

ADAPTATION
AT ALTITUDE

Leave No Mountain Behind: The Synthesis Series

Integration of Indigenous knowledge for adaptation in mountain regions



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 synthesis series is an example of that work.

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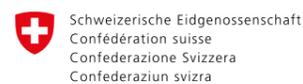
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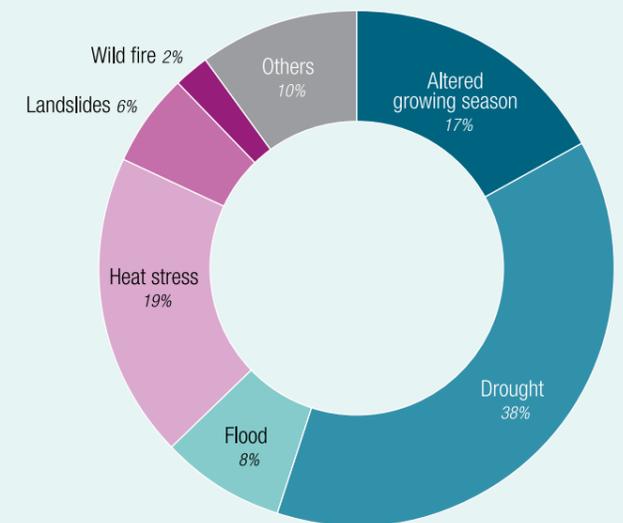
Mountains feature some of the clearest indications of climate change: rising temperatures, melting glaciers and changing precipitation patterns are disrupting water flows and affecting ecosystems, creating and worsening natural hazards and threatening livelihoods and communities both within mountain regions and further downstream. Indigenous mountain peoples are among the first to experience these impacts of climate change, even though they contribute little to global greenhouse gas emissions. Climate change poses severe threats to their livelihoods, cultures and identities. At the same time, however, Indigenous peoples are crucial agents of change because the knowledge and ways of life passed down through multiple generations are essential for climate change mitigation and adaptation in mountain regions.

Here we synthesise experience and learning captured on the [Adaptation at Altitude Solution Portal](#) that show how Indigenous knowledge (also termed local or traditional knowledge) has been leveraged to support climate change adaptation in mountain regions. As of August 2023, **25% of the solutions (22 out of 88) showcased on the portal have involved the use of Indigenous knowledge.**

The majority of documented experiences of the use of Indigenous knowledge within climate change adaptation solutions for mountain regions comes from the Andes. Comparatively limited experience has been reported from mountain regions in Africa or Asia. This suggests there may be scope to improve the documentation of relevant solutions from Africa and Asia and also significant opportunities to transfer learning from the Andes to other mountain regions.

