Adaptation interventions targeting climate-sensitive diarrheal disease and its determinants

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About the Information Included

The information in this document was sourced from a scoping review of climate adaptation interventions designed to mitigate the impacts of climate change on diarrheal disease developed for the SPRINGS project.

The full protocol for this review is available here:
https://www.medrxiv.org/content/10.1101/2025.06.03.25328790v1

Each intervention slide includes the following elements:

1. **Examples of the Intervention -** examples of adaptation designs or a link (click on ‘Examples’) to a list of examples identified in the scoping review. These examples help illustrate what the intervention looks like in practice.
2. **Global Goal on Adaptation (GGA) Target -** The GGA, established by the Paris Agreement, aims to increase the global ability to adapt to climate change by enhancing adaptive capacity, strengthening resilience, and reducing vulnerability. A framework of 11 thematic targets—including water, food, ecosystems, and others—guides progress toward the GGA. The appendix identifies which of these targets each intervention aligns with.
3. **Action Type -** Each adaptation is categorized by its response types, which may include: Technological, Infrastructural, Financial, Nature-based, Social / behavioral, Informational / educational, and Institutional. This helps clarify the nature of the intervention and how it operates.
4. **Sector -** This identifies the sector(s) where the adaptation has been implemented (e.g., water, agriculture, land use, society and economy, health).
5. **Risk Type -** For each intervention, the appendix specifies whether it primarily aims to reduce: climate hazards (e.g., extreme rainfall, heat, flooding), exposure to these hazards (e.g., improving water systems, sanitation access),or vulnerabilities that increase the risk of harm (e.g., poverty, weak infrastructure)
6. **Health Pathway -** This describes the plausible climate–health pathway through which the intervention could influence diarrheal disease and other outcomes. These pathways are derived from general climate-health conceptual frameworks and literature. They are not direct evidence of intervention effectiveness but rather illustrate mechanisms through which the intervention may reduce diarrheal risk.
7. **Reported Outcomes -** The outcomes reported for the adaptation identified in the scoping review.
8. **Country** – Country or region where the adaptation was implemented

List of adaptation interventions (main sector)

SPRINGS

Agriculture, forestry & fishing

- Sustainable agriculture
- Irrigation for agriculture
- Soil and/or water conservation
- Agricultural extension services
- Crop diversification
- Weather based or agricultural insurance
- Integrated resilience/ livelihoods intervention
- Climate information services
- Access to financial services
- Agroforestry
- Livestock ownership and management practices
- Land and/or water management
- Income diversification
- Sustainability certification
- Financial protection
- Community social capital
- Climate resilient villages
- Agricultural subsidies
- Social safety nets
- Participation and access to markets
- Community assets

Land use & built environment

- Urban greening
- Low impact developments
- Green building design
- Biodiversity conservation
- Payments for environmental services
- Coastal protection
- Climate resilient cities
- Universal basic services
- Disaster risk reduction

Society & economy

- Migration
- Cooking stoves
- Women's participation in environmental decision-making
- Trailbridges
- Serious games
- Internet use and social networks
- Financing for climate change
- Biodigesters
- Household infrastructure

Water

- Safe water source
- Safe sanitation facilities
- Drinking water treatment
- Wastewater treatment
- Handwashing
- Water storage
- Health risk assessment
- Integrated WaSH intervention
- Water harvesting
- Wetlands
- Dams
- Wastewater treatment for irrigation

Health

- Vaccination
- Personal protective equipment
- Nutrition support programs
- Health resources and infrastructure
- Other preventive and curative care
- Early detection
- Food safety
- Disease surveillance systems
- Child feeding practices

Adaptation intervention

Dams

Global Goal on Adaptation (GGA) target

Food and agricultural production

Ecosystem and biodiversity

Examples

Mekong dams store water upstream and regulate flow seasonality

Dams

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Infrastructure	 	 Reduced hazards	**More reliable water supply** – dams stabilize water availability during droughts, reducing reliance on unsafe surface water sources that carry diarrheal pathogens. **Reduced flood-related contamination** – flood-control functions limit overflow of latrines, sewage systems, and polluted runoff, lowering exposure to fecal contamination during extreme rainfall events. **Improved irrigation and food security** – regulated water for agriculture strengthens nutrition and household resilience, reducing susceptibility to diarrheal disease. **Enhanced community services and infrastructure** – dam-related investments (e.g., water treatment, distribution networks, hydropower-supported services) improve access to clean water and health systems that prevent diarrheal outbreaks.	Hydrological regime Agricultural production and productivity Vietnam Africa Global

Adaptation intervention

Financing for climate change

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Examples

Global Climate Finance Fund (CF), including the Adaptation Finance Fund (AF) and Mitigation Finance Fund (MF)

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Institutional		 Reduced vulnerability	**Improved infrastructure and service delivery -** support resilient water supply, sanitation, and drainage systems, reducing contamination and diarrheal risk. **Enhanced household and community resilience** – financing enables investments in climate-resilient agriculture, WASH infrastructure, and disaster preparedness, protecting food and water security during shocks. **Support for health and adaptation programs** – climate finance can fund early-warning systems, community training, and capacity-building that promote safe water, hygiene, and sanitation practices. **Indirect reduction in enteric disease exposure** – by stabilizing livelihoods and ecosystems, climate finance reduces environmental degradation, flooding, and unsafe water use that drive diarrheal outbreaks.	Energy vulnerability Developing countries

Adaptation intervention

Internet use and social networks

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Food and agricultural production

Examples ←

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Informational/ educational Technological	 	 Reduced vulnerability	**Faster early warning and risk awareness** – real-time updates and search tools help communities protect water and sanitation systems before climate disasters. **Improved information sharing** – social media spreads hygiene messages and safe water practices, reducing pathogen transmission during shocks. **Empowerment and peer learning** – self-publishing allows communities to share strategies for water safety and disaster response. **Strengthened social cohesion** – online networks enable coordination, resource sharing, and collective preparation, lowering diarrheal risk.	Disaster losses Fertilizer use Thailand China

Adaptation intervention

Serious Games

Global Goal on Adaptation (GGA) target

n/a

Examples

Serious games for climate change adaptation

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Informational/ educational Social/ behavioral			**Increased awareness of climate-health risks** — serious games simulate climate risks (like flooding, drought) and adaptation options, helping communities understand how climate change affects water safety and sanitation. **Improved decision-making and planning** — by playing through adaptation scenarios, players practice strategies like water management, early warnings, and community resilience, which can reduce contamination of water supplies during climate events. **Behavioral change and social learning** — games encourage group discussion and collective learning, which translates into real-life adoption of hygiene, safe water practices, and infrastructure that prevent diarrheal disease. **Enhanced community engagement and capacity** — serious games can build local capacity to anticipate and respond to climate shocks, strengthening systems (e.g., local early-warning, community water governance) that protect against water-borne disease outbreaks.	Influencing behavior and learning Global

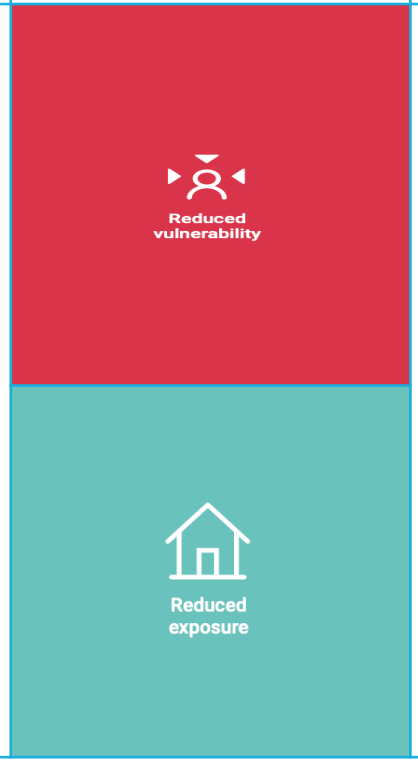
Adaptation intervention

Trailbridges

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Infrastructural			**Improved access to markets and income** – trailbridges reduce transportation barriers during floods, allowing households to maintain livelihoods and purchase safe water, food, sanitation, and healthcare, lowering diarrheal risk. **Safer movement during extreme weather** – bridges reduce reliance on unsafe river crossings, preventing waterborne infections and exposure to contaminated water. **Enhanced access to health and WASH services** – reliable transport enables timely visits to clinics and easier delivery of hygiene supplies and clean water to communities. **Indirect reduction in enteric disease risk** – increased connectivity supports community resilience, social networks, and supply chains that maintain food security and safe water access during floods, reducing diarrheal outbreaks.	Income Rwanda

Adaptation intervention

Women's participation in environmental decision-making

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Examples ←

Action Type	Sector	Risk Type	Health Pathway	Outcomes (2)
Informational/ educational Social/ behavioral			**Improved household and community WASH decisions** – when women have influence over natural resource and environmental governance, investments more often prioritize clean water, safe sanitation, and hygiene—all directly reducing diarrheal exposure. **Enhanced livelihood and food security choices** – promotes diversified, nutrition-enhancing livelihoods, strengthening household immunity and reducing susceptibility to diarrheal disease. **Better management of local ecosystems** – leads to more sustainable water, forest, and land practices, lowering contamination of shared water sources during climate events. **Greater community adoption of health-protective practices** – decision-making spaces and supportive workshops (including for men) increase acceptance of women's roles in promoting hygiene, safe water handling, and climate-resilient practices that prevent diarrhea	Preparedness Kenya

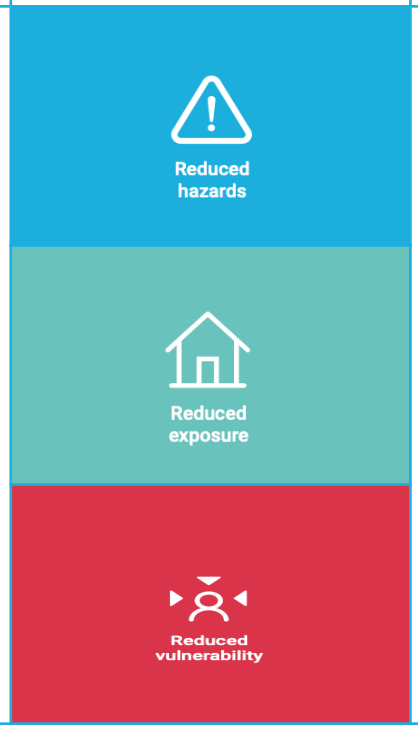
Adaptation intervention

Cooking stoves

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (2)
Technological	  		**Reduced household air pollution improves immunity** – cleaner-burning stoves lower respiratory stress and inflammation, strengthening overall immune function and reducing vulnerability to diarrheal infections. **Safer indoor environments** – improved ventilation and reduced smoke help keep indoor water and food storage areas cleaner, lowering contamination risks. **Time and resource savings** – more efficient fuel use frees household time and resources, allowing greater investment in clean water, sanitation, and hygiene practices that prevent diarrheal disease. **Lower environmental degradation** – reduced fuelwood demand decreases deforestation and soil erosion, improving local water quality and reducing pathogen-laden runoff into community water sources.	Resilience Ethiopia SSA

