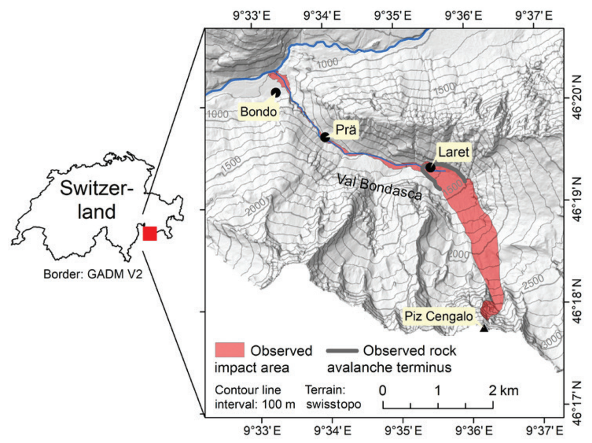
CIRCULAR STRATEGIES | 2023-2024

EVENT

THE PIZ CENGALO LANDSLIDE

TEAM: RINA KRAVCHENKO | PETRA ĎURIŠKOVÁ

LOCATION: VILLAGE OF BONDO, SWITZERLAND
COORDINATES: 46.335318, 9.554227
ALTITUDE: 823 M



In August 2017, the village of Bondo in the Swiss Alps was devastated by a massive landslide. Triggered by a collapsing section of the Piz Cengalo mountain, millions of cubic meters of rock and debris hurtled down into the Bondasca Valley, obliterating everything in its path. The landslide caused significant destruction, burying houses, roads, and bridges, and leading to the evacuation of over 100 residents. Tragically, eight hikers were reported missing and presumed dead.