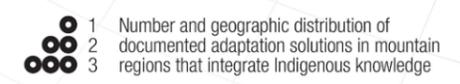
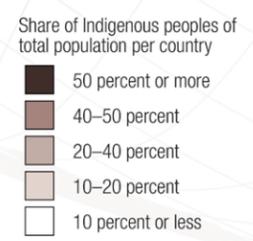
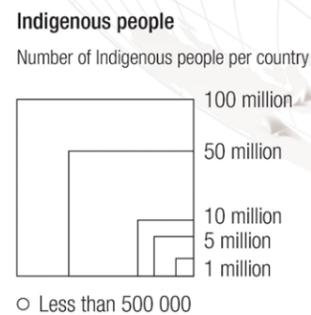
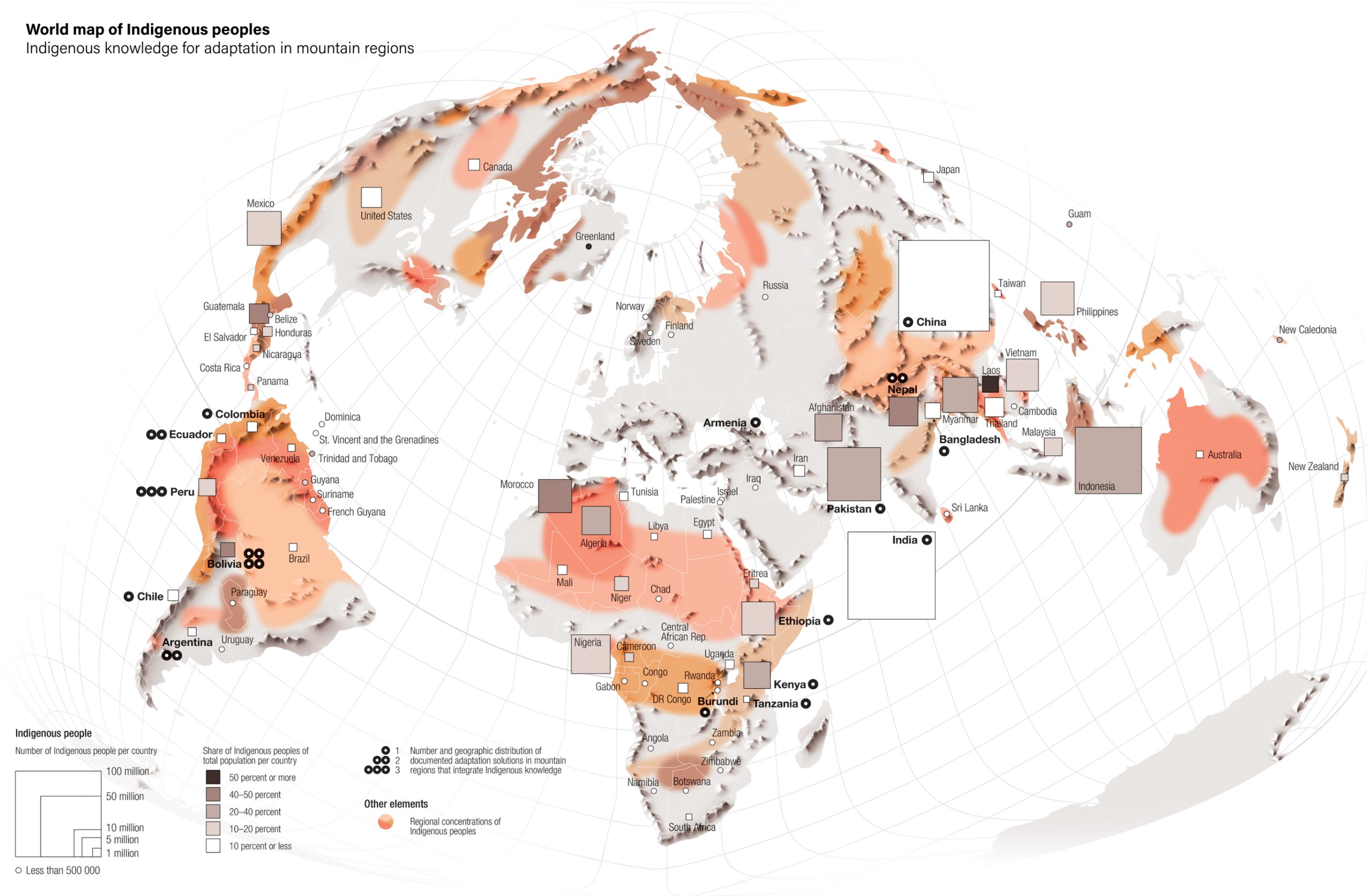
Indigenous knowledge has primarily been utilised in solutions that address drought and water scarcity. This is in line with the general focus of climate adaptation solutions in mountain regions, particularly in the Andes. Together with changes in growing seasons and heat stress, drought and water stress are typical slow-onset climate change impacts which pose major risks to ecosystems and agriculture in particular (Figure 1). Droughts have always occurred due to natural climate variability, meaning that many local mountain communities have developed practices to anticipate and respond to periods of water scarcity. The extent to which traditional practices remain adequate in conditions where the intensity and/or frequency of droughts is increasing in many regions will be decisive for the long-term success of these solutions.

Figure 1: Climate impacts addressed by adaptation solutions in mountain regions that integrate Indigenous knowledge.