Adaptation intervention

Migration

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Health impact and health services

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (2)
Social/ behavioral		 Reduced exposure	**Reduced hazard exposure through relocation** – moving away from drought-, flood-, or cyclone-prone areas lowers direct contamination of water supplies and reduces WASH system failures that drive diarrheal outbreaks. **Improved access to services in destination areas** – migration to safer or more urbanized regions can increase access to clean water, sanitation, healthcare, and hygiene supplies, reducing diarrheal risk. **Better food and income stability** – migration that expands livelihood opportunities or remittance income supports more stable diets and the ability to afford safe water and healthcare, strengthening immunity to diarrheal disease. **Potential reduction of environmental contamination** – relieving population pressure on degraded ecosystems reduces overuse of unsafe water sources and lowers household reliance on contaminated surface water during climate shocks.	Resilience Nigeria Bangladesh

Adaptation intervention

Universal basic services

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Health impact and health services

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (1)
Nature-based Infrastructural Social/ behavioral			**Improved access to safe water and sanitation** – provision of clean drinking water, hygiene facilities, and sanitation infrastructure reduces exposure to diarrheal pathogens. **Enhanced nutrition and food security** – access to ecosystem services (land, forests, pastures) and food-related services supports reliable diets that strengthen immunity against diarrheal disease. **Better healthcare and health knowledge** – basic health services and communication improve disease prevention, early treatment, and adoption of hygiene practices, lowering diarrheal incidence. **Resilience to climate and livelihood shocks** – integrated access to multiple services helps households maintain food, water, and healthcare during floods, droughts, or other climate events, preventing diarrheal disease spikes.	Resilience Pakistan

Adaptation intervention

Climate resilient cities

Global Goal on Adaptation (GGA) target

Infrastructure and human settlements

Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (2)
Nature-based Infrastructural Informational/ Educational	  	 	**Reduced climate hazards through resilient urban infrastructure** – upgraded drainage, flood control systems, and climate-resilient utilities lessen stormwater overflow and sewage contamination, directly reducing diarrheal outbreaks during extreme weather. **More reliable and safer urban water systems** – strengthened water supply, wastewater management, and early-warning systems limit pathogen intrusion into drinking water during floods, heatwaves, and service disruptions. **Improved household health protection** – city-level investments (e.g., resilient roads, sanitation networks, emergency shelters) prevent displacement and reduce reliance on unsafe water sources, lowering diarrheal risk. **Enhanced public awareness and adaptive capacity** – community preparedness, risk communication, and climate education support safer hygiene practices and quicker response to water-related health threats.	Resilience Green total factor productivity China

Adaptation intervention

Coastal Protection

Global Goal on Adaptation (GGA) target

Ecosystem and biodiversity

Health impact and health services

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (8)
Nature-based options Institutional	 	 Reduced hazards	**Reduced climate hazards through natural coastal buffers** – mangroves, salt marshes, coral reefs, seagrass beds, and dense coastal vegetation absorb storm surges, cyclones, and coastal flooding; this prevents damage to water systems and reduces contamination of drinking water sources that drive diarrheal outbreaks. **Cleaner and more stable water quality** –filter sediment, pathogens, and pollutants, reducing runoff into surface water and groundwater after storms and lowering exposure to diarrhea-causing organisms. **Lower disruption of WASH infrastructure** – lessen flooding severity and shoreline erosion, protecting latrines, wells, and piped water systems from overflow or collapse, thereby preventing fecal contamination. **Indirect nutrition benefits** – support fisheries and household food access, strengthening immunity and reducing susceptibility to diarrheal disease.	Damages, Deaths Ecosystem functions, Wave attenuation Flooded land Sri Lanka Bangladesh Mexico Global

Adaptation intervention

Payments for environmental services

Global Goal on Adaptation (GGA) target

Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (14)
Financial/ market mechanism Nature-based options	  	 **Reduced hazards**	**Carbon sequestration reduces climate hazards** – restored forests and reduced deforestation lower the severity of floods, droughts, and heat extremes that normally contaminate water sources and increase diarrheal disease. **Cleaner water through ecosystem restoration** – improved watershed function reduces erosion and runoff during storms, leading to safer surface and groundwater and fewer pathogen exposures. **Stable nutrition from PES income** – compensation for conservation maintains food access and dietary quality, strengthening immunity against diarrheal infections. **Greater household capacity for WASH** – predictable PES payments help families afford clean water, sanitation, hygiene supplies, and healthcare, directly reducing diarrheal incidence.	Forest coverage, deforestation Ecosystem services Migration Costa Rica Mexico China Brazil Guatemala Nigeria Global

Adaptation intervention

Community assets

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Financial/ market mechanism Institutional	 	 Reduced vulnerability	**Improved food and nutrition security** – short-term, labor-intensive employment provides immediate income that stabilizes food consumption and supports more nutritious diets, strengthening immunity against diarrheal disease. **Greater ability to afford WASH and healthcare** – allow households to purchase clean water, soap, sanitation services, and medical treatment that directly reduce diarrheal risk. **Community assets that reduce exposure to pathogens** – construction of drainage systems, soil conservation structures, all-season roads, and reforestation reduces flooding, stagnant water, and erosion, lowering environmental contamination pathways for diarrheal diseases. **Reduced vulnerability to climate shocks** – increase resilience to droughts and floods, preventing food insecurity and health deterioration that elevate diarrheal susceptibility	Adoption of climate-smart agriculture Malawi

Adaptation intervention

Food safety

Global Goal on Adaptation (GGA) target

Health impact and health services

Food and agricultural production

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Informational/ educational Technological	 		**Improved food and nutrition security** –reduce post-harvest losses and preserve nutrient quality, supporting stronger immunity against diarrheal infections. **Higher and more stable income** – less spoilage and damage increase marketable food and reduce replacement costs, allowing households to invest in clean water, sanitation, and health services that reduce diarrheal risk. **Reduced vulnerability to climate shocks** – protected food reserves during floods, heatwaves, or droughts prevent nutrition declines that heighten susceptibility to diarrheal disease. **Lower food contamination risk** - limit mold, mycotoxins, pests, and bacterial contamination. **Safer household food preparation** – educational programs and food-safety schemes (e.g., hygiene training, safe handling of raw poultry, reducing Campylobacter loads) reduce ingestion of pathogens that cause diarrheal disease.	(Pathogen-specific) infection risk Food security Ethiopia UK

Adaptation intervention

Participation and access to markets

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Financial/ market mechanism			Improved food and nutrition security – accessing agricultural markets (e.g., poultry, livestock, crops) increases cash income and availability of diverse foods, strengthening household nutrition and reducing susceptibility to diarrheal disease. Higher and more reliable income – selling farm products provides liquidity to invest in clean water, sanitation, hygiene supplies, and timely healthcare that directly reduce diarrheal risk. Reduced vulnerability to shocks – stable market access allows households to buffer climate or economic shocks without cutting food intake or healthcare spending, preventing nutrition decline associated with diarrheal illness.	Food security Zimbabwe

Adaptation intervention

Social safety nets

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Financial/ market mechanism	 	 Reduced vulnerability	Improved food and nutrition security –stabilize household consumption, protecting nutrition during shocks and strengthening immunity against diarrheal disease. Increased ability to afford WASH and healthcare – predictable transfers allow families to purchase clean water, soap, sanitation services, and medical treatment that directly reduce diarrheal risk. Reduced vulnerability to climate and economic shocks – safety nets prevent harmful coping strategies (e.g., cutting meals, reducing healthcare spending) during crises, maintaining health and resilience. Enhanced human capital – support for schooling and healthcare increases health knowledge, child wellbeing, and uptake of preventive behaviors that lower exposure to diarrheal pathogens.	Crop yield Bangladesh

Adaptation intervention

Agricultural Subsidies

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Financial/ market mechanism Institutional			Improved food and nutrition security – subsidies for seeds, fertilizers, and other inputs raise yields and stabilize food availability, strengthening household nutrition and immunity against diarrhea. Higher and more stable income – reduced input costs increase farm profitability, enabling investments in clean water, sanitation, hygiene products, and medical care that directly lower diarrheal risk. Reduced vulnerability to climate shocks –lowers crop losses during extreme weather, preventing nutrition declines that heighten susceptibility to diarrheal illness. Indirect environmental and health benefits – reduce soil degradation and protect water sources, lowering exposure to diarrheal pathogens.	Food security Productivity Malawi Bangladesh

Adaptation intervention

Climate resilient villages

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Technological Financial/ market mechanism	 	 Reduced vulnerability	Improved food and nutrition security – adoption of climate-smart agriculture (resilient crops, crop diversification, improved livestock management) ensures stable, nutritious food that strengthens immunity against diarrheal disease. Enhanced livelihoods and income stability – access to savings, credit, and community-based support allows households to maintain income and invest in safe water, sanitation, and healthcare during climate shocks. Resilience to climate extremes – village-level planning, water and soil management, and CSA practices reduce the impact of floods, droughts, and heatwaves, protecting food and water from contamination.	Economic outcomes (income) Adoption of adaptation Kenya Drylands

Adaptation intervention

Community Social Capital

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (3)
Social/ behavioral Institutional	 	 Reduced vulnerability	Improved knowledge and adaptive practices – strong networks and farmer-to-farmer learning spread information on soil, water, hygiene, and safe food practices that reduce disease risk. Stronger mutual support during climate shocks – neighbors aid with food, water, childcare, and recovery, preventing households from resorting to unsafe water or poor hygiene during disasters. Better access to services and resources – socially connected communities are more effective at securing clean water, sanitation, and health services, reducing exposure to diarrheal pathogens. Enhanced resilience and faster recovery – collective action allows to repair water points, maintain sanitation infrastructure, and coordinate responses after floods or droughts, lowering diarrheal transmission.	Economic outcomes (yield, investment, income) Community network strength China Global

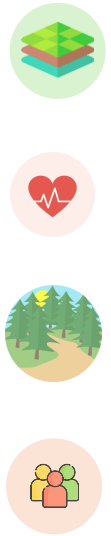
Adaptation intervention

Financial Protection

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods
Food and agricultural production
Health impact and health services
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (17)
Financial/ market mechanism		 Reduced vulnerability	Improved food and nutrition security –allows households to maintain food access, preventing undernutrition that increases susceptibility to diarrheal disease. Protection of WASH access during shocks – cash enables families to buy safe drinking water, hygiene supplies, and essential sanitation items when disasters disrupt normal access. Reduced harmful coping strategies – financial support prevents reliance on unsafe water sources, skipping meals, or postponing medical care during climate crises. Faster recovery and resilience – post-disaster cash helps households rebuild assets, repair water systems, and restore safe living conditions, lowering diarrheal exposure in the aftermath of floods, droughts, or storms.	Food security/ consumption/ expenditure Resilience/ vulnerability Health outcomes Ethiopia LMICs Nigeria Kenya Global Mexico Tanzania South Sudan Indonesia Pakistan South Africa

