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ADAPTATION AT ALTITUDE

Leave No Mountain Behind

Disaster Risk Reduction for All

Adaptation at Altitude, a collaborative programme launched and co-supported by the Swiss Agency for Development and Cooperation, assists mountain communities and those working with them by improving the knowledge of appropriate climate change adaptation and disaster risk reduction strategies in the mountains, and by transferring that knowledge through science–policy platforms to inform decision-making in national, regional and global policy processes. This issue brief is an example of that work.

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Leave No Mountain Behind

Disaster Risk Reduction for All

Leave no one behind. That is the promise made by the United Nations in the 2030 Agenda for Sustainable Development in its commitment to eradicate poverty in all its forms, end discrimination and exclusion, and reduce the inequalities and vulnerabilities that leave people behind and undermine the potential of individuals and of humanity as a whole.

Mountain regions cover one quarter of the world's land surface and are home to more than 1.2 billion people in more than 100 countries, with about one-third of the people living in cities (Ehrlich et al. 2021). Distinguished by rich biological and cultural diversity, mountains provide vital goods and services to those living in the mountains and to those downstream (Adler et al. 2022). The ecosystem services they provide – particularly freshwater – are crucial in the lowlands and beyond.

The IPCC (2022) reports observable climate change impacts with serious consequences for people and ecosystems in many mountain regions – reductions in snow cover extent and duration, loss of glacier mass, thawing of permafrost, increases in the number and size of glacial lakes and changes in seasonal weather patterns, are all related to higher temperatures. The accelerated warming in the mountains in combination with the large population dependent on mountain services, place mountain regions in a unique and sensitive position in the context of sustainable development under climate change (Adler et al. 2022).

Sustainable development in the mountains helps countries and regions adapt to climate change, reduce disaster risks and achieve the Sustainable Development Goals. But mountain communities are often left behind economically and politically. As we celebrate 2022 as the International Year of Sustainable Mountain Development, let's work to honour our commitment to leave no one behind.

MOUNTAINS 2022
International Year of Sustainable Mountain Development

Disaster risk in the mountains

From a distance, the vulnerability of mountain people and ecosystems may not be apparent, but up close, the array of hazards and the potential for disaster becomes clearer. Higher elevations experience more rapid changes in temperature than lower elevations, and this warming can increase the rate of changes to ecosystems, the cryosphere, hydrology and biodiversity (Mountain Research Initiative EDW Working Group 2015). These consequences of climate change – together with other human activities and development failures – are increasing the likelihood of disasters and testing the existential and ecosystem limits of the planet (UNDRR 2022a).

No shortage of hazards

The potential harm from any common mountain hazard – flood, drought, extreme weather event, wildfire, earthquake, volcano eruption, landslide, avalanche, rockfall and debris flow – is significant in itself, but the conditions conducive to interactions among hazardous events are common, and, in fact, such compound and cascading events have resulted in significant damage to people, ecosystems and infrastructure (Adler et al. 2022). When a hard rain falls on denuded pastures and deforested slopes – the consequences of unsustainable land management practices – it can race downhill and trigger slides, rockfalls and torrents that become debris flows crushing everything in their path. Deposits of rock and mud can block river channels, leading to temporary lakes that later burst and cause far-reaching floods. The possible combinations of hazards in these compounding or cascading events can have overwhelming consequences – always greater than the sum of the single hazards.