The disaster underscored the region's vulnerability to natural hazards, prompting extensive search and rescue operations and long-term mitigation efforts. Emergency services worked tirelessly to manage the aftermath, while geologists and engineers assessed the ongoing risks and reinforced the area to prevent future incidents. The 2017 Bondo landslide remains a stark reminder of the powerful forces of nature and the importance of preparedness and resilience in mountainous regions.

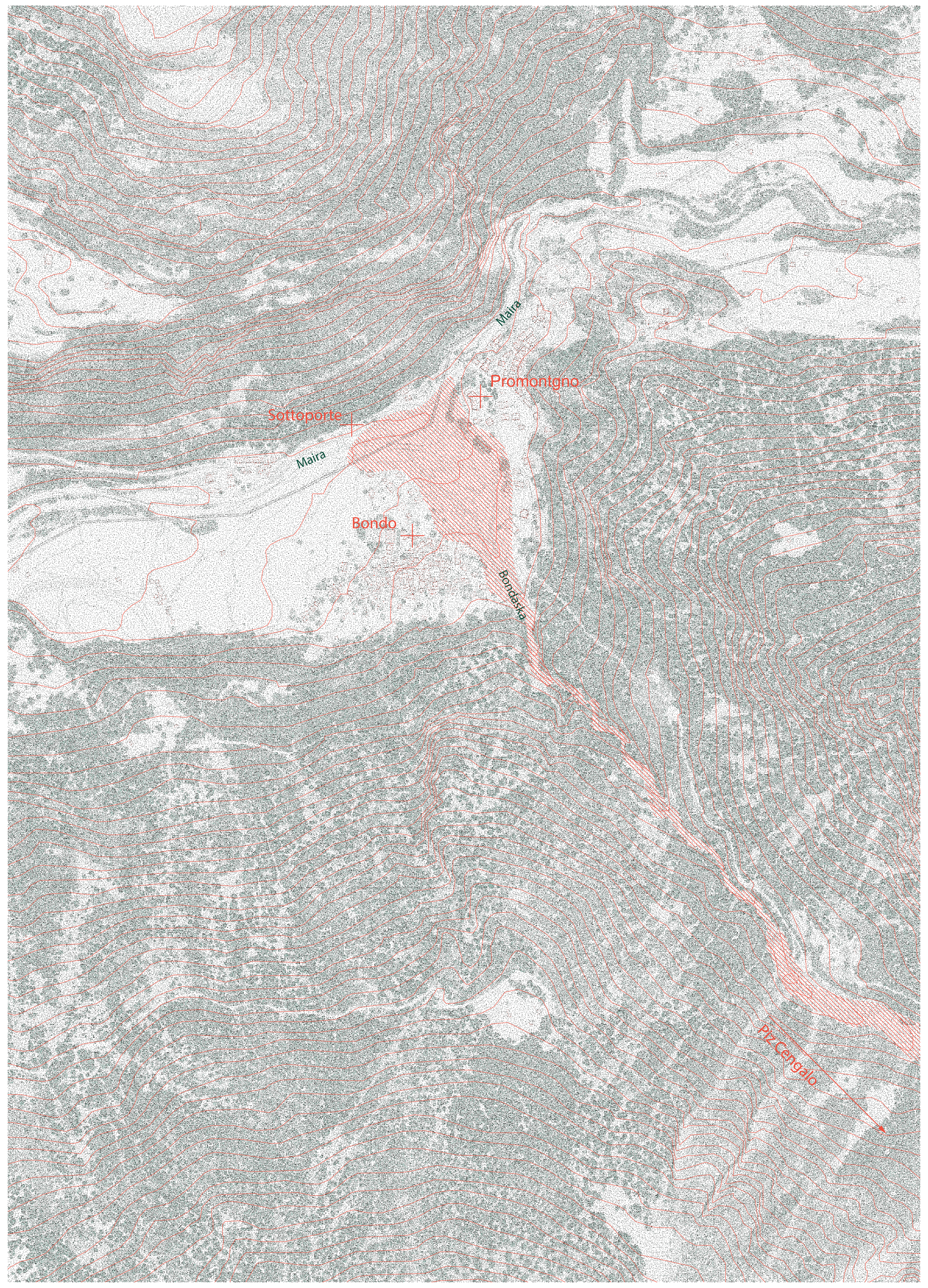
Study area with the impact area of the 2017 Piz Cengalo-Bondo landslide cascade. The observed rock avalanche terminus was derived from WSL (2017).