World map of Indigenous peoples

Indigenous knowledge for adaptation in mountain regions



Map produced by Zoï Environment Network, February 2024
 Source: Fabrice Dubertret. Rendre explicite une présence invisible : vers un atlas mondial des territoires autochtones. Géographie. Université de la Sorbonne nouvelle - Paris III, 2020. Français.;
 National Geographic; Julian Burger, United Nations; A@A Solutions Portal

Indigenous knowledge is harnessed and integrated into various aspects of climate adaptation, helping mountain communities cope with the adverse effects of climate change. Drawing on examples from the Adaptation at Altitude Solution Portal, the manner in which Indigenous knowledge is used in climate adaptation in mountain regions can be summarised under five themes:

1. Ecological expertise and biodiversity conservation

Indigenous Peoples primarily depend on natural resources and ecosystems for their livelihoods and share a complex relationship with their surroundings and ecosystems, which they value for more than mere economic gains. Indigenous communities therefore typically possess deep ecological knowledge passed down through generations and often serve as capable stewards of biodiversity-rich mountain ecosystems. Their traditional conservation practices help protect critical habitats and

preserve plant and animal species that can be vital for adaptation. Preserving biodiversity can further enhance resilience by ensuring access to diverse food sources and traditional medicines.

Conservation of Queuña forests in Peru's Vilcanota mountain range was carried out together with local communities through traditional collective work strategies, with the aim of protecting and restoring the forests along with their landscapes, water resources and biodiversity. Local populations depend on these ecosystems for drinking water, pastures for cattle ranching and agriculture. The forests help maintain humid conditions that buffer the strong changes in temperature between day and night at high altitudes. Under this solution, conservation areas were created and managed by the communities in cooperation with relevant authorities. The conservation areas are an important resource for ecotourism and provide a legal framework under which payments are made for maintaining ecosystem services.

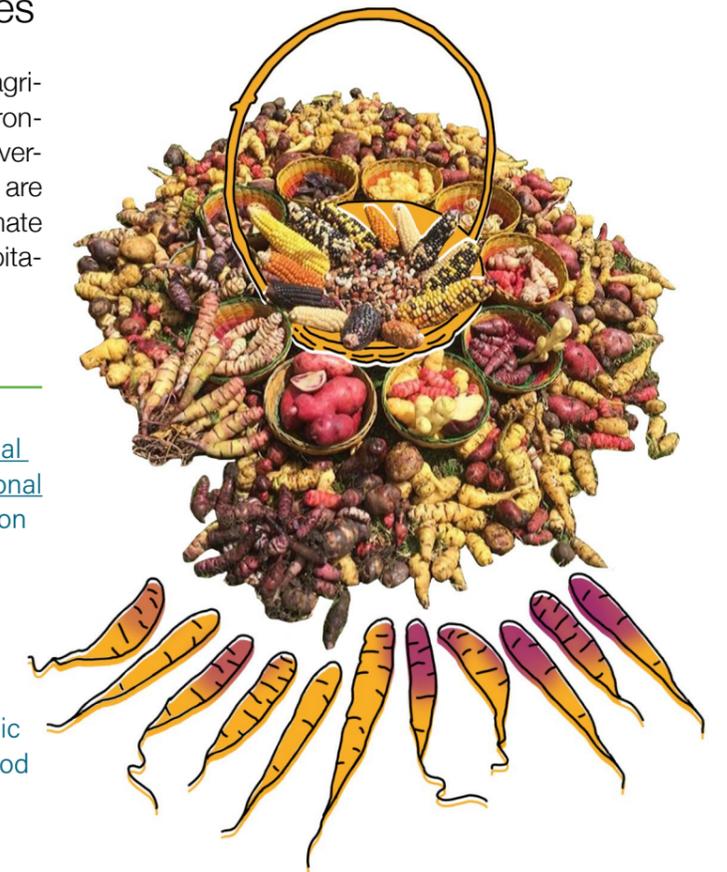


Members of the Quelcanca, an Indigenous community in the Peruvian Andes, taking part in restoration activities. December 2020.
© Gregorio Ferro M. Quelcanca Community

2. Traditional farming techniques

Indigenous Peoples have developed resilient agricultural practices tailored to mountain environments. Techniques such as terracing, crop diversification, and water management systems are adapted to the specific challenges posed by climate variability and change, including shifting precipitation patterns and temperature fluctuations.