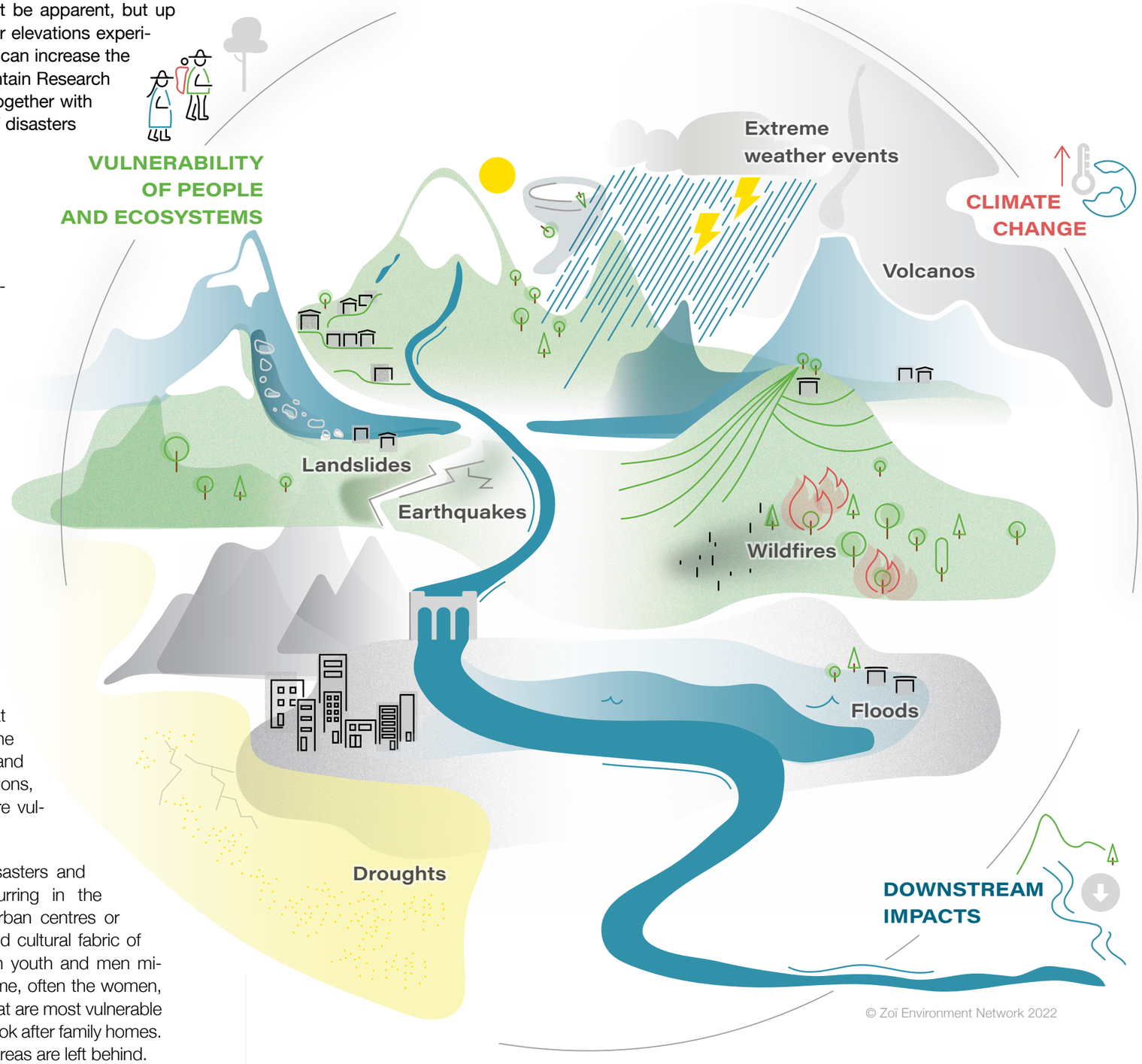
The vulnerability of mountain people

More than 90 per cent of the people living in the mountains live in developing countries, and more than 60 per cent live in rural areas where smallholder family farmers and pastoralists work the land (UN SG 2019). Changing weather patterns are affecting agriculture and livelihoods in mountain communities, and the incidence of poverty is high. In 2017, about 340 million people living in rural mountain regions in developing countries were vulnerable to food insecurity, a figure that represents 55 per cent of the total rural mountain population (UN SG 2019).