Mergili, M., Jaboyedoff, M., Pullarello, J., and Pudasaini, S. P.: Back calculation of the 2017 Piz Cengalo-Bondo landslide cascade with r.avaflow: what we can do and what we can learn, Nat. Hazards Earth Syst. Sci., 20, 505-520, https://doi.org/10.5194/nhess-20-505-2020, 2020.

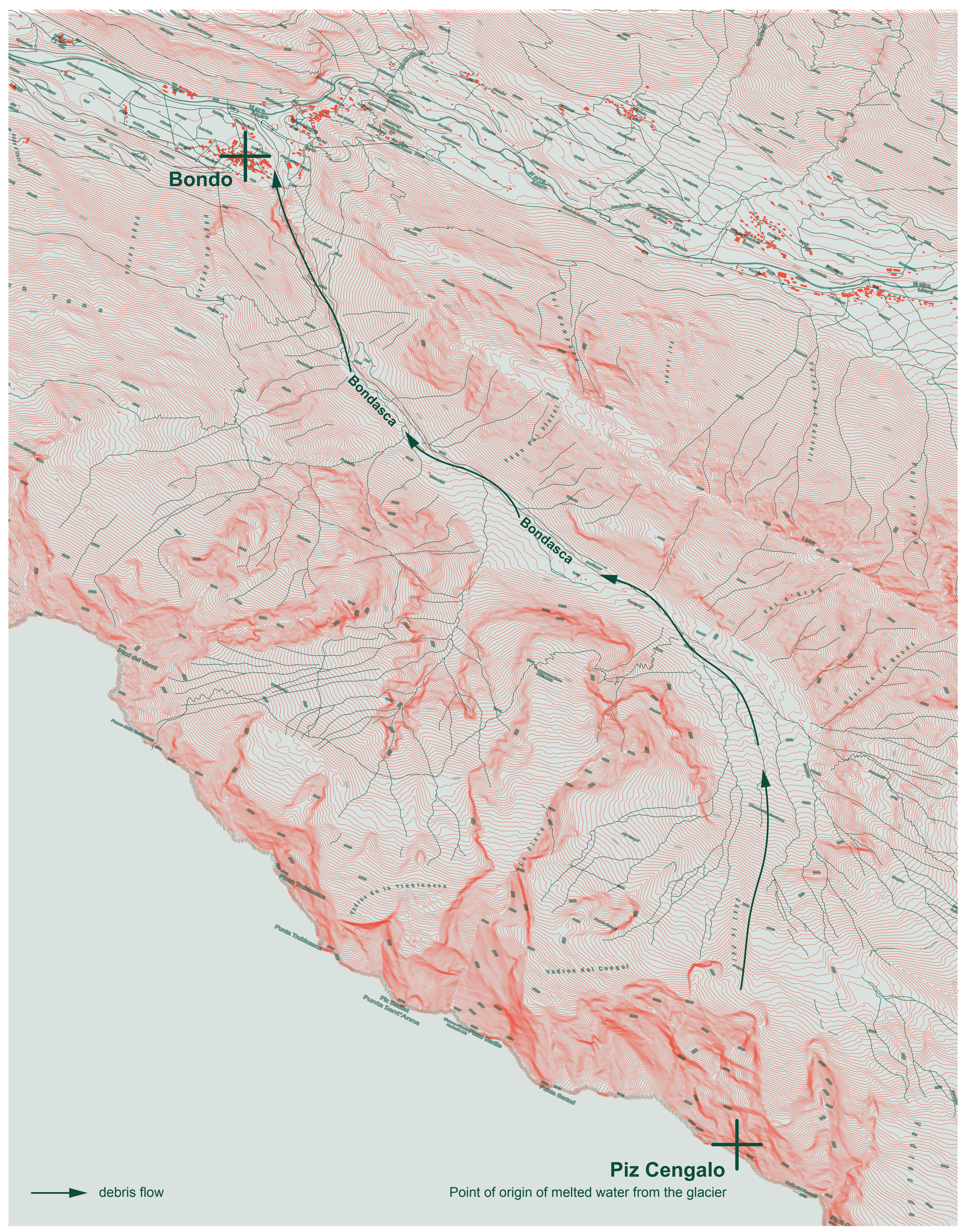
6 June 2015 . Bondo before the landslide. WorldView-3. EUSI