In Boyacá Department of Colombia, conventional production systems were reconverted to traditional agroecological systems, promoting the cultivation and consumption of tubers with traditional knowledge as a climate change adaptation strategy for small producers. Andean tubers, usually catalogued as marginal, undervalued or underutilised, have been cultivated in the mountainous areas of Boyacá since pre-Hispanic times, and have been an important source of food and medicine for local communities who have transferred the techniques of their cultivation, management and uses from generation to generation. Because of their great capacity to adapt to different climatic conditions, resistance to pest attacks and tolerance of drought, Andean tubers can be cultivated in a wide ecological zone at altitudes of 2400–4000 metres. These characteristics, together with their nutritional and medicinal properties, means that increased use of these crops can reduce climatic and food vulnerability while strengthening the adaptive capacity of Andean farmers. As opposed to newer commercial crops, Andean tubers are traditionally produced with techniques based on the use of biocides and organic fertilisers.



Andean tubers.
© AITAB Innovative Association of Andean Tubers Boyacá

In the Makanya Basin In Tanzania, farmers irrigated their crops with a traditional water-harvesting technology known as ndiva, a local word meaning micro-dam. Local communities have improved the technology, which has been in use since the 18th century, to meet current challenges. Ndivas normally range in capacity from 200 to 1,600 cubic metres and are constructed on a raised area from where canals can carry the water to crops up to 3 kilometres away. A challenge is water loss through seepage when the water travels over longer distances. To address this issue, farmers lined the canals with stone. A single ndiva system can serve more than one farm and some community members established group-owned systems from which their gardens are irrigated in turn.

3. Community cohesion and networks

Indigenous knowledge fosters community cohesion and resilience. Traditional decision-making processes, cultural values, and social networks enable communities to respond effectively to climate-related challenges. Indigenous knowledge can inform community-based adaptation strategies, such as disaster preparedness plans, conservation plans and water resource management initiatives.

Several solutions draw on traditional communal work practices to implement adaptation measures on a large scale. For instance, [reforestation in the Queuña forests of the Vilcanota mountain range, Peru](#), was only possible through the ancestral practice of communal work that is part of the Andean worldview (locally called Ayni, Minka or Minga). Communities banded together to create a network of private conservation areas underpinned by a commitment to mutual support and to sustainable development and conservation. In this way, they collaborated to protect the headwaters of local catchments and ensure the availability of water to meet their needs. Other solutions in the Himalaya have made use of strong existing community networks, including women's organisations such as [women farmer groups](#).

4. Cultural and spiritual resilience

Indigenous knowledge recognises the interconnectedness of nature and culture. By preserving traditional practices and spiritual beliefs linked to their environment, Indigenous communities maintain their cultural identity and resilience, which can be a source of strength during times of climate-related stress.

Recognition of and respect for spiritual beliefs are at the core of activities implemented under [community-based biodiversity conservation plans in Yunnan Province, China](#). Mentsunmo, which means "Goddess Peak", is a sacred, snow-capped mountain in the Eastern Himalayas. According to local beliefs, the mountain transformed into a goddess to bless local women and, more importantly, control the local climate. Women believe that when this goddess is happy, the climate will be good, but when she is angry, bad weather, which is accompanied by natural disasters, will occur. The Tibetan women in nearby Jiabi village established the "Mentsunmo Climate Action Carbon Neutral Forest" on the mountain, deliberately using this name to show that women have the spiritual power to deal with climate change and the traditional ecological knowledge behind this spiritual power. Based on their belief in the sacred mountain and sacred forest culture, the women formulated customary law and regulations to reserve hillsides for afforestation, forbidding tree-cutting and the destruction of vegetation. The women also undertook other forest conservation measures based on their traditional beliefs. For example, women chose cedar seedlings for afforestation, reflecting the ritual burning of cedar branches and leaves as sacrifices to the sacred mountain to seek its blessings.



Tibetan women of Jiabi village. © Liqing Peichu

5. Collaboration and knowledge-sharing

Collaborative efforts between Indigenous communities and external stakeholders such as government agencies, research institutes and NGOs facilitate the exchange of knowledge and the co-development of adaptation strategies. This two-way learning process enhances the effectiveness of climate adaptation initiatives in mountain regions. Incorporating Indigenous knowledge into adaptation efforts not only increases the resilience of mountain communities, it also fosters a more holistic and sustainable approach to addressing climate change challenges in these vulnerable environments. Recognising the value of Indigenous knowledge systems is essential for creating more effective and culturally sensitive climate adaptation strategies in mountain regions.