Rural mountain communities in developing countries tend to be more vulnerable as a consequence of poverty, marginalisation, lack of economic opportunities, inadequate basic services and infrastructure, and remoteness from centres of power. Livelihoods in rural mountain areas largely depend on climate-sensitive activities such as agriculture, horticulture and gathering, and many people collect wood for domestic heating and cooking. To the extent that these activities collide with the declining ecosystem services and other climate change disruptions, the people become ever more vulnerable.

Some people respond to disasters and environmental changes occurring in the mountains by migrating to urban centres or abroad, eroding the social and cultural fabric of mountain communities. When youth and men migrate in search of better income, often the women, children and elderly – those that are most vulnerable to disasters – stay behind to look after family homes. In many countries, mountain areas are left behind.

Compounding and cascading events



Climate change in the mountains

Rising temperatures, melting glaciers and changing precipitation patterns are disrupting water flows and affecting ecosystems, creating and worsening natural hazards and threatening livelihoods and communities both within the mountains and downstream. The melting of glaciers and thawing of permafrost may destabilise slopes, alter the frequency and location of avalanches, landslides and debris flows, and cause glacial lake outburst floods. More than 600 glaciers around the world have disappeared in recent decades (IPCC 2021).

The number of extreme precipitation events in mountain regions is likely to increase in the coming years, with potential cascading consequences – floods and landslides – and potential subsequent effects such as dam failures, isolation due to road and rail damage, and supply chain breaks (IPCC 2021), and with warming between 1.5°C and 3.0°C, losses from water-related hazards are projected to increase considerably (Adler et al. 2022). The projected changes in hazards will increase the risk and consequences for people, infrastructure and the economies in many mountain regions – more rapidly and more pervasively in South and Central Asia and in north-western South America – but nearly all mountain regions face moderate to high risks at warming of around 2.0°C (Adler et al. 2022).

The conditions for the occurrence and severity of fire – fuel biomass growth, fuel moisture and type, ignition source and favourable weather conditions for fire spread – are all related to climate, and mountain ecosystems, which are known to be highly sensitive to climatic warming and drying face an increase in wildfires. This increase in fires will reduce animal populations, diminish air quality, increase soil erosion and landslide risk, and reduce the quantity and quality of freshwater – all with negative effects on human health and well-being (Adler et al. 2022).

Energy production in the mountains – especially hydropower – is affected by changes in precipitation and river flow regimes and by landslides (Adler et al. 2022). In the Himalayas, for example, recent floods, glacial lake outbursts and landslides led to massive destruction of hydropower infrastructure and significant losses in the energy sector. Energy production assets worth billions of dollars are exposed to changing mountain hazards, while climate change, hydropower development and other human interventions have combined to exacerbate water security problems (Adler et al. 2022). With hydropower infrastructure expanding into higher mountain valleys, finding a balance between social and economic development and long-term disaster risk reduction has become an urgent matter.

Mountains are important biodiversity hotspots and reservoirs for agrobiodiversity, and mountain forests account for up to 28 per cent of natural forest cover worldwide. The challenging work of restoring and maintaining ecosystems in mountain areas repays the effort. The enhanced capacity of ecosystems to cope with the effects of climate change and to continue delivering their services, including mitigation of hazards, contributes to more liveable, healthy and resilient communities.

Downstream ecosystem services

Mountain ecosystems provide important ecosystem services to billions of people living downstream, extending far beyond their geographical boundaries and benefiting all continental mainland areas. They contribute to stabilising slopes, regulating climate, regulating hydrological cycles, maintaining biodiversity and supporting livelihoods. Mountain forests also play a significant role in disaster risk reduction by buffering settlements and infrastructure against some natural hazards. The people living downstream have a real stake in disaster risk reduction and climate change adaptation in the mountains.