27 August 2017. Bondo after two landslides. WorldView-3. EUSI

5 September 2017. Bondo after three landslides. WorldView-4. EUSI



Impact area. 1 : 10 000



Topography of the area. 1 : 15 000

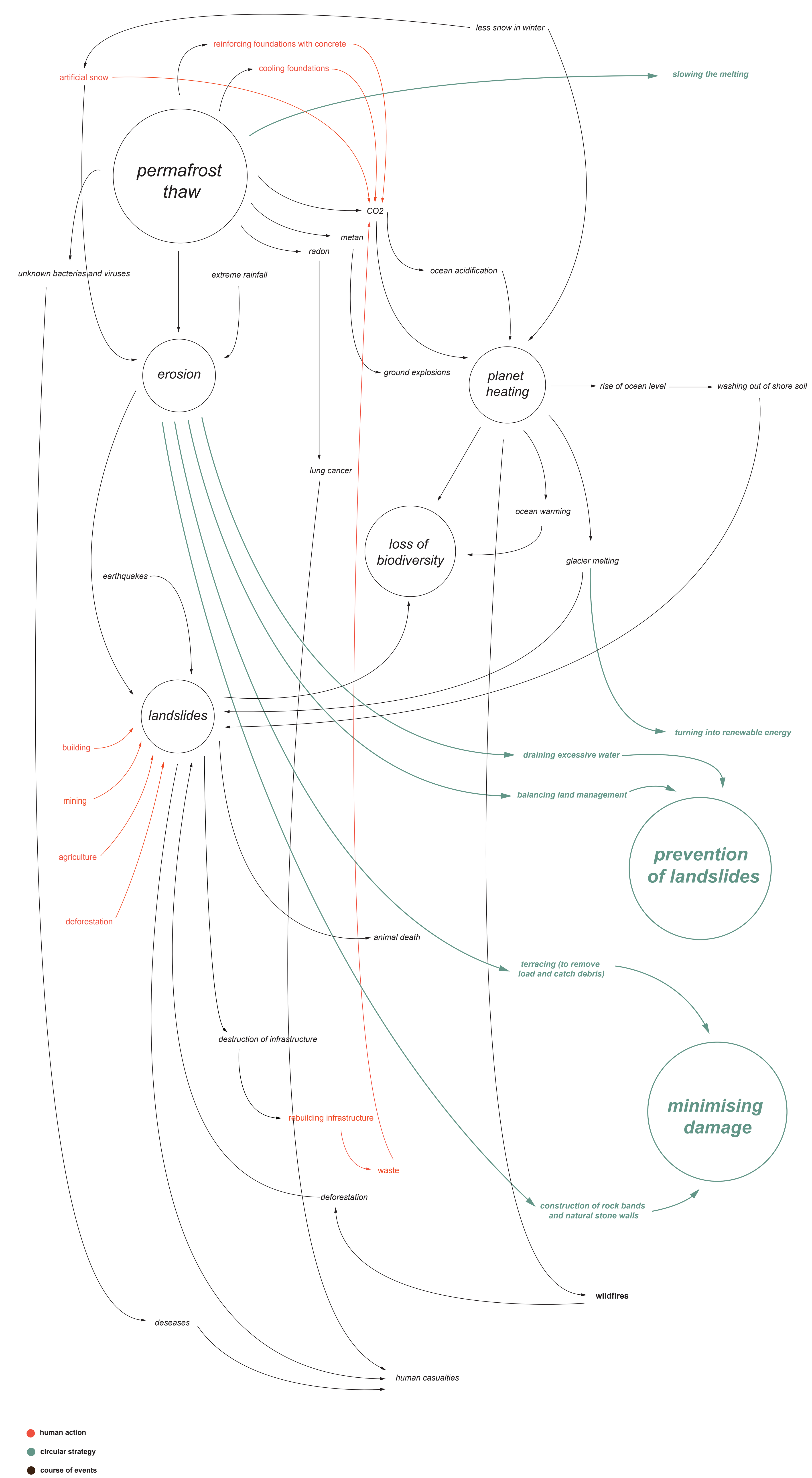
The 2017 Piz Cengalo-Bondo landslide was a devastating event in southeastern Switzerland, resulting from a series of complex, cascading processes. On August 23, 2017, a significant portion of the northeastern face of Piz Cengalo, a mountain in the Bregaglia Range, collapsed in a massive rockslide. This initial failure involved around 3 million cubic meters of rock, rapidly transforming into a rock-ice avalanche as it plummeted into Val Bondasca.

The avalanche, consisting of rock, ice, and debris, accelerated down the valley, increasing in volume as it entrained more material. This transformation continued, turning into a long-runout debris flow that traveled approximately 6.5 kilometers, ultimately reaching the village of Bondo. The force and volume of the debris flow were immense, causing widespread destruction. Houses, infrastructure, and farmland were buried under meters of mud and rubble, significantly impacting the local community.

In response to the disaster, authorities evacuated over 100 residents from Bondo and nearby areas to ensure their safety. Despite extensive search and rescue efforts, eight hikers who were in the vicinity at the time were reported missing and presumed dead, highlighting the tragic human cost of the event. The landslide underscored the region's vulnerability, given its steep and fractured terrain, which is highly susceptible to such natural hazards.

Geologically, the northeastern face of Piz Cengalo is marked by unstable rock formations prone to landslides. The area has a history of similar events, and the retreat of the glacier in the forefield further exacerbated the instability. As the glacier melted, it reduced support for the rock face, increasing the likelihood of a collapse.

The 2017 Piz Cengalo-Bondo landslide serves as a stark reminder of the power of natural forces and the risks posed by climate change and glacial retreat in mountainous regions. It has prompted significant scientific investigation and highlighted the importance of continuous monitoring and risk mitigation strategies to protect vulnerable alpine communities. The event has also spurred discussions on improving early warning systems and disaster preparedness to better safeguard against future occurrences of such catastrophic events.



