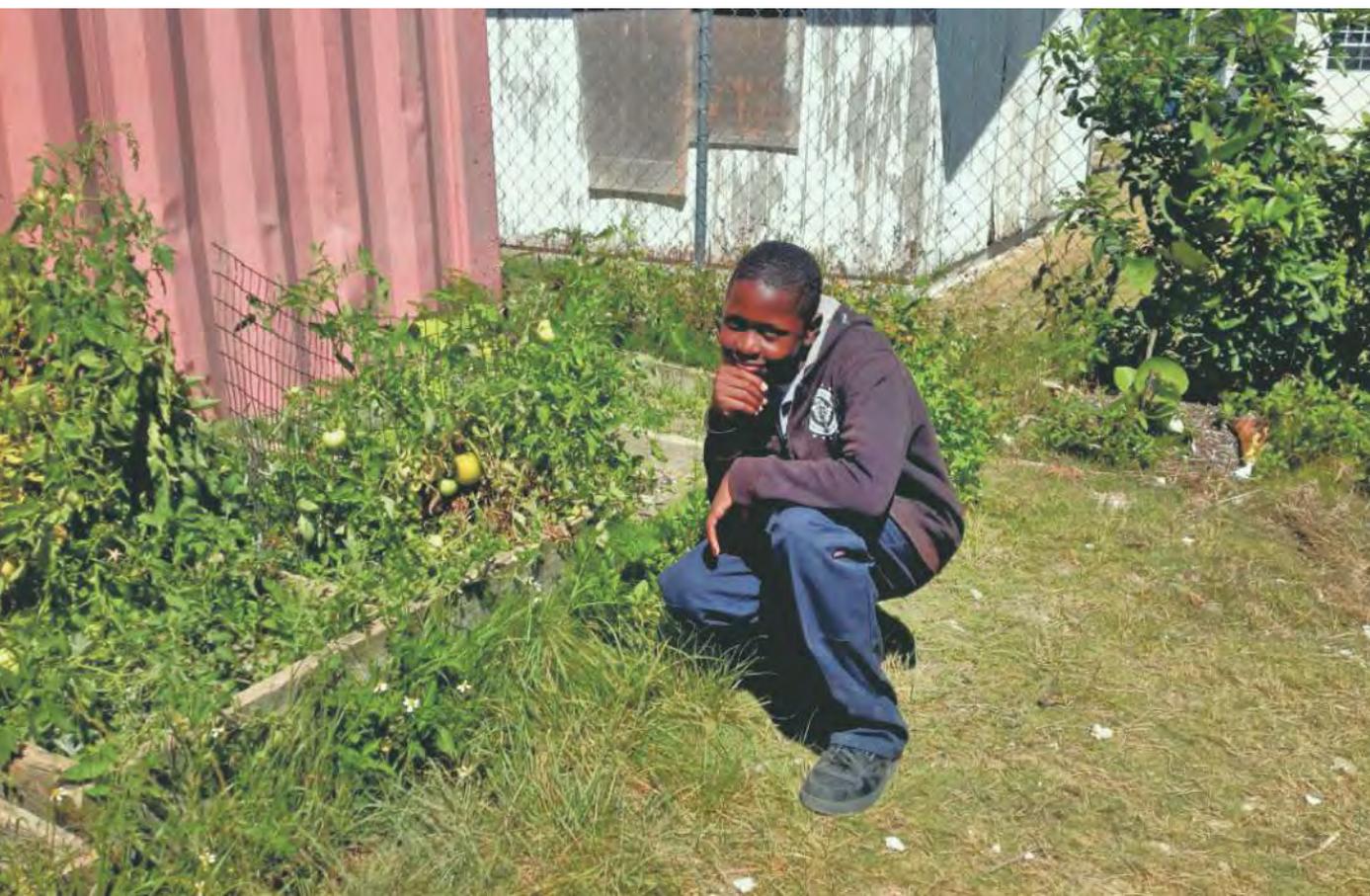
Every Child Counts, Abaco Island, The Bahamas

Like in many other island countries, climate change is a major threat in The Bahamas. A large percentage of the country's population lives, at the most, 7 feet above sea level. This region is highly vulnerable to hurricanes. The Bahamas has experienced even Category 5 hurricanes, the last one being Hurricane Dorian that devastated the island in the year 2019.