Adaptation intervention

Sustainability Certification

Global Goal on Adaptation (GGA) target

Food and agricultural production

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (3)
Financial/ market Nature-based		 Reduced vulnerability	Improved food and nutrition quality – certification-linked agroecological practices enhance soil health, reduce chemical exposure, and improve crop quality, strengthening household nutrition and immunity against diarrheal disease. More stable and higher income –increase household earnings, enabling investment in clean water, sanitation, and hygiene. Cleaner water and environment – standards that protect waterways, reduce runoff, and promote tree cover improve local water quality and reduce exposure to diarrheal pathogens. Resilience to climate shocks – soil conservation, diversified cropping, and shade systems reduce climate-related crop losses, preventing nutrition declines that raise diarrheal risk.	Adaptation of adaptation Return on investment Ghana

Adaptation intervention

Income diversification

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods
Food and agricultural production
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (6)
Nature-based Financial/ market mechanism Social/ behavioral	 	 Reduced vulnerability  Reduced hazards	More stable and resilient resources –reduces reliance on climate-sensitive income streams, ensuring households can consistently afford safe food, clean water, and hygiene supplies that reduce diarrheal disease risk. Reduced shocks to food access – diversified livelihoods buffer households when one activity fails , preventing food insecurity and undernutrition that increase susceptibility to diarrhea. Lower reliance on unsafe coping strategies during climate extremes – less likely to use contaminated water, skip meals, sell sanitation assets, or migrate under unsafe conditions during droughts or floods. Improved ability to invest in protective infrastructure –enable investment in latrines, water treatment, protected wells, or clean cooking environments that reduce fecal–oral transmission.	Economic benefits (income, consumption, diversification) Deforestation Adaptation of adaptation Benin Guatemala Bangladesh Ethiopia Africa

Adaptation intervention

Land and/or water management

Global Goal on Adaptation (GGA) target

Food and agricultural production
Ecosystem and biodiversity
Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (16)
Nature-based Infrastructural Institutional Technological Social/ behavioral	  	 Reduced vulnerability  Reduced hazards	Improved soil and water availability –maintain moisture and soil fertility, supporting stable crop production and consistent access to nutritious food that strengthens immunity against diarrheal disease. Reduced contamination of water sources –prevent sedimentation and runoff, protecting wells, ponds, and rivers from microbial contamination. Enhanced livelihoods and income stability – increase household food and income security, allowing households to invest in hygiene, latrines, and clean water. Resilience to climate extremes – integrated land and water management reduces vulnerability to floods, droughts, and soil erosion, preventing households from resorting to unsafe water or food sources during climate shocks.	Economic benefits (yield, income) Deforestation/ greening/ vegetation properties Carbon stocks Food security Ethiopia Tibet Pakistan Brazil Mexico Nigeria Global

Adaptation intervention

Livestock ownership and management practices

Global Goal on Adaptation (GGA) target

Food and agricultural production
Poverty eradication and livelihoods
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (6)
Financial/ market mechanism Nature-based Informational/ educational			Improved food and nutrition security – better herd management, forage production, destocking strategies increase availability of milk, meat, and animal-source foods, strengthening nutrition and immunity against diarrheal disease. Enhanced livelihoods and income stability – livestock insurance, improved market access, community-based rangeland management, and livestock loans protect household income during droughts or disease shocks, enabling continued investment in safe water, sanitation, and healthcare. Resilience to climate extremes – sustainable grazing plans, migration strategies, water-infrastructure support, and fodder production reduce livestock losses during droughts or floods and prevent households from resorting to unsafe water and food sources in crises.	Economic benefits (yield, income) Poverty Resilience Rangeland management Ethiopia Pakistan Brazil Namibia

Adaptation intervention

Agroforestry

Global Goal on Adaptation (GGA) target

Food and agricultural production
Poverty eradication and livelihoods
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (6)
Nature-based Informational/ educational		 Reduced vulnerability	Improved food and nutrition security – integrating trees with crops increases year-round food availability, dietary diversity, and access to fruits, nuts, vegetables, and forest products, strengthening immunity against diarrheal disease. Enhanced livelihoods and income stability – agroforestry products (timber, fruits, fuelwood, bush yams, bushmeat, honey) and improved crop yields provide diversified income streams, allowing households to invest in safe water, sanitation, and healthcare and reducing financial shocks during climate extremes. Resilience to climate extremes – trees improve soil moisture, reduce erosion, buffer crops during heat and drought, and stabilize water availability; this prevents crop failure and reduces reliance on unsafe water sources during climate shocks.	Economic benefits (yield, income) Resilience Kenya Ethiopia Malawi Liberia

Adaptation intervention

Access to financial services

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods
Food and agricultural production
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (12)
Financial/ market mechanism Social/ behavioral	  	 Reduced vulnerability	Improved food and nutrition security –help households smooth consumption, avoid food shortages after climate shocks, and invest in improved seeds and inputs, leading to more reliable and nutritious diets that strengthen immunity against diarrhea Enhanced livelihoods and income stability – reduce financial volatility during disasters, allowing households to maintain spending on safe water, sanitation, and healthcare .Resilience to climate extremes –prevent households from coping by using unsafe water sources or unsafe food during floods or droughts; financial buffers enable protection of water storage, latrines, and hygiene supplies.	Economic benefits (yield, income) Adoption of adaptation Resilience Deforestation Bangladesh Pakistan Nigeria Ethiopia Vietnam Guatemala

Adaptation intervention

Climate information services

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (9)
Informational/ educational	 	 Reduced vulnerability	Improved food and nutrition security – accurate forecasts and seasonal climate advisories help farmers protect crops and livestock, reducing losses and supporting consistent nutrition that strengthens immunity against diarrhea. Enhanced livelihoods and income stability – timely information allows households to plan agricultural activities, avoid losses, and maintain stable income, enabling investment in safe water, sanitation, and healthcare. Resilience to climate extremes – early warning systems for floods, droughts, storms, and heatwaves allow communities to safeguard water sources, store safe drinking water, and protect sanitation infrastructure, reducing exposure to contaminated water.	Economic benefits (yield, income) Adoption of adaptation China Taiwan Burkina Faso Pakistan Benin India

Adaptation intervention

Sustainable agriculture

Global Goal on Adaptation (GGA) target

Food and agricultural production
Poverty eradication and livelihoods
Ecosystem and biodiversity

Examples

Action Type	Sector	Risk Type	Health Pathway	Outcomes (57)
Nature-based Technological Infrastructural Financial Social/ behavioural	  	 Reduced vulnerability  Reduced hazards	Enhanced food and nutrition → reduced malnutrition and susceptibility to diarrhea Strengthened livelihoods and income stability Reduced environmental degradation Increased community resilience to climate extremes	Economic benefits (yield, income, revenue) Livelihoods, food security Soil erosion Ghana Kenya Southern, West, East Africa Tanzania China India Zambia Bangladesh Zimbabwe Mali Nepal Nigeria Pakistan Indonesia

Adaptation intervention

Irrigation for agriculture

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (18)
Nature-based Technological Infrastructural Financial Institutional	  	 Reduced vulnerability	Reliable water supply for crops – stabilizes production and reduces dependence on unsafe water sources. Improved food and nutrition security – year-round crops and dietary diversity strengthen immunity, lowering susceptibility to diarrheal disease. Enhanced livelihoods – stable income allows households to access safe water, sanitation, and healthcare. Resilience to climate extremes – irrigation buffers against droughts and floods, reducing exposure to contaminated water. Integrated water and land management – proper drainage and irrigation infrastructure minimize runoff, flooding, and pathogen spread, lowering enteric disease risk.	Economic benefits (yield, income, revenue) Livelihoods, food security Resilience Adoption of adaptation China India Thailand Ghana Philippines Brazil Mali Ethiopia

Adaptation intervention

Soil and water conservation

Global Goal on Adaptation (GGA) target

Food and agricultural production
Ecosystem and biodiversity
Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (21)
Nature-based Technological Infrastructural Financial Social/ behavioural	 	Reduced vulnerability Reduced hazards	Reduced soil erosion and runoff – prevents sediment and pathogen contamination of water sources Improved water retention and availability – supports safe water for domestic use, hygiene, and irrigation Enhanced crop productivity and nutrition – better soil fertility leads to more reliable food supply and dietary diversity, strengthening immunity against diarrheal disease Resilience to climate extremes – terraces, check dams, and bunds reduce flooding and drought impacts, limiting exposure to contaminated water Ecosystem and watershed protection – stabilizes landscapes and water quality, lowering enteric pathogen transmission risk.	Economic benefits (yield, income, revenue) Water preservation Soil organic matter India Jordan Ethiopia China Costa Rica Kenya Laos Malawi

Adaptation intervention

Agricultural extension services

Global Goal on Adaptation (GGA) target

Food and agricultural production
Ecosystem and biodiversity
Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (10)
Informational/ educational Social/ behavioural	 	 Reduced vulnerability  Reduced hazards	Improved farming practices – promotes climate-resilient, safe, and efficient agricultural techniques. Enhanced food and nutrition security – guidance on crop diversification and soil fertility increases availability of nutritious foods, strengthening immunity against diarrheal disease. Increased livelihoods and income stability – technical support helps farmers boost yields and market access, enabling investment in safe water, sanitation, and healthcare. Resilience to climate extremes – education on risk management (e.g., drought- or flood-adapted crops) reduces vulnerability to climate shocks and related exposure to contaminated water. Knowledge dissemination on hygiene and water safety – extension services can integrate messaging on safe water use and sanitation, lowering enteric pathogen exposure.	Economic benefits (yield, income, revenue) Adoption of adaptation Pasture restoration Ghana Tanzania India Pakistan South Africa

Adaptation intervention

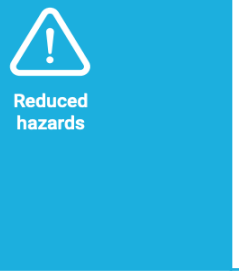
Crop diversification

Global Goal on Adaptation (GGA) target

Food and agricultural production

Poverty eradication and livelihoods

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (9)
Nature-based	 	 	Improved food and nutrition security – multiple crops increase dietary diversity and nutrient intake, strengthening immunity against diarrheal disease. Enhanced livelihoods and income stability – diverse crops reduce market and climate risk, allowing households to invest in safe water, sanitation, and healthcare. Resilience to climate extremes – variety of crops buffers against droughts, floods, and seasonal variability, lowering dependence on unsafe water sources. Reduced environmental degradation – crop rotations and mixed planting improve soil fertility and water retention, decreasing runoff and contamination of water sources. Indirect reduction in enteric disease risk – better nutrition and stable food production reduce susceptibility and severity of diarrheal infections.	Economic benefits (yield, income) Livelihoods, food security Resilience China Ethiopia Malawi Tanzania India Niger

Adaptation intervention

Weather based or agricultural insurance

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods
Food and agricultural production