System-map describing course of events that cause landslides and their integration in a bigger scale of global climate change.

circular strategies

CASE STUDY 01

REDESIGN OF BONDASCA

ARCHITECT: TEAM MAVO LANDSCAPES, ZÜRICH

LOCATION OF THE CASE STUDY: BONDO, SWITZERLAND
COORDINATES: 46.335318, 9.554227
ALTITUDE: 823 M

The Strata team's project proposal embodies a harmonious fusion of cultural heritage and contemporary design. Clear artifacts engage in a meaningful dialogue with the majestic natural landscape—walls, terracing, and protective structures form an organic integration of the new infrastructure within its surroundings. For example, the newly elevated cantonal road not only serves as a shielding barrier but also adapts to the site's texture through refined garden terracing.

These meticulously integrated protective structures will significantly enrich the everyday life of the community. The tops of the embankments will create essential pedestrian connections, weaving together various key points such as the new bus stop, the striking new Punt bridge, the Crotti, the multi-purpose hall, and the community center. This thoughtful design anticipates future transformations in community rituals, like the Chestnut Festival, and accommodates evolving social and technological dynamics.

By fostering a seamless interplay between tradition and modernity, the project not only respects the historical context but also embraces the future, ensuring the landscape and its cultural heritage remain vibrant and relevant for generations to come.

Removing debree from the river Maira.

The stones of the Piz Cengalo are crushed at the nearby landfill and then installed. (Photo: Hanspeter Schiess)

The upper half of the protective dams is built from the stone of the Piz Cengalo. (Photo: Hanspeter Schiess)

The fallen stones that were dragged into the village during the rockslide are cut into smaller pieces and used to build new retaining walls that will protect buildings from potential damage that may come with future landslides.

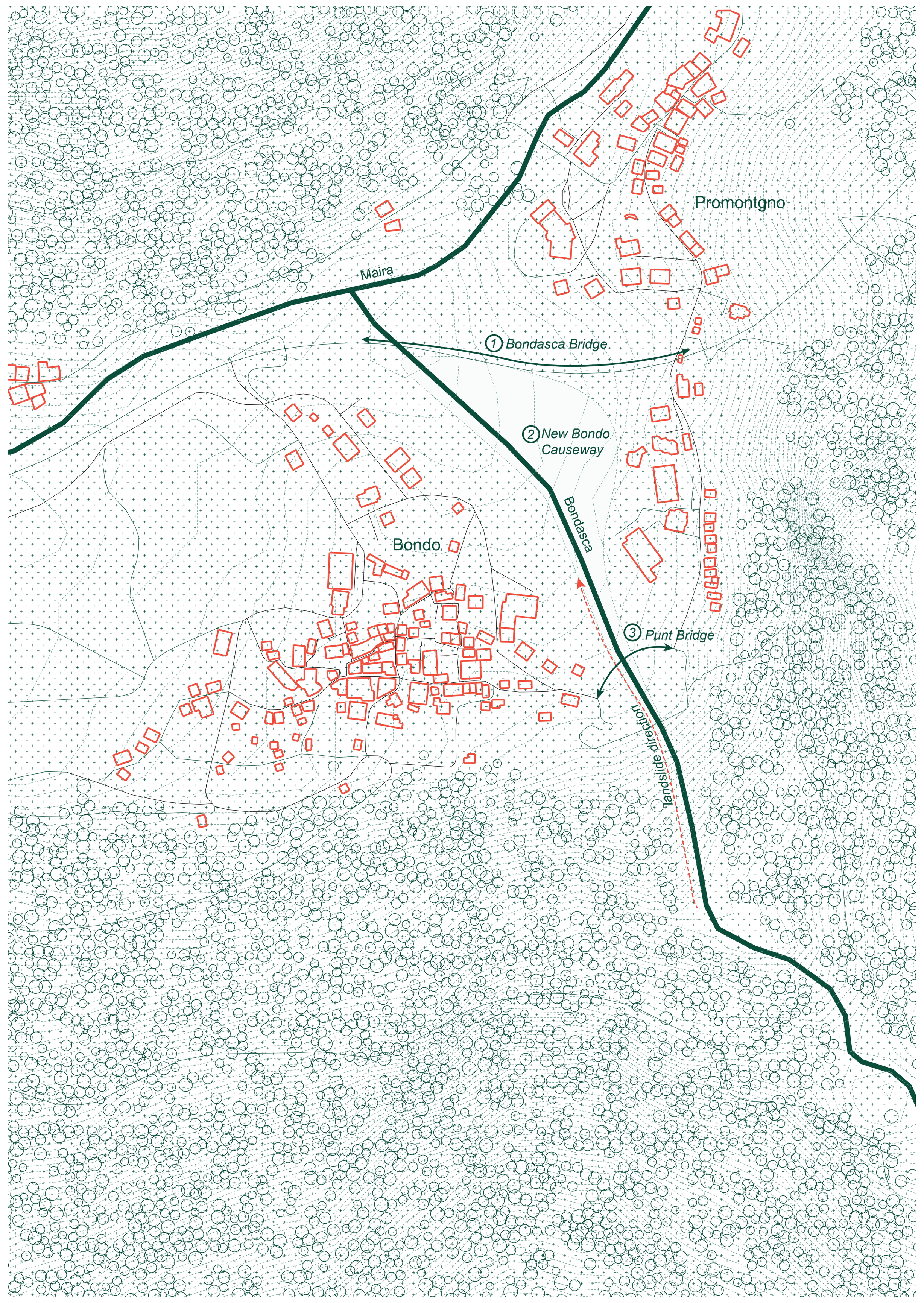
In the ongoing construction of a protective structure in Bergell, Switzerland, designed to shield lives, properties, and preserve the cultural landscape, designers faced numerous challenges. Led by an interdisciplinary team including landscape architect Martina Voser and engineer Gianfranco Bronzini, the "strata" project navigated complex terrain both physically and metaphorically.