About 2 billion people living in the lowlands depend on freshwater from the mountains, as does 68 per cent of irrigated agriculture worldwide, and current and future hotspots of water scarcity include Central and South Asia, the tropical and subtropical regions of western South America, and south-western North America (Adler et al. 2022). In recent decades, water resources in the lowlands have grown increasingly dependent on mountain areas, a trend that is likely to continue. Lowland areas can expect more severe water scarcity, and some agricultural regions can expect to face risks to their water security (Viviroli et al. 2020). The downstream economic consequences of diminished ecosystem services also extend beyond agriculture to tourism. The downstream effects of the 2013 flood disaster in Uttarakhand, for example, caused an estimated loss of USD 1.85 billion in the state's tourism sector (Trivedi, 2014).

People living downstream may also have an affinity for the mountains based on spiritual or cultural values and beliefs. Cultural services of mountain ecosystems may include recreation or tourism that brings physical and mental health benefits, aesthetic enjoyment and spiritual experience. For many, the mountains offer a profound sense of place and the accompanying feeling of well-being.

Development failures

Disasters occur when hazards coincide with vulnerability and exposure, both of which result from human decisions, and the root causes of disasters and disaster risk lie in the mode of development and growth (UNDRR 2022b). Where hazards meet development failures, the damage is inevitably worse. When a poorly managed mine tailings pond fails in a flood, for example, the floodwaters can spread chemicals that are toxic to humans and wildlife. Other poorly sited or poorly maintained infrastructure, such as road infrastructure, is more likely to fail in a flood or a slide, and that failure can raise the costs for repairs and replacement.

Inadequate planning can lead to increased exposure to hazards both in the mountains and on the adjacent lowlands. Where settlements, infrastructure and agriculture are concentrated in valleys, the potential for economic losses in disasters is high. Increased population density can concentrate risk in places already ill-designed to withstand current hazard exposures to say nothing of the added exposure resulting from climate change (UNDRR 2022a).

The strong relationship between poverty and disaster risk (UNDRR 2022a) comes into play in the mountains when increasing pressures on land tend to push vulnerable people into unsafe areas, such as when low-income families inhabit informal settlements on steep and unstable slopes. Likewise, rising temperatures can push farming families to migrate towards higher, more exposed elevations in search of suitable growing conditions.

In general terms, the failures of development include inadequate land-use planning and construction standards that increase the numbers of exposed people and assets and magnify low-level hazards. Disasters then come with greater losses to buildings and infrastructure, more deaths and injuries and more environmental damage. These disaster costs and the indirect effects of systemic economic losses undermine and destroy livelihoods, stall socioeconomic development, reduce capacity to respond to risk, and increase human exposure to hazards. In contrast, the inclusion of risk reduction strategies in planning and construction reduces exposure, lowers the losses, contains the indirect effects of disasters, and reduces the susceptibility to harm (DIFD 2005).

The Sendai Framework in mountain areas

In proposing measures that reduce risk and increase resilience and that prevent the creation of new risk, the Sendai Framework for Disaster Risk Reduction provides guidance across four priority areas. This summary applies that guidance to disaster risk reduction in mountain areas.

SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

Sendai priority 1
Understanding disaster risk

Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment.

UNDERSTANDING
DISASTER RISK

Underlying dynamics

Taking account of poverty and the limits of economic opportunity are essential to disaster risk management in the mountains, as is understanding the forces at work. In one common scenario, climate change, population growth, urbanisation and ecosystem degradation intensify the competition for safe space and often lead to the spatial concentration of infrastructure. The less-safe spaces come with greater exposure to hazards, and the people and the infrastructure become even more vulnerable. Identifying the underlying dynamics specific to a site becomes an essential step in disaster risk planning and management. At warming above 1.5°C, the urgency of taking adaptation measures increases (Adler et al. 2022).