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (8)
Financial/ market mechanisms	  	 Reduced vulnerability  Reduced hazards	Improved food and nutrition security – insurance reduces risk of crop failure, ensuring consistent food availability and dietary diversity, strengthening immunity against diarrheal disease. Enhanced livelihoods and income stability – compensation for losses stabilizes household income, allowing investment in safe water, sanitation, and healthcare. Resilience to climate extremes – insurance coverage reduces vulnerability to droughts, floods, and other shocks, preventing households from resorting to unsafe water sources. Indirect reduction in enteric disease risk – stable nutrition and income lower susceptibility and severity of diarrheal infections, even during climate shocks.	Livelihoods, food security Access to health services Socioeconomic impact China Ethiopia India

Adaptation intervention

Integrated resilience/ livelihoods intervention

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods
Food and agricultural production
Water supply and sanitation

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (10)
Financial/ market mechanisms Nature-based Educational/ informational Infrastructure	  		Improved food and nutrition security – diversified livelihoods reduce the risk of crop and livestock failure, ensuring consistent access to safe, nutritious food and strengthening immunity against diarrheal disease. Enhanced livelihoods and income stability – financial services, cash grants, and income-generating activities stabilize household income, enabling investment in safe water, sanitation, and healthcare. Resilience to climate extremes – natural resource management, infrastructure, and climate information reduce vulnerability to droughts, floods, and other shocks, preventing households from relying on contaminated water sources.	Livelihoods, food security Resilience Economic benefits Ethiopia Bangladesh India Malawi Afghanistan Myanmar Niger

Adaptation intervention

Safe water source

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

Action Type	Sector	Risk Type	Health Pathway	Evidence (25)
Infrastructural Institutional Financial Nature-based		 Reduced exposure	Reduced reliance on unsafe or contaminated sources Decreased exposure to waterborne pathogens Reduced household-level water insecurity and unsafe storage practices. Improved hygiene behaviors	Diarrhea incidence/ prevalence (Pathogen-specific) infection risk Cost/ Cost-effectiveness Other health outcomes Cambodia Benin Botswana Bangladesh Mexico Global Ethiopia US DRC Tanzania The Gambia Peru Rwanda Italy LMICs Yemen Vietnam

Adaptation intervention

Safe sanitation facilities

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples ←

Action Type	Sector	Risk Type	Health Pathway	Evidence (20)
Infrastructural Financial		 Reduced exposure	Reduced reliance on unsafe or climate-vulnerable practices Decreased environmental contamination Reduced household and community exposure to fecal pathogens Improved hygiene practices	Diarrhea incidence prevalence (Pathogen-specific) infection risk Other health outcomes Adoption of adaptation Botswana Bangladesh Mexico SSA Ethiopia Ecuador Vietnam Argentina Global Rwanda LMICs Cambodia Ghana Yemen

Adaptation intervention

Drinking water treatment

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

Chlorination, flocculation, coagulation, rapid sand filter, and UV

Point-of-use household water treatment with silver-impregnated ceramic water filters

Ceramic “candle” water filters

Water purification tablets

Action Type	Sector	Risk Type	Health Pathway	Evidence (11)
Technological		 Reduced exposure	Reduced exposure to waterborne pathogens Reduced reliance on unsafe water sources during climate stress Improved household water security and storage practices Strengthened hygiene	Diarrhea incidence/ prevalence (Pathogen-specific) infection risk Other health outcomes
				Canada Norway US Ethiopia South Africa Ecuador Dominican Republic China India Bangladesh

Adaptation intervention

Wastewater treatment

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

Urban canals

Wastewater treatment plants with different methods: screens, sequencing bed reactor or moving bed biofilm reactors, chlorine, dual media filter, activated carbon filter, UV

Treated wastewater for agriculture

Action Type	Sector	Risk Type	Health Pathway	Evidence (10)
Adaptation action to reduce exposure to hazards	 Water	 **Reduced exposure**	Reduced reliance on untreated or inadequately treated wastewater Improved pathogen removal from water streams Safer reuse of treated wastewater Enhanced community and household hygiene outcomes Climate resilience and system reliability	Diarrhea incidence/ prevalence (Pathogen-specific) infection risk Pathogen prevalence in water Sustainability Other health outcomes
Infrastructural Technological				Mexico USA Italy Thailand Bangladesh England India Germany

Adaptation intervention

Handwashing

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

Providing liquid soap + Standard hygiene kit

Distance to water or access to water or soap for handwashing

Mother's handwashing habits

Action Type	Sector	Risk Type	Health Pathway	Evidence (7)
Adaptation action to reduce exposure to hazards	 Water	 **Reduced exposure**	Improved personal and household hygiene behaviors Reduced transmission of fecal–oral pathogens Decreased environmental contamination Increased community resilience to climate-sensitive health risks Behavioral co-benefits for other health outcomes	Handwashing Diarrhea incidence/ prevalence Other health outcomes
Social/ behavioural				Ethiopia LMICs Tuvalu Ecuador Afghanistan Ghana

Adaptation intervention

Water storage

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

Underground cisterns and concrete or metal tanks for drinking water storage
Covering water pots for kitchen use
Construction of rainwater cement cisterns

Action Type	Sector	Risk Type	Health Pathway	Evidence (6)
Adaptation action to reduce exposure to hazards	 Water	 **Reduced exposure**	Reduced contamination during storage and handling Improved household-level water security Decreased exposure to waterborne pathogens Enhanced hygiene practices Community-level resilience to climate variability	Diarrhea incidence/ prevalence Pathogen prevalence in water Other health outcomes
Social/ behavioural Infrastructural				Ethiopia Ecuador Jordan Brazil Afghanistan Bangladesh

Adaptation intervention

Health risk assessment

Global Goal on Adaptation (GGA) target

Health impact and health services

Water supply and sanitation

Examples

Spatial risk assessment

QMRA

Satellite imaging forecasting tools for diarrheal risk

Action Type	Sector	Risk Type	Health Pathway	Evidence (11)
Adaptation action to reduce exposure to hazards	 Health  Water  Agriculture	 **Reduced exposure**	Improved identification of high-risk areas and populations Quantitative exposure estimation Early warning and outbreak prediction Monitoring intervention effectiveness Enhanced decision-making for climate adaptation	Performance for risk assessment
Informational/ educational				Thailand Indonesia China Ghana Canada Austria Bangladesh Ireland Australia Uganda

Adaptation intervention

Integrated WaSH

Global Goal on Adaptation (GGA) target

Water supply and sanitation

Examples

WaSH Benefits trial – Kenya

WaSH Benefits trial – Bangladesh

SHINE Sanitation, Hygiene, Infant Nutrition Efficacy Project (SHINE)

Combined water, sanitation, handwashing, and nutrition

Action Type	Sector	Risk Type	Health Pathway	Evidence (5)
Adaptation actions that modify hazards directly **Adaptation action to reduce exposure to hazards** **Action on structural drivers of vulnerability** Infrastructural, financial, technological, social, institutional	Water Health Agriculture	**Reduced hazards** **Reduced exposure** **Reduced vulnerability**	Reduced exposure to fecal pathogens Enhanced child nutrition and immunity Synergistic behavioral improvements Financial protection Increased resilience to climate-sensitive health risks	Diarrhea incidence/ prevalence Other health outcomes Cost/ Cost-effectiveness Bangladesh Kenya Zimbabwe Pakistan Global

Adaptation intervention

Water harvesting

Global Goal on Adaptation (GGA) target

Water supply and sanitation
Food and agricultural production
Ecosystem and biodiversity

Examples

Rainwater harvesting system/ rainwater as drinking water
Collection, storing, and utilizing runoff from roofs or ground surfaces through different technologies
Bunds

Action Type	Sector	Risk Type	Health Pathway	Evidence (13)
Adaptation action to reduce exposure to hazards	 Water  Agriculture, forestry and fishing	 **Reduced exposure**	Reduced reliance on unsafe water for drinking or agriculture Reduced exposure to waterborne pathogens Enhanced household water security Supports hygiene and sanitation practices Community and environmental resilience	Diarrhea incidence/ prevalence Sustainability Adoption of adaptation Yield/ income Water use/ runoff efficiency Soil properties
Nature-based Infrastructural Technological Informational/ educational				Mexico Bangladesh Nepal Kenya Iran Brazil Nepal

Adaptation intervention

Wastewater treatment for irrigation

Global Goal on Adaptation (GGA) target

Water supply and sanitation
Food and agricultural production

Examples

Lagoon based wastewater treatment
On-farm water treatment methods: three-tank system, filtration, sedimentation for irrigation of vegetables

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Adaptation action to reduce exposure to hazards	 Water	 **Reduced exposure**	Reduced exposure to fecal pathogens from agricultural water Safe food production Supports climate-resilient water management Environmental and ecosystem protection	Pathogen specific infection risk
Technological Nature-based	 Agriculture, forestry and fishing			Ghana Burkina Faso

Adaptation intervention

Disaster risk reduction

Global Goal on Adaptation (GGA) target

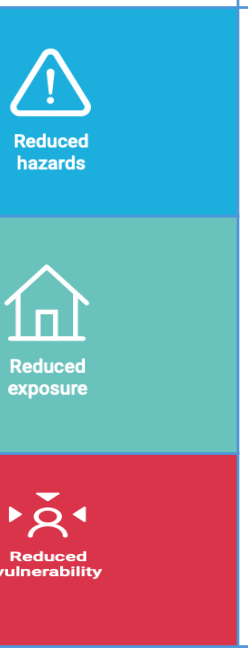
Infrastructure and human settlements

Examples

Flood control. Construction of river embankments and polders as well as riverbank protection schemes

Disaster preparedness training and warning messages

Disaster alert systems

Action Type	Sector	Risk Type	Health Pathway	Evidence (18)
Infrastructural Nature-based Informational Financial Institutional			Reduced exposure to waterborne pathogens during floods Protection of water and sanitation infrastructure Enhanced community resilience to climate extremes Support for hygiene and health behaviors	Diarrhea incidence prevalence Adoption of adaptation Resilience Hydrological regimes Disaster risk Productivity Bangladesh, Vietnam, Nepal, Pakistan, China, Brazil Argentina

Adaptation intervention

Wetlands

Global Goal on Adaptation (GGA) target

Ecosystem and biodiversity

Water supply and sanitation

Examples

Urban wetlands as frontline safeguard of pathogens in surface water

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Adaptation actions that modify hazards directly **Adaptation action to reduce exposure to hazards** **Action on structural drivers of vulnerability** Nature based	 Water	 Reduced hazards  Reduced exposure  Reduced vulnerability	Carbon absorption and climate mitigation → less climate extremes Flood regulation and resilience to climate extremes → less spread of pathogens as less overflow Water purification and safe water availability Ecosystem resilience and sustained livelihoods	Pathogen prevalence in water US