The project adhered to strict regulatory standards due to the region's vulnerability to natural hazards like landslides from Piz Cengalo. This required innovative engineering solutions to ensure structural integrity while harmonizing with the environment. Initially preferring local Soglio quartzite, logistical challenges led them to repurpose Bondasca granite dislodged by previous events, turning potential waste into a resource.

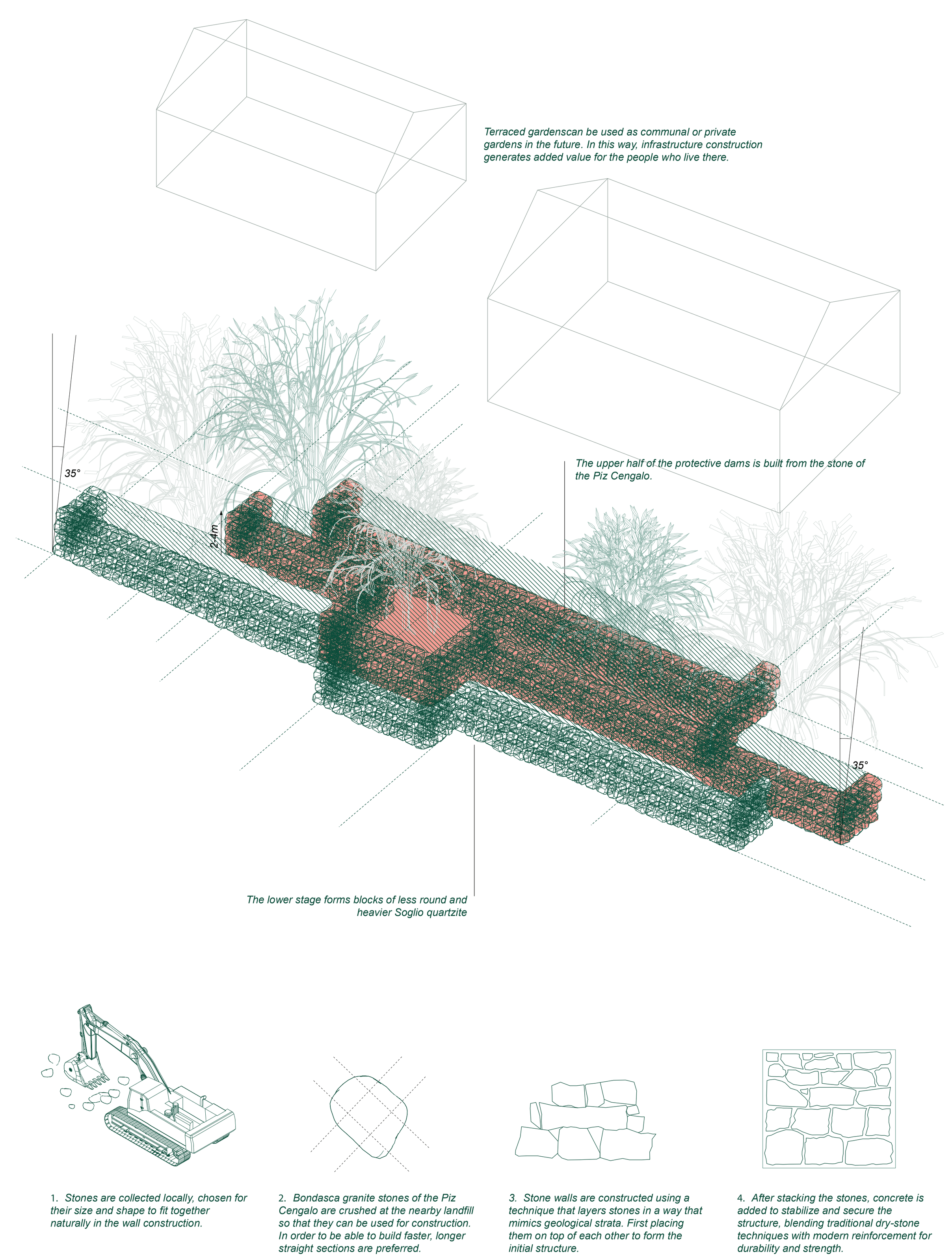
Designing the protective dams and walls involved balancing aesthetics and functionality. The team used large stone blocks for robustness in flood-prone areas and smaller elements for community interaction. These decisions not only ensured resilience but also enhanced the area's livability.