Assessments for site-specific disaster risk reduction

The understanding of local conditions necessary for site-specific disaster risk reduction starts with the identification and recognition of the underlying dynamics, and multistakeholder engagement is an effective way to develop this understanding. People know their local environment, hazards and socioeconomic situation, and can contribute to fine-scaled disaster risk assessments that integrate local knowledge and technical expertise. Such assessments that incorporate local concerns and values and that consider multiple risks are more robust than single-risk assessments (Adler et al. 2022).

Spatially explicit vulnerability assessment tools can capture the specific needs of mountain communities, and can inform decisions about targeted measures. Hazard and risk maps, for example, can raise awareness and help guide development interventions. Land use planners can incorporate information derived from these tools to create zoning that restricts development in high-risk areas.

Sendai priority 2
Strengthening risk governance

Disaster risk governance at the national, regional and global levels is important for prevention, mitigation, preparedness, response, recovery, and rehabilitation, and fosters collaboration and partnerships.

STRENGTHENING
RISK GOVERNANCE

Institutional support

Understanding the local dynamics and assessing the site-specific disaster risks form the basis for disaster risk management, but the effective governance of risk calls for more than clear ideas and plans. Remote and scattered mountain communities are difficult to access and only weakly linked to and supported by national governmental institutions, so building the capacity of local disaster organisations and their financial resources is a crucial development role (Wymann von Dach, et al., 2017).

Stakeholder engagement

Applying the findings of an assessment to the selection of targeted measures once again calls for multistakeholder engagement to establish priorities. What happens in the mountains affects downstream communities, and coordination and cooperation across sectors and administrative boundaries can avert disaster and nurture partnerships. Stakeholder engagement must be inclusive to be successful, and must work to involve marginalised and vulnerable groups. Environmental organisations and indigenous people can contribute stewardship expertise and knowledge, both traditional and modern. The marginalisation and language differences of the indigenous peoples and cultural minorities who live in the mountains often mean they may not participate in disaster risk reduction activities.

Sendai priority 3

Investing in resilience

Public and private investment in disaster risk prevention and reduction through structural and non-structural measures is essential.

INVESTING
IN RESILIENCE

Nature-based solutions

The sustainable management of mountain ecosystems protects the valuable ecosystem services they provide, and builds resilience in both the mountains and the lowlands. Among the ecosystem-based adaptations in wide use in the mountains are afforestation, reforestation and improved forest management, which reduce the risks of shallow landslides, and river restoration, which reduces the risks of floods (Adler et al. 2022).

The application of nature-based solutions in the mountains protects ecosystems and provides social and economic co-benefits. Agroforestry projects in the mountains, for example, could develop a network of wildlife habitats, pastures and agricultural lands with buffer zones and wildlife corridors. The benefits could include improved slope stability, increased food production, enhanced biodiversity and greater carbon storage capacity. Multi-purpose projects can respond to the needs of stakeholders with different interests – a water management strategy, for example, that provides benefits for hydropower, agriculture and flood control.

Livelihoods

The livelihoods of people in and around mountain regions depend on ecosystems services, and the decreasing quantity and quality of these services is worsening the underlying socioeconomic conditions and contributing to livelihood insecurity. The exposure and vulnerability of mountain people exacerbate these climate change-driven negative effects on livelihoods. Adaptation efforts in the mountains have contributed to reductions in poverty in some cases, but only limited evidence suggests any effect on the underlying social determinants of vulnerability (Adler et al. 2022).

Expanding the livelihood options for people living in the mountains would enhance their resilience, and investments in projects designed to develop such options would tap into the innovation and entrepreneurial spirit of mountain people. An investment in slope stability, for example, could combine green infrastructure in the form of hillside vineyards that create a new income stream and generate new businesses related to wine tourism.

Sendai priority 4

Enhancing preparedness

The growth of disaster risk indicates a need to strengthen disaster preparedness, to take action in anticipation of events, and to ensure capacities for effective response and recovery are in place.