The school, 'Every Child Counts,' is located on Abaco Island of the Bahamas. This island was hit hard by Hurricane Dorian in 2019. The school building was completely devastated. The local farms were completely destroyed by Dorian, thus making it difficult to get local produce, especially vegetables. This impacted the food security and health of the community, especially the children.

The school participates in the FEE Eco-Schools programme, and as such, the students work on various themes such as reducing waste by repurposing cardboard, plastic, glass and tin waste to make compost containers and bird feeders for their homes, and to make toys, aquariums, and globes from household trash.

During this year, the school will focus on biodiversity. All students have started growing their own vegetables from table scraps, which provided the children and families with fresh local produce. Initially started with just one class, it now has spread to all the classes, involving 82 students as well as their families in growing their own produce.





Farms destroyed by hurricane and sea level rise



Awareness generation on growing vegetables



82 students taking up vegetable farming



Reaping benefits



Community adopting the practice



CO₂ Emission Reduction by eliminating commercial production and transportation

Income generation

Healthier eating

Influencing community

- Local food growing for enhanced food security
- Vegetable farming for additional source of income
- Learning climate resilient farming at an early age

Banana Miracle: Innovation for Drought Resilience



Kiliçarslan Primary School, Antalya, Turkey

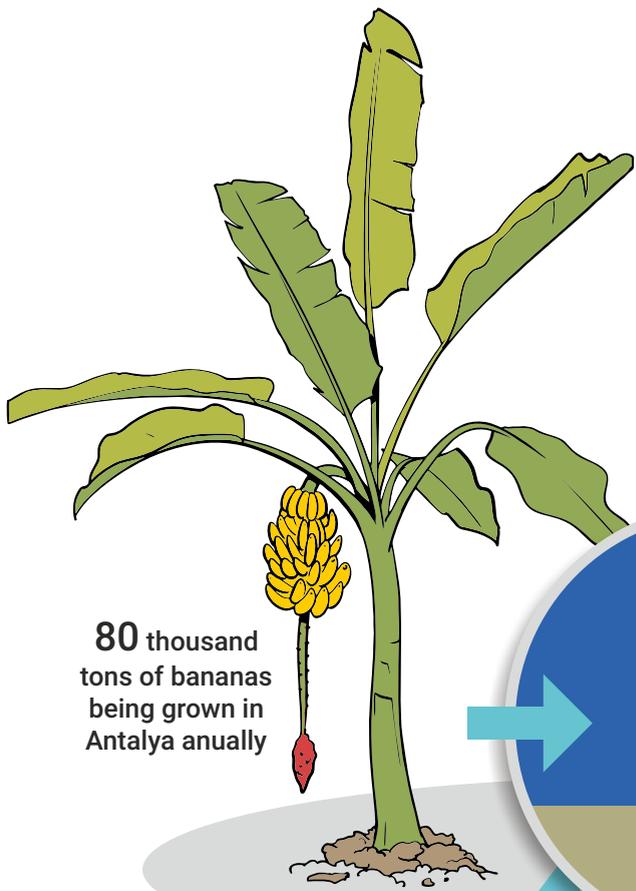
Water scarcity is a big climate threat looming over the rain-fed agrarian communities, especially for the small and marginal farmers in drylands. Kiliçarslan Primary School in Antalya, Turkey is trying an innovative solution to address water scarcity. Antalya traditionally has hot and dry summers with frequent droughts.

The Antalya region cultivates over 80 thousand tons of bananas annually. While the banana fruit is harvested, the stems, which are full of watery juices, are most often discarded. The school devised a plan to use these discarded banana stems for watering plants in their greenhouse. After most of the water is extracted, the remainder of the stems are placed into vermicomposting receptacles to make compost that can then be reused at the school for its grounds. Students work on this project under the guidance of teachers, and families provide support throughout the process. The students, and by extension, their families and community, have learned that natural wastes can be useful and repurposed as an alternate water resource.

The project was also supported by the National Education and Provincial Directorate for Agriculture. About 70 students and teachers participate in this project and it is being considered for replication in other agriculture fields in their region.