Indigenous communities worked alongside conservationists, engineers and anthropologists to refurbish [a water management system in the High Andes of Peru](#) designed by their ancestors and dating back as far as 700 years. This renovated system is a hybrid of grey (constructed) and green (natural) infrastructure that makes the most of ancient engineering and modern science. Related capacity-building activities aimed to generate the knowledge needed to effectively manage and conserve water resources, natural pastures and livestock. The focus was on informing community members and park rangers through evaluation workshops and training sessions on topics such as pasture fencing, water management and water distribution. A 3D model was developed to help plan the management of pastures and water resources in the communal territory.

While there are diverse ways in which Indigenous knowledge has been integrated into adaptation solutions in mountain regions, all of these solutions share a common aim of reducing poverty and thus contributing to Sustainable Development Goal (SDG) 1 (Figure 2). In contrast, if all adaptation solutions in mountain regions are considered, only around half aim to contribute towards SDG 1. This suggests that adaptation solutions that make use of traditional and Indigenous knowledge have even greater potential to deliver deep and systemic co-benefits to communities, and thereby contribute directly to poverty reduction and sustainable economic development in mountain regions. These benefits also extend far downstream, with reported beneficiaries from individual solutions ranging from a few hundred households up to several hundred thousand inhabitants.

[A sustainable land management project in Ethiopia](#) aimed to increase resilience to climate change across over 1.3 million hectares of degraded communal and smallholder lands in 135 watersheds. The project included numerous interventions based on the assumption that

a sustainable land management approach, supported by land certification and increased institutional capacity, would motivate community participation and smallholder investments to reduce land degradation and improve farmland productivity. The interventions benefitted a total of 421,130 rural households (76% of all households in the implementation area) by enhancing income-generating activities, and reducing poverty. Most of the economic benefits resulted from increased productivity (60%) and avoided soil loss (31%).

Adaptation solutions are generally falling short of delivering transformational change in mountain regions and ensuring the scalability of the solutions remains a key challenge. An [analysis](#) of the transformative potential of the solutions gathered in the Adaptation at Altitude portal revealed weaknesses across several key diagnostic indicators (Figure 3). Scalability is the biggest challenge, although solutions that integrate Indigenous knowledge score higher in this area, with increased evidence of replication via out- or up-scaling. Nevertheless, evidence of mainstreaming into broader adaptation policies and long-term initiatives is evident for only about one quarter of the solutions.

Figure 2. The number of solutions that integrate Indigenous knowledge in mountain regions addressing each of the 17 SDGs.