ENHANCING
PREPAREDNESS

Early warning systems

Understanding the local dynamics and assessing the sensitivity to climate change, the limited safe space for settlements and the remoteness of mountain areas pose specific challenges to disaster risk preparedness. Investments in decentralised early warning systems and evacuation plans and procedures can reduce the vulnerability of mountain communities. Early warning systems should be based on scientific and traditional knowledge, and wherever possible, be managed locally. In areas with traditionally different gender roles and responsibilities, gender-mixed emergency teams may respond more effectively to female needs.

Planning

Appropriate land use planning can reduce deforestation, soil degradation and the overexploitation of flood plains, and can provide a framework for risk governance that identifies hazardous zones, guides economic development and specifies safe areas for shelter in the event of a disaster. The planning for recovery can include zoning code requirements proscribing rebuilding in hazard zones and building code requirements that account for the ongoing and anticipated future risks. In the mountains – with multiple and potentially cascading hazards and downstream communities in the path of destruction – the stakes are particularly high. The rapid pace of climate change is leading to new, often unprecedented threats, and calls for forward-looking, scenario-based hazard mapping to provide a robust basis for long-term planning (GAPHAZ 2017).

The efforts spent on preparedness and recovery can improve the housing stock, safeguard livelihoods and bolster food security, all of which directly or indirectly can build the resilience of people and communities. As development efforts in the mountains incorporate the practices of disaster risk reduction and climate change adaptation, they improve the chances for making progress towards achieving the Sustainable Development Goals, and they increase the prospects for leaving no mountain people or communities behind.

Case studies: DRR in the mountains

Chosen from among selections on the **Adaptation at Altitude solutions portal**, these cases illustrate the range of projects and activities underway in mountain regions across the globe. The link for each case takes you to the full case study on the solutions portal.

Community-Based Risk Reduction in Nepal

This project aimed to reduce human and material losses from glacial lake outburst floods (GLOFs) in the Solukhumbu district, and catastrophic flooding events in the Terai and Churia Range of Nepal.

Given its geographic characteristics, Nepal faces numerous geological and climatic hazards that present an imminent and increasing danger to the well-being of the local population and their livelihoods. With the increase in average annual temperatures and the retreat of glaciers, one of the main threats is the possibility of glacial lake outburst floods. Studies have shown that Nepal has at least 21 glacial lakes that have been identified as potentially dangerous, six of which pose high risk, although numbers may be higher. Many additional threats can originate from lakes located upstream in Tibet. With the rising frequency of extreme precipitation events come the additional risks of floods and flash floods. Conducted at an altitude of 5,010 metres, this project is known as the world's highest climate adaptation project.

The results of the project include:

- Reduction of the water level of Lake Imja through controlled drainage
- Development of 18 safe evacuation centres
- Implementation of community-based early warning systems
- Generation of GLOF risk monitoring protocols
- Forming, equipping and training of local disaster risk management committees

The early warning systems were designed to require minimal maintenance, and local government agencies received the appropriate protocols, training and skills to carry out the monitoring and maintenance. The project also provided training in flood risk management and GLOFs, conducted 52 drills, and set up sediment controls and stabilisation of risk-prone slopes and riverbanks through structural and non-structural mechanisms.

https://adaptationataltitude.org/solutions-portal/community-based-flood-and-glacial-lake-outburst-risk-reduction-in-nepal

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Enhancing resilience of communities in Ecuador

The main goal of this project was to reduce the vulnerability and food insecurity in the most vulnerable communities and ecosystems within the Province of Pichincha and the Jubones River basin.

This project emerged as a response by the Ministry of Environment and the World Food Programme to the high levels of poverty, food insecurity and climate vulnerability that – coupled with a lack of awareness and inadequate infrastructure – posed numerous threats to local populations. The project set out to develop awareness of the risks related to climate change and food insecurity, to increase adaptive capacity and to reduce recurrent climate variability risks. The project followed community- and ecosystem-based approaches, and its focus on climate change, food security and gender equity guided the selection of specific measures to undertake.