In addition to the use of banana stems to mitigate water scarcity, the school is also involved in activities such as preparing seedboxes for birds.





80 thousand tons of bananas being grown in Antalya annually

Natural waste being repurposed as an alternate resource



Water from discarded banana stem used in greenhouses and school ground. Remaining dry stem used in vermicomposting

Innovative approach to enhance drought resilience in drylands. Also recognized as a project to be replicated in other agricultural fields.

Early Education for Creation of a Climate Sensitive Generation



Sincan Lale Kindergarten, Ankara, Turkey

One of the key elements for developing climate adaptation and resilience is behavioral change. At a very young age, awareness about climate change and its impacts and participating in climate resilience building activities, can even in a very small way- help in fostering a generation that is more aware of climate impacts and shows a readiness to adapt. Early education in the formative years plays a key role in helping develop a sense of respect towards nature and learning to live in harmony with it.

Sincan Lale Kindergarten in Ankara has taken an initiative towards making their campus a climate education learning ground through various activities such as development and use of an agriculture area or science centre in the garden. The children are involved in many innovative activities that sensitize them towards environmental challenges and solutions such as collection of rainwater and using this for watering plants in the school garden and agriculture areas. A harvest was made to meet the 1-year Linden tea need of the entire school. The vegetables and fruits produced in the garden were used in meals cooked at the school throughout the year. Children are also involved in preparing various products from the school's organic agriculture and garden plots such as drying apples and pears, making tomato sauce and tomato pickles, and preparing vinegar from apple and pear peels. This was combined with educating them about organic farming. Dried fruits and herbs are harvested for winter preparation, so that these foods are also available in winter for healthy eating. The school also engages children in observance of important environmental days, such as Water Day, through various awareness activities. Since 2014, the school has engaged 700 children (age group 3-6 years) and 20 teachers. The school has been successful in engaging parents and other community members, such as nearby shopkeepers and neighbors in their activities.





School campus used as a climate education learning ground by encouraging children to practice climate resilience building activities

20 Teachers

700 Students

Creating Climate Resilient Communities



Resilient Schools Consortium (RiSC), Brooklyn, New York, USA

Since 2017, the National Wildlife Federation in New York City has been delivering the Resilient Schools Consortium (RiSC) - a nationally recognized climate and resilience education program for secondary school students that is empowering youth to help create more climate resilient communities. Through a project based RiSC curriculum and field trips, students learn about climate science, current and future climate impacts, and resilience strategies.

Through boat trips in New York Harbor, and hands-on activities such as tree planting, and dune restoration, the Resilient Schools Consortium (2019-2020) engaged students in learning about and taking action to mitigate coastal flooding and extreme heat in their communities. It also helped them to understand the critical links between climate justice and climate resilience.

This initiative focuses on empowering youth to create climate-resilient communities. In Fall 2021, the RiSC program was launched in Coney Island, Brooklyn, a frontline coastal community devastated by the impacts of Hurricane Sandy (2012) that has continued to experience flooding events.

Coney Island is a racially diverse community. Teachers and students from 8 local public middle and high schools have documented and amplified the local citizens' experiences with extreme weather events, and increased awareness about coastal hazards such as sea-level rise, coastal flooding, and erosion.

An "Adopt-a-Shoreline" guide was developed in 2021 to teach students about coastal ecology, biodiversity, and the role of nature-based resilience features, such as marshes and dunes, in local communities. Through a RiSC curriculum that engages students in hands-on field-based activities, RiSC has been successful in engaging students in discussions about climate change and empowering them with digital tools to directly understand climate impacts. The RiSC program also created digital learning resources for students during the Covid-19 pandemic.