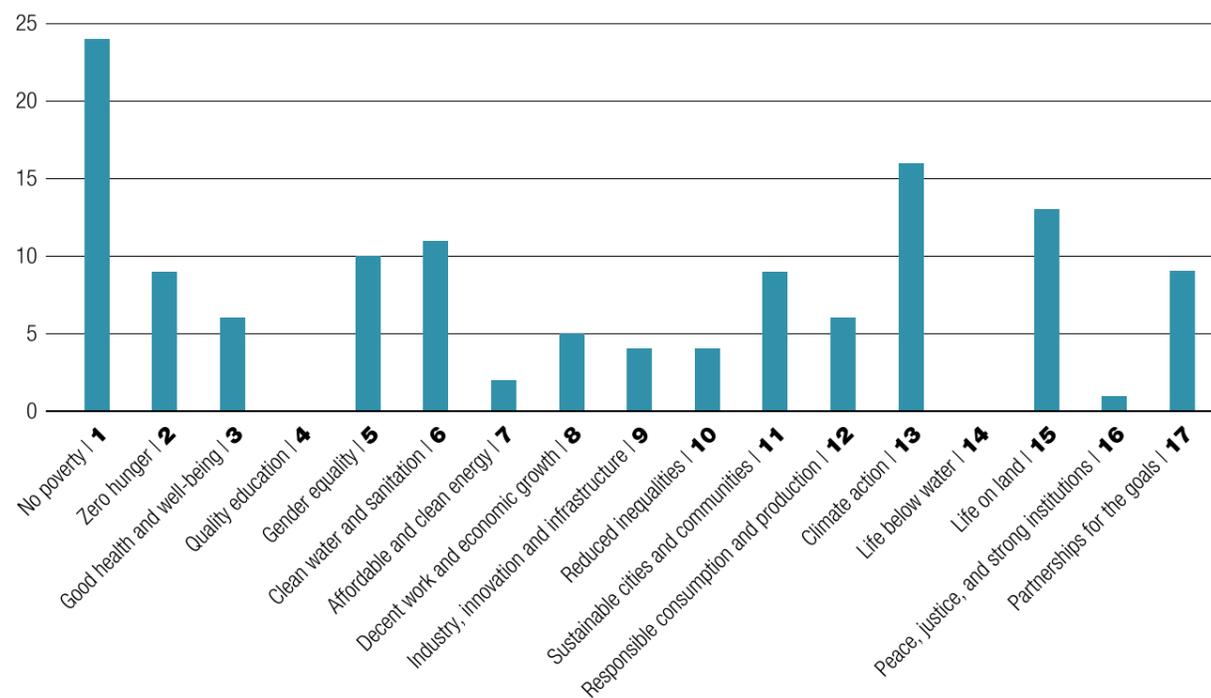
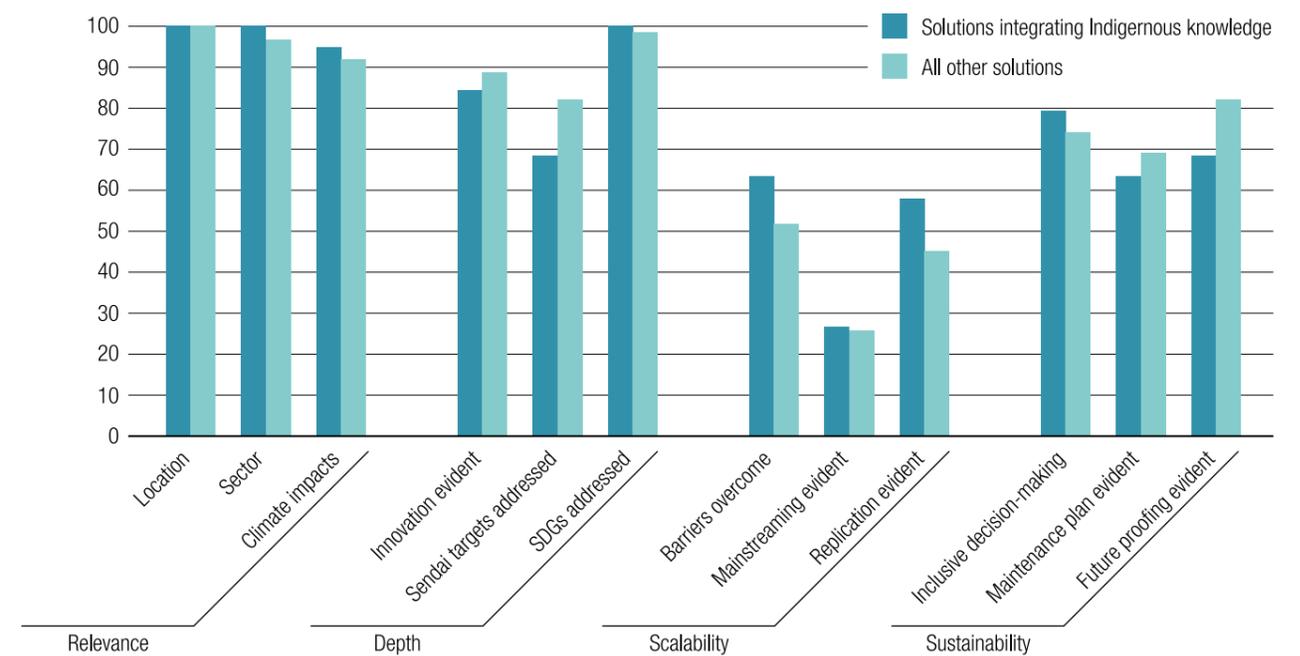
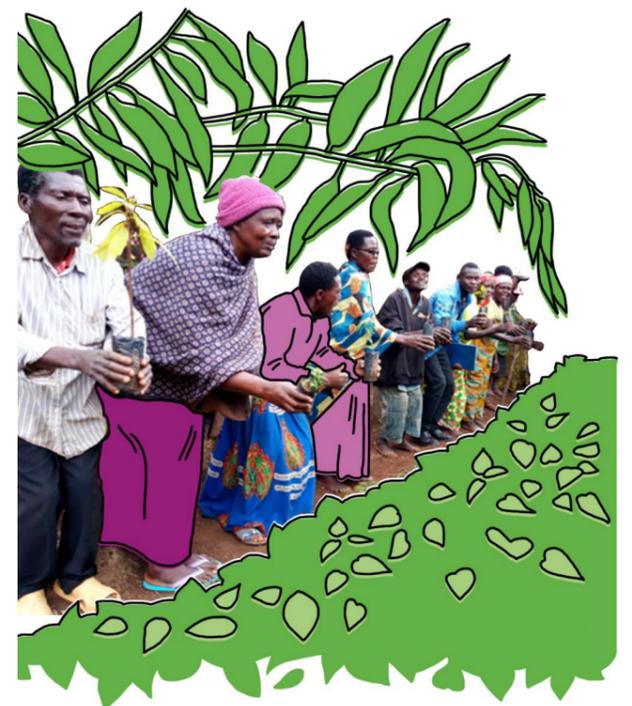