The project benefited 19,356 people in 240 communities, and produced:

- 47 local climate risk and vulnerability assessments
- 50 adaptation measures
- 2 early warning systems on climate risk and food security
- 49 local climate change adaptation plans
- 38 local adaptation policies

A gender focus informed the planning, implementation and evaluation of solutions, and the project worked to improve the participation and well-being of women. The communities involved in the project included populations with high levels of poverty, as well as members of various indigenous groups.

https://adaptationataltitude.org/solutions-portal/enhancing-resilience-of-communities-to-the-adverse-effects-of-climate-change-on-food-security-in-pichincha-province-and-the-jubones-river-basin

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Soil erosion in Georgia

Implemented by the Caucasian Environmental Non-Governmental Organizations Network with support from the United States Agency for International Development, this project aimed to reduce soil erosion by planting vineyards of Chkhaveri grapes.

The Keda municipality in the mountainous Adjara region in southwestern Georgia is subject to flash floods, mudflows and landslides related to its topography, climate and human activities. Widespread use of annual crops on the slopes has led to increased soil erosion and the risk of landslides, which are expected to become more frequent due to warmer and wetter climate conditions.

The soil erosion project supported the development of a plantation of Chkhaveri grapevines in the village of Merisi. With their developed perennial root system anchored in the soil, these grapevines help combat soil erosion, stabilise slopes, and improve soil quality. The cultivation and use of Chkhaveri grapes for wine-making also provides livelihoods and helps revive viticulture in the region. This solution was implemented in collaboration with the Wine Club and Vineyard Fund, together with the Adjara government and local government of Keda municipality.

Local farmers are the main direct beneficiaries, and wine-producing businesses are indirect beneficiaries. Other inhabitants in the village may also benefit from the development of eco-tourism enabled by the revival of viticulture in the region.

The accomplishments of this project include:

- Reducing soil erosion and the risk of landslides
- Generating new and higher income streams for farmers
- Promoting the development of eco-tourism and wine-based tourism in the region

Chkhaveri wine is unique to the Adjara region and in high demand domestically and internationally.

This solution brings welcome attention to the cultural values and local knowledge of the Adjara region.

https://adaptationataltitude.org/solutions-portal/chkhaveri-vineyards-against-land-erosion-in-keda-municipality-georgia

Sustainable land management in Ethiopia

Integrated sustainable land management interventions in watershed landscapes supported by land certification and institutional capacity development provide incentives for community participation and smallholder investments that lead to a reduction in land degradation and improved productivity on communal and household farmland.

Nearly 85 per cent of the population in Ethiopia depends on agricultural activities as their main source of livelihood, but long-term land degradation across the country is leading to declining agricultural productivity, high rates of rural poverty and food insecurity. The state of farming systems, the open access to grazing for livestock production, the expansion of agriculture into forest areas, the pressures of population growth, and the high dependency of local people on wood and other biomass for energy production are all implicated in accelerating this degradation and depletion of soil nutrients.

This sustainable land management project set out to reduce land degradation in agricultural lands, to enhance the productivity of smallholder farmers, and to protect and restore ecosystem functions and biodiversity in agricultural landscapes. Watershed management, the main component of the initiative, reduced land degradation, enhanced land productivity and improved livelihoods and the environment as measured by changes in vegetation cover, increases in soil carbon, and the area under sustainable land management practices.

The rural land certification and administration component of the project worked to expand the coverage and enhance the government's land certification programme to strengthen land tenure security for smallholder farmers in the project area, and issued second-level certificates to 60,000 households. The project management component assisted the Ministry of Agriculture and other institutions in the effective and efficient implementation of watershed management by enhancing technical capacities at the regional, local, and community levels.