Adopt-a-Shoreline



8 Public Schools,
150 Students and
10 Teachers



Awareness
generation
programmes



Developed a
curriculum and
guide book



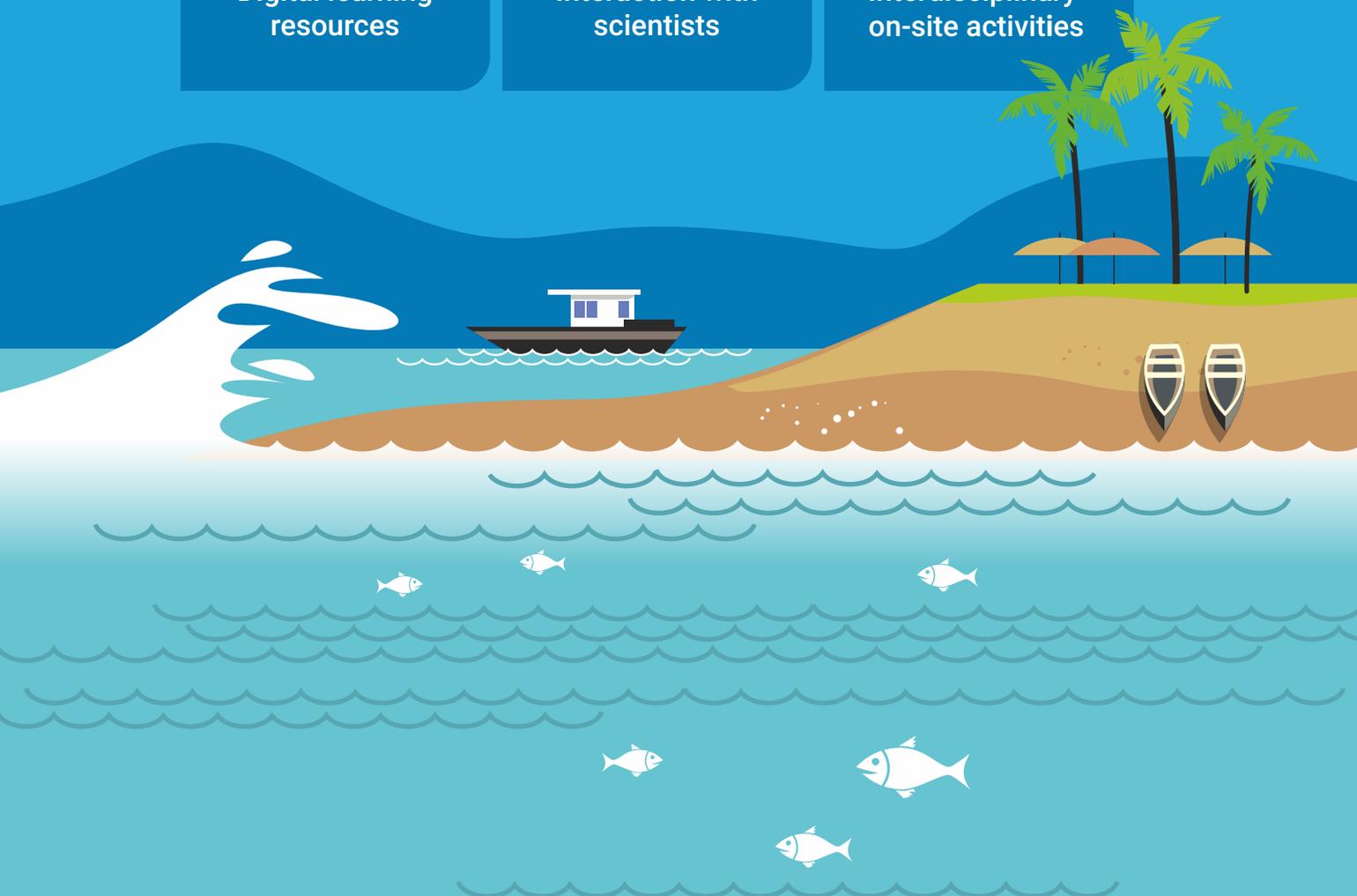
Digital learning
resources



Interaction with
scientists



Interdisciplinary
on-site activities



Analysis

In the arid and semi-arid regions across the globe, particularly in Africa, water has remained a major limiting factor to achieving the 2030 Sustainable Development Goals. Climate change impacts have had serious consequences on the availability of water, and increasing demand is expected to pose further challenges, thereby worsening the water crisis. As GCA's State and Trends in Adaptation Report 2021: Africa shows, droughts already threaten livelihoods and trap people in poverty. As a result, most of the climate adaptation initiatives in the region focus on harvesting rainwater through rooftop structures, water tanks, by creating soft grounds to enhance filtration and through climate-smart water management.