Adaptation intervention

Vaccination

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Rotavirus vaccination

Potential campylobacter vaccination

Action Type	Sector	Risk Type	Health Pathway	Evidence (3)
Action on structural drivers of vulnerability	Health	Reduced vulnerability	Direct reduction in diarrheal disease incidence Decreased severe illness and mortality Reduced pathogen transmission in communities Increased resilience to climate-sensitive diarrheal outbreaks	Diarrhea incidence/ prevalence Pathogen specific infection risk
Institutional				England Peru LMICs

Adaptation intervention

Personal protective equipment

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Personal protective equipment for disaster personnel

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Action on structural drivers of vulnerability	Health	Reduced vulnerability	Reduced exposure to contaminated water and fecal matter Decreased occupational diarrheal illness among responders Reduced secondary transmission to affected populations Increased resilience of response systems to climate-sensitive diarrheal outbreaks	Diarrhea incidence/ prevalence
Institutional				Denmark

Adaptation intervention

Nutrition support programs

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Vitamin A supplement in response to natural disaster
Food fortification and supplementation
Nutrition education

Action Type	Sector	Risk Type	Health Pathway	Evidence (4)
Action on structural drivers of vulnerability	 Health	 Reduced vulnerability	Improved immune function and resistance to enteric infections Decreased severity and duration of diarrheal illness Reduced vulnerability of malnourished populations to climate-related disease burdens Increased community resilience to climate-sensitive diarrheal outbreaks	Other health outcomes (mortality, stunting, improved diet)
Institutional Informational/ educational Social/ behavioral				India Bangladesh Small Island States

Adaptation intervention

Health resources and infrastructure

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Budget, doctors, hospital beds, and advanced equipment

Medical resources and infrastructure to deal with winter disasters

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Action on structural drivers of vulnerability	 Health	 Reduced vulnerability	Improved access to timely medical care for diarrheal patients Decreased severity and mortality from diarrheal disease Enhanced capacity to respond to outbreaks and prevent secondary transmission Increased resilience of health systems to climate-sensitive diarrheal outbreaks	Resource needs Child mortality
Institutional				Greece, China, Philippines and Gambia, Mongolia

Adaptation intervention

Other preventive and curative care

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Household preventive and curative health care for prevailing climate change diseases

Psychological interventions for mental disorders in survivors of natural disasters

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Action on structural drivers of vulnerability	 Health	 Reduced vulnerability	Timely administration of oral rehydration and supportive care Decreased severity and mortality from diarrheal episodes Reduced secondary transmission through proper case management Increased resilience of health systems and communities to climate-sensitive diarrheal outbreaks and natural disasters	Cost Efficacy of adaptation
Institutional				Nepal Global

Adaptation intervention

Early detection

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Data collection and tools for use in the prehospital setting for early detection of heat illness

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Action on structural drivers of vulnerability	 Health	 Reduced vulnerability	Prompt identification of heat stress in vulnerable population Decreased severity and mortality from dehydration-related diarrheal complications Reduced risk of secondary infections due to compromised immunity Increased resilience of communities and health systems to climate-sensitive diarrheal outbreaks	Other health outcome (Early detection)
Informational/ educational				India

Adaptation intervention

Disease surveillance systems

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Rotavirus surveillance system

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Action on structural drivers of vulnerability	Health	Reduced vulnerability	Early detection of rotavirus outbreaks in communities Decreased severity and mortality through rapid response Reduced transmission through informed public health actions Increased resilience of health systems to climate-sensitive diarrheal outbreaks	Performance for risk assessment
Informational/ educational				Yemen

Adaptation intervention

Child feeding practices

Global Goal on Adaptation (GGA) target

Health impact and health services

Examples

Exclusive breastfeeding, complementary foods and food diversification

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Action on structural drivers of vulnerability	 Health	 Reduced vulnerability	Improved infant and child immunity and gut health Decreased severity and frequency of diarrheal episodes Reduced risk of secondary transmission within households Increased resilience of children and communities to climate-sensitive diarrheal outbreaks	Diarrhea incidence/ prevalence
Social/ behavioral				LMICs

Adaptation intervention

Urban greening

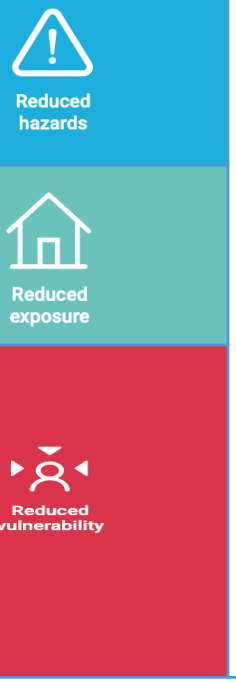
Global Goal on Adaptation (GGA) target

Infrastructure and human settlements

Examples

Parks and pocket parks

Tree planting or the creation of parks or green roofs

Action Type	Sector	Risk Type	Health Pathway	Evidence (3)
Adaptation actions that modify hazards directly Adaptation action to reduce exposure to hazards Action on structural drivers of vulnerability Nature based	 Land use and built environment		Carbon absorption and climate mitigation → Less climate extremes Stormwater regulation and reduced flooding → Limits pathogen spread Improved water quality through natural filtration → Reduced exposure to waterborne pathogens Enhanced community well-being and recreation → Supports healthier behaviours Ecosystem resilience and sustained urban livelihoods	Diarrhea incidence/ prevalence Pollution Temperature Hungary Taiwan Global

Adaptation intervention

Low impact developments

Global Goal on Adaptation (GGA) target

Infrastructure and human settlements

Examples

A series of vegetative techniques to retain rainfall close to the site of origin such as storage ponds or water cascades

Action Type	Sector	Risk Type	Health Pathway	Evidence (1)
Nature based	 Water  Land use and built environment		These infrastructures can be considered a risk to public health due to the presence of pathogens in the runoff and human exposure to contaminated water held in and transported by LIDs	Diarrhea incidence/ prevalence (**maladaptation**)
				Global

Adaptation intervention

Green building design

Global Goal on Adaptation (GGA) target

Infrastructure and human settlements

Examples

Avoiding development in or adjacent habitat/ Increase vegetated open space

Install light colored roof or vegetated roof

Earth to air heat exchanger (EAHE) system using low cost building materials like Bamboo (Bambuseae) and hydraform (cement and soil plaster)

Action Type	Sector	Risk Type	Health Pathway	Evidence (8)
Adaptation actions that modify hazards directly **Adaptation action to reduce exposure to hazards** Nature based Infrastructural	 Water  Land use and built environment	 Reduced hazards  Reduced exposure	Reduced contamination of water sources and pathogen exposure Improved stormwater infiltration and reduced flooding → Limits spread of waterborne pathogens Decreased pathogen runoff into community water sources Mitigation of urban heat → Less favorable conditions for pathogen proliferation Increased resilience of communities to climate-sensitive diarrheal outbreaks	Other health outcomes Temperature Energy consumption Global Taiwan

Adaptation intervention

Biodiversity conservation

Global Goal on Adaptation (GGA) target

Ecosystem and biodiversity

Examples

Forest protected areas and forest coverage and loss

land demarcation, registration and certification process

Indigenous territories

Farmer-Managed Natural Regeneration

Action Type	Sector	Risk Type	Health Pathway	Evidence (18)
Adaptation actions that modify hazards directly Adaptation action to reduce exposure to hazards Action on structural drivers of vulnerability Nature based Institutional	  	 Reduced hazards  Reduced exposure  Reduced vulnerability	Carbon storage and climate mitigation → Less climate extremes and reduced pathogen proliferation Regulation of water flow and reduced flooding → Limits contamination of water sources Maintenance of water quality through soil and vegetation → Reduced exposure to pathogens Preservation of ecosystem services and biodiversity → Supports livelihoods and community health Increased resilience of communities to climate-sensitive diarrheal outbreaks	Diarrhea incidence/ prevalence Deforestation Carbon stocks Yield Forest fires/ disasters Cambodia Ethiopia China Brazil India Global West Africa

Adaptation intervention

Modifying housing and infrastructure

Global Goal on Adaptation (GGA) target

Infrastructure and human settlements

Examples

Home rebuilding, infrastructure, fans, air conditioning, seasonal clothing

Raise homes in flood-prone areas

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Adaptation action to reduce exposure to hazards			Enhanced protection from direct impacts of climate hazards within the built environment	Cost or cost-effectiveness
Infrastructural	Society and Economy	**Reduced exposure**		Nepal

Adaptation intervention

Biodigesters

Global Goal on Adaptation (GGA) target

Poverty eradication and livelihoods

Examples

Household-level systems use human and animal waste to produce clean-burning biogas used for cooking

Biogas digesters replacing fuelwood

Action Type	Sector	Risk Type	Health Pathway	Evidence (2)
Technological	 Society and Economy	 Reduced hazards	Increased exposure to fecal pathogens	Diarrhea incidence/ prevalence (**maladaptation**) Forest biomass and diversity
		 Reduced exposure	Increased forest and vegetation .Enhanced carbon sequestration and climate mitigation Improved watershed and flood regulation Reduced contamination and disease risk	Nepal India
		 Reduced vulnerability		

Sustainable agriculture

- No till farming, crop diversity, soil cover
- Changing crop
- Floating gardens or hydroponics
- Saline-tolerant, flood-tolerant, drought-resistant, and early maturing crop varieties (e.g., rice, maize, vegetables); sorjan method of farming; pond-side vegetable cultivation; cultivation of watermelon, sunflower, or plum; relay cropping; urea deep placement; organic fertilizer; mulching; pheromone traps; seed storage in plastic or glass containers
- Reseeding, fixing, and cleaning seedlings
- Organic agriculture as a climate-smart option among cocoa farmers
- Changing planting dates, crop varieties, and fertilizer types
- Adjustment in sowing time, use of drought-tolerant varieties, and shifting to new crops
- Reduced tillage, crop rotation, legume intercropping, improved seeds, and inorganic fertilizer use
- Crop rotation, conservation tillage, residue retention, organic inputs, improved crop varieties, and complementary fertilizer use
- Mechanization, technical guidance, soil treatment
- Sowing at different sowing dates for maize vegetative growth and grain yield
- Training on agronomic practices, certified seed access, urea fertilizer, and gypsum provision, plus marketing assistance
- Conservation agriculture practices: reduced tillage and maize-cowpea intercropping
- Maize-based conservation agriculture systems
- Cultivar choice, staggered planting dates, and variable fertilizer rates
- Multiple agricultural technologies (MATs) combining improved maize varieties (IMVs) with conservation agriculture practices
- Crop intensification
- Companion cropping system (“push–pull”)
- Input supply systems (e.g., seed systems)
- Improved crop varieties, laser land levelling, zero tillage, residue management, site-specific nutrient management, and crop diversification
- Crop and varietal adjustment; timing of farm operations; soil and water management; fertilizer and off-farm management
- Adjustment to farming practices, climate-smart agriculture (CSA), sustainable land management, and new technologies
- Modified, rainfed system of rice intensification (SRI)
- Improved or diverse seed varieties
- Manure adoption and residue retention
- Submergence-tolerant (Sub1) rice varieties
- Mixed cropping, diversification, intercropping, selling/moving livestock
- Minimum tillage as a climate-smart agriculture practice
- Soil and water management CSA practices and crop-specific CSA practices (e.g., drought-tolerant maize, orange maize, improved legumes)
- Introducing new technologies — microdosing of mineral fertilizer, seed priming, new cereal varieties, horticulture, poultry, and goat production, assisted natural regeneration, and ridging through farmer field schools (“Adapting Agriculture and Livestock to Climate Change” project)
- Stress-tolerant rice varieties (STRVs)
- Drought-stress tolerant rice varieties (DSTRVs)