Figure 3. Percentage of solutions achieving each indicator of transformative potential. The more indicators achieved across all dimensions of Relevance, Depth, Scalability, and Sustainability, the greater the potential for transformative adaptation to be realised.



A prerequisite for mainstreaming and replicating adaptation solutions is ensuring that experience and lessons learned are systematically transferred. In Indigenous communities, where experiences and knowledge are typically exchanged by word-of-mouth, more institutionalised mechanisms need to be established in order to enhance the distribution of knowledge.

Under a project to support [sustainable food production and food security in the highlands of Burundi](#), farmer field schools were established. The field schools provided an opportunity for people to learn new farming skills and techniques as well as to contribute and exchange their local knowledge so it can be applied more widely. This systematisation of knowledge management supports the replication and upscaling of project results in the country and the wider East African region.



Farmer field schools are a means for transferring knowledge and experience in the highlands of Burundi. © FAO

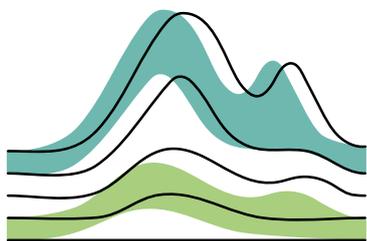
Another prerequisite – and noted barrier to the mainstreaming and replication of adaptation solutions – is the need for long-term sustainable financing. This problem is a consequence of the typical 4- to 5-year funding cycles of multi- or bi-lateral donors¹ that is often too short for the ownership and long-term maintenance of projects to be transferred to local stakeholders. Public-private partnerships offer significant potential for the long-term funding of locally led adaptation solutions.

A commercial trust fund was established to support efforts to halt the deterioration of paramo ecosystems and remnants of Andean forests in Ecuador. The [The Fund for the Tungurahua Paramos Management and the Fight Against Poverty](#) was created in 2008 by Indigenous groups and other stakeholders with competencies and interest in guaranteeing the long-term supply of water to rural and urban populations in Tungurahua province. As well as supporting relevant programmes and projects, annual contributions are used to build the capital of the public-private fund, whose returns can provide longer-term financing. So far, the fund has mobilised nearly USD 5.5 million for ecosystem conservation and the safeguarding of water supplies for the Ambato and Pastaza river basins. The fund has received international recognition and its experiences have informed the establishment of similar initiatives in Peru and Colombia.

The [Adaptation at Altitude Solution Portal](#) provides a unique platform for showcasing how the integration of Indigenous knowledge can support climate change adaptation solutions in mountain regions around the world. The solutions demonstrate that Indigenous knowledge contributes to adaptation solutions in multiple ways, from the uptake of traditional approaches to ecosystem conservation and agriculture, to the harnessing of traditional belief systems and social networks. Policymakers, researchers, donors and organisations involved in climate adaptation should therefore respect and integrate Indigenous knowledge during the design and implementation of projects and programmes. Recognising the value of Indigenous knowledge will lead to more holistic and sustainable approaches to climate adaptation in mountain regions.

¹ See also the Adaptation at Altitude Synthesis Series paper: [Is public funding of adaptation going to the mountain regions most in need?](#)

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