Furthermore, schools have developed agriculture and biodiversity management initiatives by creating vegetable plots and practicing agriculture in schools, distributing medicinal plants, and conducting research on salt resistant rice varieties. Strengthening forest-based livelihoods as a means of conserving forests and generating additional income are of importance, as highlighted in the case studies.

The case studies represent a variety of pedagogical approaches across different age groups. Three types of pedagogical approaches have been identified in Climate Change Education: Inquiry-Based Science Education (IBSE which deals with garnering interest on the topic, Nature of Science Pedagogy (NoS builds knowledge on the science of climate change, and Project Based Pedagogy (PBP promotes hands-on learning (Cliona Murphy, G., et al., 2020. Using this framework, in the featured case studies, PBP and NoS are predominant when it comes to Adaptation Education. The interventions pertaining to younger age-groups veer more towards 'experiencing nature', while the initiatives led by middle and high school students focus on project-based learning and community partnerships.

With agriculture dominating economic life in most African countries, accounting for 30 to 40 percent of their GDP, and serving as the leading source of jobs for over two-thirds of Africa's population, the impact of climate change on agriculture has disastrous consequences (GCA, 2021. Thus, preparing youth and young children to practice climate-resilient agriculture and nature-based solutions has far-reaching impacts for future climate adaptation. These case studies also show that school-led adaptation works as a 'learning and demonstration center' for the community to learn and adapt to the changing climate.

Recommendations

This publication identifies a range of adaptation efforts led by schools with community engagement. The case studies on adaptation and resilience presented in the publication are encouraging and highlight that young people are leading the way towards climate adaptation action and are instrumental in reducing the impacts of climate change. At the same time, deeper analysis uncovers the following challenges and needs for the future:

- **Adaptation education needs to be contextualized to address local climate change impacts that learners can easily connect with.** Furthermore, most of the cases show that adaptation solutions do not just rely on technology but require a deeper understanding of socio-cultural aspects and connections with the community.
- **Local, traditional and indigenous knowledge is vital to adapt to the various impacts of climate change.** However, such knowledge is largely undocumented and can only be obtained from community leaders or in communities that still actively practice traditional methods. Thus, crossing the classroom and school campus boundaries to connect with the community is a milestone and can help acquire adaptation education and skills. Formal education systems need to create cross-learning spaces where students can engage with the community and learn from their experiential wisdom.

- **There is a need to equip children, young people, and educators with tools to foresee the upcoming risks and prepare for both short-term needs and long-term solutions.** Climate change issues are 'creeping' problems. Thus, impacts and changes are generally visible only over a long period of time. Most often, the impacts are predicted sometime in the future, making it challenging for the young people to learn to perceive and understand the implications of the uncertain impacts.
- **The significant impacts of climate change on livelihoods make knowledge of alternative employment opportunities critical, particularly for young people.** Equipping young learners with skills to gain climate-resilient and alternative livelihoods is an important element of climate adaptation education. Young people have the potential to transfer these skills to their families and to community members, thereby strengthening their adaptive capacity.
- **While an integrated approach to climate education that involves both mitigation and adaptation approaches is essential to address climate change, there seems to be a lack of clear understanding about the difference between the two responses.** This calls for large scale interventions focused on detailing what constitutes adaptation and adaptation education to enhance awareness in the teaching community and the education system.
- **Children and young people can learn from each other's experiences and share best practices to replicate successful climate adaptation projects.** To document these practices, students and their local communities could collaborate to develop a handbook featuring a range of potential adaptation and resilience projects to be implemented within educational settings. The handbook could help promote adaptation actions through an exchange of existing experiences, knowledge and solutions to ensure students' participation in building community resilience.
- **Although schools can implement small-scale projects, dedicated financial support is required for further replication, wider reach, and to ensure the projects' sustainability.** In most cases, adaptation action requires resources. In several case studies, the local community and the school provided material and financial resources to carry out the initiatives. In some cases, schools managed to seek financial support from local government bodies, donors or not-for-profit organizations.

In conclusion, these 15 case studies provide information about school-led climate adaptation actions to inspire novel approaches to deal with observed and expected climate change impacts. The cases share crucial insights on how school children and young people can take a lead role in climate adaptation action.

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