Irrigation

- Tapping deep groundwater using borewells and access to groundwater
- Irrigation infrastructure - small reservoirs, ponds, irrigation stations
- Reliable source of irrigation – e.g., access to tubewells
- Increasing tubewell density for groundwater irrigation
- Investments and maintenances of irrigation facilities such as canal, tubewell, cistern, pond, and pump equipment
- ASPL funded irrigation improvements (ASPLII) to the physical infrastructure, to canal and on-farm water management mainly through promotion of Water Users Associations (WUA), and to agricultural extension.
- Irrigation management transfer is an important strategy among donors and governments to strengthen farmer control over water and irrigation infrastructure.
- Collective tubewells to own tubewells or groundwater markets.
- Reservoir-irrigated croplands
- Installation of large-capacity wells in rural areas.
- Engineering measures including irrigation and drainage engineering facilities such as pumps, irrigation/drainage ditches, motor-pumped wells and others
- Irrigated vs rainfed production
- Climate-resilient irrigation in small-scale farming. irrigation with water pumped from the Niger River and its tributaries and used to irrigate small perimeters of up to 40 ha
- Small scale irrigation investments
- Small scale irrigation for agricultural production
- Role of irrigation in agricultural transformation (transformation defined as a switch from subsistence agriculture to high-input high-output agriculture with surplus for markets)
- The Koga irrigation development project is a large-scale modern irrigation scheme that aimed to improve rain fed agriculture by allowing two crop seasons through the building of two dams on the Blue Nile river, that were completed in 2012. In addition to basic irrigation development activities, it integrates forestry, livestock, soil management, water and sanitation.

Soil and water conservation

- Watershed development. Pond construction, tree planting , trenches, boulder checks, improvement of domestic water access
- Water pricing for water conservation
- Reducing plant community evapotranspiraiton (ET) by removing leaves from stalks
- Pressure management in urban water distribution networks
- Private water-conserving technology (WCT) adoption
- Traditional technologies include border irrigation, furrow irrigation and field leveling. Household-based technologies include surface level plastic irrigation pipe. Community-based technologies include underground pipe systems, lined canals, sprinkler systems and drip irrigation systems
- Stickers added to water bills at low cost
- Farm-based irrigation water-saving techniques
- Adoption of soil and water conservation measures, small-scale irrigation, agronomic practices, and livelihood diversification strategies
- Water and soil conservation practices (WSC); changes in cropping schedule and varieties (Cr); and improvement of irrigation systems (I).
- Adoption of water-saving technology (WST), changing crop varieties (CV), changing planting date (CPD), changing harvesting date (CHD), and reseeding. e insurance, double-film covering, maintaining drainage, and irrigation facilities
- Stone and soil bunds, grass strips, waterways, trees, and contours
- In situ soil and water conservation tillage practices (derdero+ and terwah+) as compared to a conventional system
- A commonly used SWC technique (Fanya-juu terracing)
- Organic and clay-based soil amendments
- Soil testing and formulated fertilization
- Wellness and Agriculture for Life Advancement (WALA) implemented watershed restoration across eight districts in southern Malawi from 2009 to 2014 to improve degraded soils and boost grain yields

Agricultural extension services

- Education and training - crop water budgeting and farmer schools
- Education to provide agricultural support to farmers and assist farmers in making decisions that will better their farming practices and ensure food-secured communities in South Africa
- Farmer field schools and weather and climate information services
- Comprehensive agricultural training program
- Biochar and compost production training
- Public and private extension services for farmers
- Farmers received technical training and financial support for the initial adoption of soybean production
- Training and technical assistance for pastoral livelihoods
- Participatory approach, mainly in farmers' field schools.
- Community based approach to promote the adoption of climate smart agriculture (CSA) practices. Based on two community-based organizations, Farmer Field Business Schools (FFBS) and Village Savings and Loan Associations (VSLAs), this approach combines interventions on farmer training, access to microfinance, and women's empowerment in agriculture to introduce and enhance the adoption of the practices.

Crop diversification

- New diversified mode of "Rice-Cole, rice, cotton, seedling nursery, and coarse cereals
- Adoption rates of improved or modern varieties (MV) of sorghum
- Crop diversification beyond maize
- Diversify their crops, i.e. added additional crop types, changed their portfolio of crops, i.e. substituted some crops or cultivars with others
- Intercropping - Growing more than one species simultaneously in the same field
- Diverse crop mix
- Diversification in crop species and labor diversification
- CD via intercropping and crop rotation is a strategy for attempting to grow and manage more than one crop across space or time which involves the exploitation of jointly beneficial interactions among individual crops. These include reducing the incidence of weeds, pests and diseases; improving soil fertility, organic matter content and water-holding capacity; diversifying the seasonal requirements of resources; and stabilizing farm income over time through evening out the impact of price fluctuation
- To facilitate the adoption and conservation of well-performing local varieties by smallholders, a participatory development program, namely Seeds for Needs (S4N)

Weather-based insurance

- Policy-based agricultural insurance
- Index based weather insurance
- Microinsurance
- Agricultural yield insurance
- Weather index insurance for farmers
- Subsidized livestock insurance
- Index-based insurances (IBIs) aim to overcome moral hazard and asymmetric information problems by delinking payouts from individual behaviour. Payouts will be made if an objectively determined index falls below a given threshold. The index can be constructed from the intensity of rainfall, images of vegetative cover on the earth's surface, often measured by satellite remote sensing, or area yield losses.
- Index-based livestock insurance product

Climate information services

- Content and accessibility to risk communication - messages, print media, modern communication,
- Access to public climate information and technical or physical support
- The practical information provided objective facts about flood risk and mitigation options. , social information conveyed behavior, attitudes, and beliefs of a particular group
- Climate information services (CIS) refer to agricultural advisories integrated in climate information, and these assist crop farmers in determining which practices to use to manage the predicted/anticipated climate risks
- Uptake of tailored seasonal and daily weather forecasts that are mediated by a multidisciplinary working group (MWG)
- Four types of WCIS were communicated to farmers. (i) downscaled rainfall seasonal forecasts, (ii) 10-day rainfall forecasts, (iii) daily climate information and (iv) agro-met-advisories
- WCIS in the cotton-wheat cropping areas of Pakistan
- Short message services of weather forecasts
- Agri-met advisory via SMS

Integrated resilience/ livelihoods intervention

- Financial Services (VSLA, Microfinance and SILC), Agro-pastoral (livestock, climate smart agricultural), Natural Resource Management, Climate information (weather forecasts, early warning systems), Policy, institutions and community organisation
- Building dams, providing improved types of seeds, introducing new products, offering workshops/trainings, concreting water, canals, digging water wells, establishing gardens, providing fertilizer and pesticides, digging terraces, and re-greening pasture lands.
- Improving access to financial services; Improving access to weather and market information; Improving access to natural resources; Focusing on livestock production, management, and marketing
- The Malawi Farmer to Farmer Agroecology project (MAFFA)
- Theory-based educational intervention on air pollution exposure; cash transfer program against drought (Bolsa Familia); risk communication for flooding; WWWC Initiative; REDD+; 3 day mental health integrated disaster preparedness group intervention.; Water Supply System (SAA) initiative; FMNR - agroforestry; Cardiopulmonary outcomes and Household Air Pollution (CHAP) RCT; MAIS programme; Forecast-based unconditional cash transfer in anticipation of extreme weather event; relocation
- Food- and-Cash-for-Work (FCW). Food-and–Cash-for-Training (FCT) Cash Grant for IGA and a monthly stipend for consumption support. In addition, the project provided a monthly allowance of 500 BDT to the IGA participants for one year to smoothen household consumption during the investment period. The final component was community development that comprised several skills and capacity-building initiatives aimed at a strong and resilient community. The activities included environmental improvement, social infrastructure development, and water and sanitation improvement.
- ‘Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' project. Some of the implemented activities sought to reduce households’ vulnerability and improve buffer capacity through spice tree nurseries, livestock hand-outs, farmer field schools and extension for uptake of climate-smart agriculture (CSA) technologies, and income generating forest-based enterprises (butterfly farming, beekeeping, ecotourism). Others supported the functioning of village structures and networks overseeing forest, land and water management (including water supply technologies) and various self-help and development groups nurturing collaboration and self-reliance
- Comprehensive package of services delivered to vulnerable communities in urban and peri-urban settings covering: (i) livelihood, to meet the immediate food needs of households (through different transfer modalities) while restoring degraded landscapes, improving water harvesting, reducing the risk of environmental disasters and creating community assets to secure ecosystems. FFA activities are also done to increase agricultural and pastoral productivity and yields, support economic development, and strengthen social ties between community members and villages; (ii) education, providing school meals and capacity and resilience building activities for children; (iii) health, nutrition and WASH, to improve access to basic health services, water and sanitation infrastructure at health facilities and schools, and sensitise communities
- CBINReMP provided support to watershed communities for the restoration of degraded soils and water sources, rehabilitation of forests, as well as in obtaining access to secure land titles and practices for climate change adaptation. The project further provided support towards diversification of incomes in off-farm activities and incentives for women’s empowerment and youth employment.

Access to financial services

- Contingent repayment system, which allows rescheduling of repayment during natural disasters for disaster-affected members
- Post harvest bum and access to microfinancing
- Savings-led microfinance programs
- Access to credit to mitigate impact of climate change
- Access to savings pooling
- Access to formal financial institutions
- Microcredit for agriculture
- Being credit constrained or not
- Microcredits for farmers
- Cooperatives - disseminating improved agricultural inputs (e.g., fertilizers, improved seeds), providing loans, and marketing produced from the member's farm. Cooperative supports (CS) and technology adoption (TA)
- Loan and technical assistance package or a cash transfer with a smaller loan and technical assistance
- Rural credit program for agriculture

Agroforestry

- Agroforestry is a multifaceted, ecologically based, natural resource management system that, through the integration of trees on farms and within the agricultural landscape
- Homegarden agroforestry (HGAF) and non-tree based garden (NTBG).
- Treatments of Faidherbia trees with bare soil underneath, wheat grown beneath Faidherbia and wheat grown in open fields.
- Adopting fertilizer trees such as Gliricidia sepium and Faidherbia albida
- Farmer-managed agroforestry interventions. 5 agroforestry and agriculture training sessions, 200 to 300 seedlings, training in tree nursery management, tools and seedlings for tree nursery establishment, a small amount of food each week for involvement in community projects, and ICRAF staff support for 1 year, roughly a US$300 investment per household.
- Household collected or processed any forest product such as bushmeat, bush yam, fish, and timber in the12 months

Livestock management

- Commercial livestock destocking
- Livestock insurance, selling of livestock, allocation of more land area for fodder and migration
- The MAIS is a set of agricultural production practices and technologies with specific goals to improve milk and sheep meat yields. Teaching farmers to grow extra forage and manage herds appropriately, while also regenerating and protecting their natural capital assets.
- Pastoralist Areas Resilience Improvement and Market Expansion" (PRIME) project. The project's interventions fell into four areas: livestock productivity and competitiveness, pastoral natural resource management, financial services, and climate change adaptation.
- Community Based Rangeland and Livestock Management program (CBRLM) to jointly develop locally tailored rangeland grazing management, livestock management, and livestock marketing plans. GOPA then offered multi-faceted support to communities that established committees to coordinate and monitor these resource management plans. GOPA's support included water-infrastructure development, trainings on animal husbandry, livestock marketing, and rangeland management, livestock loans, matching grants, and technical assistance from trained field facilitators.