An estimated 98,000 rural households in 45 watersheds benefited from improved soil retention, enhanced carbon sequestration, increased vegetation cover, improved water management and increased incomes.

https://adaptationataltitude.org/solutions-portal/sustainable-land-management-project-i-ethiopia-slmp-1

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Avalanche readiness in Afghanistan, Pakistan and Tajikistan

The Avalanche Readiness Programme puts in place a comprehensive snow avalanche preparedness plan that includes risk assessment, weather monitoring, emergency communication, early warning, risk awareness, community capacity-building through volunteers, and the stockpiling of essentials. The goal is to reduce avalanche risk in Afghanistan, Pakistan and Tajikistan.

Every winter, avalanches in remote mountains across Afghanistan, Pakistan and Tajikistan result in losses of lives, livestock and infrastructure. Climate change is projected to alter the frequency and size of avalanches.

This avalanche programme is based on a community-level hazard, vulnerability and risk assessment that maps avalanche-prone villages. Community members attended awareness-raising sessions on avalanche risk and preparedness. Capacity-building is a core activity, and volunteers are trained regularly in required skills.

Weather monitoring and early warning are integral parts of the programme, and 88 low-cost weather monitoring posts have been set up in areas with high avalanche risk. Volunteers trained in weather monitoring techniques and light maintenance manage the posts. Using information from the monitoring posts in conjunction with global models, avalanche experts issue weekly weather bulletins highlighting likely avalanche days and affected regions. These bulletins serve as a weather advisory and early warning system and are passed on to communities and to a search and rescue team.

The main beneficiaries are the community members living in avalanche-prone villages in Afghanistan, Pakistan and Tajikistan. This model can be replicated in areas facing avalanche risk.

https://adaptationataltitude.org/solutions-portal/the-winter-preparedness-and-avalanche-readiness-programme-a-comprehensive-avalanche-preparedness-plan-in-afghanistan-pakistan-and-tajikistan

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Protecting biodiversity and ecosystem services in Chile

In a region with biodiversity hotspots and in a context of intense drought, heatwaves and mega fires, this project works to encourage the development of public-private initiatives that advance the conservation of biodiversity and protect or enhance the benefits provided by mountain ecosystems.

Chile has one of the five Mediterranean ecosystems in the world. The ecosystem services include the provision of water, air purification, soil formation, pollination, recreation and the sustenance of biodiversity. Despite growing efforts by public and private institutions to reverse the deterioration over the last ten years, however, the degradation of biodiversity, soils and water in the mountain ecosystem continues. Some municipalities have no regulations for land use and implement only a few biodiversity protection practices.

The project promotes local environmental management and sustainable development to include the strengthening of municipal environmental units and the integration of traditional environmental practices into the management and conservation of biodiversity, water and soils. Thirty-six municipalities in the project area have developed and implemented local ecosystem plans at the landscape scale. Maps of areas vulnerable to climate change guided proposals for restoration and training in the municipalities.

An effort to minimise the negative effects that some productive activities have on biodiversity resulted in the designation of 500,000 ha in the municipality of San José de Maipo, an area of high Andean mountains and glaciers, as an Integrated Conservation District for soil, water and forests.

https://adaptationataltitude.org/solutions-portal/protecting-biodiversity-and-multiple-ecosystem-services-in-mountain-biological-corridors-of-the-mediterranean-ecosystem-in-the-santiago-and-valparaiso-regions-chile-gef-montana

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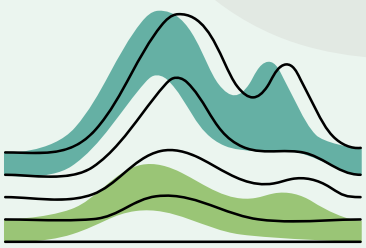
Sustainable development in the mountains helps countries and regions adapt to climate change, reduce disaster risks and achieve the Sustainable Development Goals. But mountain communities are often left behind economically and politically. As we celebrate 2022 as the International Year of Sustainable Mountain Development, let's work to honour our commitment to leave no one behind.



ADAPTATION
AT ALTITUDE