Land and/or water management

- Erosion mitigation and water conservation, such as terraces, tree planting, and check dams
- The development of a widespread community-based natural resource management(CBNRM) program.
- Type of vegetation coverage and basin development
- Rural land use management - reforestation, sprinkler irrigation, types of crops
- Soil bunds, stone bunds, grass strips
- Single-household versus multi-household land management
- Livestock holding, Extension contact and irrigated land, land rent-out, improved seed and soil fertility
- Irrigation, fertilizers, improved fallow, crop residues, mulching, and trash line, crop rotation
- ‘de-jure’ government-approved forms of forest management by local communities, with the following characteristics
- Reduced tillage, in situ water retention, Evaporation suppressants, Nutrient only, Water harvesting with storage, Cropping system and Agroforestry and Combination of two or more technologies
- Water management (bunds/terraces/drip irrigation/use of water-eficient technologies), Nutrient management (fertilizer banding, micro-dosing/organic fertilizer, animal manure), Zero or minimum tillage, Changing planting dates , Improved crop varieties
- Sustainable Land Management Programme. hillside communal land treatment, including the prohibition of free grazing, gully rehabilitation and cropland treatment using biophysical measures, promoting agro-forestry and fodder production, and the construction of water harvesting structures were supported in the watersheds
- Additional communication activities, consisting of expanded communication channels, and simplified messages and processes to join natural resource management program for women
- AAD implemented large-scale restoration and livelihood development activities aimed at increasing household income generation from restoration efforts and fostering alternative agricultural activities in an improved ecosystem
- Community forest management. These reserves are established through participatory land use planning . These reserves are managed by the village council on behalf of the village residents. Villagers with VLFRs are therefore free to manage and use forest resources anyway they see fit

Income diversification

- On-farm diversification and land use change strategies, change of activity (e.g. on-farm to off-farm activity), Owning both crops and livestock rather than specialized crop
- Off-farm employment—resident household members engaging in employment activities off their own land.
- Diversification of income sources based on off-farm jobs and operating provision shops,
- Occupational focus versus diversification
- Apiculture farming as adaptive strategy against climate change

Sustainability Certification

- Organic certification on the adoption of agro-ecological practices
- Sustainability certification. All three certification standards (Organic, UTZ, RA)
- Sustainability certification for mango farmers

Financial Protection

- PROGRESA. The family only receives the cash transfer if: (i) every family member accepts preventive medical care; (ii) children age 0-5 and lactating mothers attend nutrition monitoring clinics where growth is measured, nutrition supplements are distributed, and they are provided education on nutrition and hygiene; and (iii) pregnant women visit clinics to obtain prenatal care, nutritional supplements, and health education.
- Atención a Crisis program - short-run safety net by providing cash transfers to reduce the need for adverse coping mechanisms. Second, the program intended to promote long run upward mobility and poverty reduction by enhancing households' income diversification and risk-management capacity.
- A one-off lump sum of anticipatory cash in flood-prone areas before disaster
- Hunger Safety Net Program, which is one of the largest unconditional cash transfer programs in Kenya.
- Agricultural cash transfer program and a disaster fund
- Receiving non-contributory food aid transfers
- Raskin is an in-kind subsidy to poor households in the form of rice rations.
- Policy approach focused on cash incentives at the village level for curtailing land-clearing fires.
- The Benazir Income Support Programme (BISP) provides cash assistance to 5.8 million families (ever-married women) with a quarterly stipend of Rs. 5000 (approximately US $35).
- Productive Safety Net Program (PSNP), beneficiary households receive cash and/or food for six months in exchange for performing labor intensive public works, while poor and chronically food-insecure households receive unconditional, direct transfers.
- Cash transfers for farmers

Community Social Capital

- Stimulate farmers’ social learning across diverse regions to promote informed responses to soil degradation
- Households' informal network of neighbors and relatives to assist in recovery from the natural disaster
- Community social capital and access to public services

Climate resilient villages

- Climate resilient village (CRV) through the network program of the National Initiative on Climate Resilient Agriculture (NICRA)
- CSA interventions, but also interventions to improve access to savings and credit among smallholders by means of a community-based approach

Agricultural Subsidies

- Farm input subsidy scheme
- Agricultural input subsidy card

Social Safety Nets

- Social safety net programs (SSNP) - income security, employment generation, and assistance for education and healthcare

Participation and access to markets

- Participation in indigenous chicken markets for smallholder farmers' food and nutrition security

Food safety

Improved storage technologies on food and nutrition security
Educational intervention to avoid contamination in food due to Campylobacter
Education program or a scheme to reduce the CFU of Campylobacter on raw chicken during production

Community assets

- Malawi Social Action Fund (MASAF), which seeks to develop community assets—including all-season roads, soil conservation and drainage, reforestation, and irrigation infrastructure— by providing short-term labor intensive employment for able-bodied individuals.

Wastewater treatment for irrigation

- Three on-farm water treatment methods: 1. three-tank system, 2. filtration, 3. sedimentation, to mitigate the risk of Cryptosporidiosis due to accidental ingestion due to waste water irrigation
- Lagoon based wastewater treatment for irrigation of vegetables

Urban Greening

- Open spaces covered by plants in metropolitan area
- Tree planting or the creation of parks or green roofs
- Parks and pocket parks

Green Building Design

- Plants grown on extensive green roofs in this study were: shrubs, perennial herbs, vines, and groundcove
- Intensive and extensive green roofs.
- Two main treatments: substrate types (and the presence or absence of a water retention layer incorporated into the green roof system
- Green roof and night-time ventilation
- Earth to air heat exchanger (EAHE) system using low cost building materials like Bamboo and hydrafoam

Biodiversity Conservation

- Forest protected areas and forest coverage and loss
- Proportion of forest cover
- Strictly protected vs multiple use PAs vs indigenous areas
- Natural and planted forest coverage
- They include the Natural Forest Protection Program (NFPP), the Sloping Land Conversion Program (SLCP), the Desertification Combating Program around Beijing and Tianjin (DCBT), and the Wildlife Conservation and the Nature Reserve Development Program (WCNR).
- Improving forest coverage; Increasing forest resource reserves; Restoring the function of wetland ecosystem; Constructing national park; Strengthening forest and river ecosystem protection (Yangtze river); Restoring biodiversity of forest and river ecosystem
- Transparent and participatory land demarcation, registration and certification process, backed by legislation granting farm- households perpetual use rights to land, protection against eviction and partial transfer rights (through leasing), was expected to enhance farm-households' tenure security and their incentives in undertaking long-term land related investments
- National policy intervention for tiger (Panthera tigris) conservation in India
- Ecological forest restoration, including agroforestry systems, forest and landscape restoration, and selective logging assessment
- Indigenous Territories (ITs) with less centralized forest governance than Protected Areas (PAs)
- Strictly protected areas, which include state and national biological stations, national and state parks, ecological stations and biological reserves; (2) sustainable use areas, which include state and national forests, extractive reserves and sustainable development reserves; and (3) indigenous areas
- Indigenous land (IL) designation
- Officially designated nature reserves and buffer zones around them
- Natural Forest Logging Ban
- Government protection on forested land
- Protected areas and payments for environmental services are the most commonly evaluated interventions
- The use of the range of opportunities for the sustainable management, conservation and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change. It aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of adverse effects of climate change.
- Use of geospatial tools for deforestation detection and monitoring

Payment for Environmental Services

- Payments for environmental services: (1) mitigation of greenhouse gas emissions, (2) water protection, (3) protection of biodiversity, and (4) provision of scenic beauty.
- The current PES program only provides incentives for two modalities of ecosystem services provision, namely hydrological services and biodiversity conservation.
- Grain for Green. Compensates farmers to convert cropland on steep slopes or otherwise ecological sensitive areas to forest or grassland
- The Conversion of Cropland to Forest Program (CCFP), also known as the Sloping Land Conversion Program (SLCP) or 'Grain for Green', was one of a number of forestry programs initiated in response to growing ecological crises and increasing environmental awareness in China
- REDD+. Multilateral framework for achieving climate change mitigation goals by creating financial and institutional mechanisms
- BV was a federal cash-transfer program targeting households in extreme poverty who were living in various types of eligible conservation sites across different biomes.
- Budongo-Bugoma Payment for Environmental Services (PES) programme
- Forest landscape restoration and management through financial forestry incentives
- We examine the performance of the Sustainable Settlements in the Amazon (SSA) program, which between 2013 and 2017 provided technical and financial incentives to 350 households in the state of Pará for preserving their forest.
- The Projeto Assentamentos Sustentáveis na Amazônia, a REDD+ project implemented by IPAM, a Brazilian NGO, in the Transamazon highway region of the Pará state combined Payments for Environmental Services (PES) with sustainable livelihood alternatives to reduce smallholder deforestation.
- The GFGP is a key ecological restoration measure based on incentives to address land degradation through changing land use and land cover in China. The GFGP started in 1999 to cease sloping farmland cultivation and convert farmland to grassland and forest, aiming to alleviate the threat of desertification
- The reduced emissions in deforestation and degradation (REDD+) initiative uses payments for ecosystem services as incentives for developing countries to manage and protect their forests. REDD+ initiatives also prioritize social (and environmental) co-benefits aimed at improving the livelihoods of communities that are dependent on forests.

Coastal Protection

- Coastal salt marshes
- The mapped vegetation was dominated by coconut trees, Pandanus, and different types of shrubs in various mixtures. In some parts, there was hardly any vegetation left and houses were situated next to the beach, while in other parts there was a dense belt of shrubs and trees without buildings up to a distance of 300m from the beach. Dense in this regard refers to a type of vegetation cover, which makes it more or less impossible to walk through.
- Mangroves forests, coral reefs, seagrass beds and coastal vegetation, apart from the near-shore geomorphological influence.
- Mangrove and salt marsh vegetation
- Mangroves as protection against cyclones and tsunamis
- Public programs and the presence of a mangrove forest as barriers against storm inflicted damages
- Presence of mangroves, tropical dry forest and tropical rainforest
- Mangrove restoration

Climate resilient cities

- Infrastructure for adapting to climate change in pilot areas will be strengthened, the adaptive capacity will be significantly improved, public awareness will be significantly enhanced, a number of typical example cities with international advanced level will be built, and a series of replicable and scalable pilot experience will be formed
- Investing in and upgrading infrastructure, strengthening the construction of early warning systems

Universal basic services

- More than 17 basic services including ecosystem services (such as land, forest, pastures), and basic gateway services (such as drinking water, education, health, and communication)

Disaster Risk Reduction

- A nexus model that integrates disaster risk reduction (DRR) activities with market-based approaches to address multiple dimensions of vulnerability to disaster risk such as planting sugarcane to prevent river cutting and landslides
- In situ flood prevention systems re-distribute water retention capacity in the floodplains
- Preparedness training participation
- Participation in DPT and warning messages
- School-based disaster education programmes
- In order to intensify cattle utilization, embankments were constructed to avoid tidal ingressions in Samborombon Bay, Argentina
- Massive awareness campaign about preparedness for natural disasters like cyclones and floods, i.e. organising mass meeting, different competitions like essay, debate and drawing among the school students, school safety programme, wall painting explaining dos and don'ts of various disasters, showing the safe shelter and safe routes for evacuation, and training programme for village-level selected volunteers. cyclone shelters
- Disaster risk reduction training (including first aid and search and rescue) and village disaster management planning. Construction of raised emergency shelters, culverts, water harvesting ponds, and "flood friendly" pit latrines. Livelihood, agriculture, and animal husbandry training. Distribution of goats and hand pumps to exceptionally vulnerable households.
- Attendance at training programs on disaster preparedness and the number of information channels available
- Enhanced capacity building of local communities in terms of financial literacy, investment in flood preparedness and adoption of disaster risk reduction
- Health education was conducted at the intervention school to raise students' awareness and capability to respond to extreme heat
- Rainwater management, civil defense council, property tax, sewage system, UN PROGRAM resilient cities, climate change municipal law, natural disaster alert system
- Flood control. Structural components included the construction of river embankments and polders as well as riverbank protection schemes. Nonstructural components included flood forecasting and early warning systems as well as other flood preparedness measures
- Health promotion (HP) intervention strategies that relate to the management of disasters from natural hazards, including prevention, preparedness, response and recovery measures

Migration

- Ability to migrate
- Relocation

Cooking stoves

- Improved cooking stove construction
- Improved cookstove (ICS) dissemination

Women's participation in environmental decision making

- Community level intervention geared at opening up new decision making spaces for women and preparing them to take advantage of those spaces. The intervention also included a workshop directed at men, which aimed to persuade them of the importance of women's work for livelihood diversification.

Trailbridges

- Bridges to reduce transportation barriers due to floods

Internet use and social networks

- (i) search functions, (ii) real-time updates and ability to establish chronological records of information, and (iii) self-publishing capability and widespread distribution through social media as preparedness for climate disasters
- Internet use and social networks for farmers to respond to climate change

Wastewater treatment

- Use of treated and untreated wastewater for agriculture
- Waste water treatment plant blending to prevent overflows in a wastewater collection system or washout of a treatment plant's biological secondary process during peak wet weather flows.
- Septic tank and wastewater treatment plants (WWTPs)
- Sewerage system improvements
- The four wastewater treatment plants all used screening, grit separation, and sedimentation. Treatment plant 1 used oxidation and sedimentation as secondary treatment whereas the other 3 used activated sludge and sedimentation as secondary treatment. Treatment plant 1 did not use a disinfection method, WTP 2 & 3 used chlorination, and WTP 4 used filtration and peracetic acid for disinfection.
- Urban canals to attenuate waste-related pathogens through sedimentation, UV irradiation, and predation.
- Septic tanks, communal primary treatment, septic tanks with secondary treatment, communal primary and secondary treatment, deepen and cover drains, wetlands, Septic tanks with small-bore pipe to centralised tertiary treatment
- Conventional treatment of wastewater vs reclaimed wastewater from IPR scheme (coagulation, clarification, filtration, ozone, biological activatedcarbon,granularactivatedcarbonandultraviolet+ultrafiltration andreverse osmosisside-stream.)
- Wastewater treatment plants with different methods to treat water, including combinations of screens, sequencing bed reactor or moving bed biofilm reactors, chlorine, dual media filter, activated carbon filter, UV etc.
- Different types of treatment plants evaluated. They are all different in design, with some very simple, some very modern with additional filtration systems.

Safe water source

- Houses using safe water
- Provide clean drinking water in the program towns.
- Restricting surface water use in residential areas
- Household with access to a public or private well.
- Improved access to water supply for those who currently do not have access
- Drinking water source and distance to water source
- Access to piped water
- Basic water services and safely managed water service
- Using tubewell for drinking and bathing vs not using tubewell
- Access to piped (improved) drinking water sources
- Beach closures
- Tap water vs tube wells
- Distance to water source (five meters of more from kitchen)
- Infrastructure programme to expand and improve the existing water supply system in Uvira. An additional 1 191 households were connected to the water network, 717 private taps were rehabilitated, and 56 community taps were built.
- Pricing mechanism for water ATMs that is dependent on the weather, to incentivize users to keep using safe groundwater during rainy periods rather than switching to drinking free rainwater. Both seasonal pricing (reducing price of water during rainy seasons) and responsive pricing (decreasing the price after heavy rain)
- Access to drinking water facilities
- Access to piped (improved) drinking water sources
- Access to piped (improved) drinking water sources
- Distance to water source and improved drinking water
- Families with less than 80% of safe drinking water and safe water storage
- They tested through simulation whether a nature-based solution (Green Infrastructure) and disinfections could reduce the risk of Campylobacter infection to acceptable levels for bathing water and for three stormwater reuse cases: 1. municipal irrigation, 2. garden irrigation, and 3. toilet flushing. They tested the impact of the nature-based solution alone, treatment by UV disinfection, treatment by PFA disinfection

Safe sanitation facilities

- Houses using safe water and houses using hygienic toilets
- Improve sanitary conditions in the program towns.
- A targeted mechanism in the region to deliver sanitation subsidies to households in a vulnerable position due to climate and socioeconomic characteristics.
- Improved access to sanitation for those who currently do not have acCess
- Type of toilet
- Access to sewage system and toilet
- Improved sanitation
- Use of latrine
- Sanitary vs unsanitary toilets
- Use of public or private septic pit or a latrine. Latrine cleanliness
- Access to sanitation facilities
- Access to toilet
- Use of latrine
- Coverage of sanitation infrastructure
- Access to the public sewerage network and improved latrine facilities
- Adequate stool disposal and safe toilets
- Improved sanitation facilities
- Access to sanitation
- The proportion of households with a toilet
- Type of sanitation and waste management

Drinking water treatment

- Water treatment compliance rate and boiling of water prior to consumption.
- Main treatment steps in drinking water treatment plants are chlorination, flocculation, coagulation, rapid sand filter, and UV.
- Drinking water treatment installation
- Household water treatment before consumption
- Point-of-use household water treatment with silver-impregnated ceramic water filters compared to centralized water system
- Filtration, boiling, or chlorination to treat their drinking water
- Water treatment at the included waterworks, except for the three groundwater works, include at least coagulation, UV disinfection and chlorination. The groundwater works had protected aquifers and disinfection (in stand-by).
- Ceramic “candle” water filters
- Boiling tap water
- Point-of-use household water treatment with Ceramic Water Filters (CWFs).
- Point-of-use household water treatment with Safe Water System (sodium hypochlorite to disinfect water in special containers).
- Distribution of water purification tablets

Health risk assessment

- A back propagation neural network (BPNN) approach incorporating remotely sensed flooding data to model the risk of diarrheal disease outbreak due to flooding
- Landscape epidemiology (ie models with various spatial explanatory variables) or hotspot analysis for classifying areas according to risk levels for diarrheal disease.
- Use of GloWPa-TGR-Crypto model to understand environmental pathways, the risk assessment of Cryptosporidium and Giardia pollution, and effective prevention and control strategies that can reduce the outbreak of waterborne diseases in the TGR and other similar watersheds.
- Use of two satellite derived flood products with outpatient attendance and diarrhoeal disease in northern Ghana to estimate risk of diarrheal disease
- EO images for monitoring the microbial contamination of recreational waters
- Use of an integrative approach for an improved understanding of these effects, i.e. climate change and population growth as well as enhanced treatment at WWTPs and/or prevention of CSOs.
- Satellite data-driven forecasts of Rotavirus Diarrheal Risk
- Usage of the Swedish QMRA tool to estimate current microbial risk of drinking water production process in Dhaka city and future risk due to change in climate and socio-economic conditions
- Spatial risk assessment for planning land management to reduce the risk of surface water contamination by Cryptosporidium spp. from agricultural sources.
- Use of ZIP and CART models to forecast cryptosporidiosis cases based on weather variables
- Integration of the three WASH support tools geared towards improving WASH under changing climate conditions for Kampala.

Water harvesting

- Runoff harvesting through semi-circular bund, bund with protection, protection treatment, bund without protection and control treatment.
- Paraffin wax as an alternative surface treatment for rainwater harvesting
- Rainwater harvesting and saving technologies. The technologies selected included 3 highly resource intensive (in terms of labour and knowledge requirements) [including Fanya juu, Zai pits, and Negarims] and 3 less resource intensive technologies [including Grass strips, stone lines and trash lines].
- Natural ground catchment area covered in plastic sheets, 2ha asphaltic road and parking was diverted into a 1,200m3 ground reservoir, 40m2 roof area which was connected to a plastic tank for runoff measurement.
- Micro-field rain-harvesting farming system (MRFS)
- Water harvesting farms were identified by having one or more of the following attributes: zai pits, furrow bands, contour stone-bunds and catchment ponds
- Rainwater harvesting planting with supplementary irrigation (RI)
- Second Water Cisterns Program (SWCP) on the income of Brazilian family farmers. The policy intervention consists of a social technology that harvests rainwater for use in agriculture.
- Demi-lunes are a rainwater harvesting (RWH) technique particularly well-suited for recuperating degraded soils that are no longer productive. Demi-lunes are half-moon shaped berms, constructed on severely degraded fields to collect rainfall and runoff. Farmers plant crops in and around the demi-lunes. Unlike a number of other RWH techniques, they do not require the application of complementary inputs (e.g., fertilizer or manure) and require little maintenance after the first year.
- Rainwater harvesting system that included a first flush diverter to prevent pollution in the storage units from first rain, a disinfection unit in the primary storage unit, and a pumping system to transfer stored water to an elevated storage unit on the roof.
- Collection, storing, and utilizing runoff from roofs or ground surfaces for productive use in domestic water supply, agricultural use, and environmental management
- Rainwater to be used as a drinking water source