Throughout, Voser and Bronzini mediated between technical exigencies and community aspirations, fostering resilience and enriching Bergell's cultural and social fabric. Their approach included reinterpreting terraced gardens into public spaces, enhancing community engagement and long-term value.

Looking ahead, the project aims to integrate seamlessly with the landscape, ensuring adaptability and sustainability. By bridging expertise with community needs, the team hopes to foster resilience and appreciation for the new structures, envisioning a future where safety and cultural heritage coexist in Bergell.



Site plan.



Axonometry. Construction of protective dams.

CASE STUDY 02

GURSCHEN GLACIER COVER

ARCHITECT: GURSCHEN GLACIER PROJECT TEAM, ANDERMATT, SWITZERLAND

LOCATION OF THE CASE STUDY: ANDERMATT, SWITZERLAND
COORDINATES: 46.6311, 8.5951°
ALTITUDE: 2,200 M

In response to the urgent threat of global warming on glaciers, the Gurschen Glacier in Switzerland became a pioneering site for an innovative approach. Beginning in [year], large-scale tarps were strategically placed over the glacier during summer months. This ambitious effort aimed to mitigate melting by reducing the glacier's exposure to direct sunlight and heat absorption.

The deployment of these tarps was a logistical challenge, requiring careful planning and securing over the glacier's expansive surface. Advanced monitoring systems were implemented to assess the effectiveness of the blankets in slowing down the ice melt and to monitor any impact on the glacier's health. Initial reports and findings showed promising results in temporarily stabilizing the glacier's retreat. However, the long-term sustainability and broader environmental implications of such interventions remain critical considerations.

This case study highlights the proactive measures being taken to address the impacts of climate change on glaciers worldwide. It underscores the importance of innovative strategies and immediate action to protect these vital natural resources for future generations.

The melting of ice near the Gemsstock Hutte (Picture: Google Maps)

Unrolling thermal glacier blanket. (Picture: PD)

Parts of the Gurschengletscher glacier covered (Picture: Reuters)

The case study highlights the use of innovative tarps to mitigate glacier melting, addressing logistical challenges, implementing rigorous monitoring, and balancing short-term stabilization with long-term sustainability considerations.

Covering glaciers with tarps, such as the Gurschen Glacier in Switzerland, faces several significant challenges. One of the biggest hurdles is the logistical complexity.

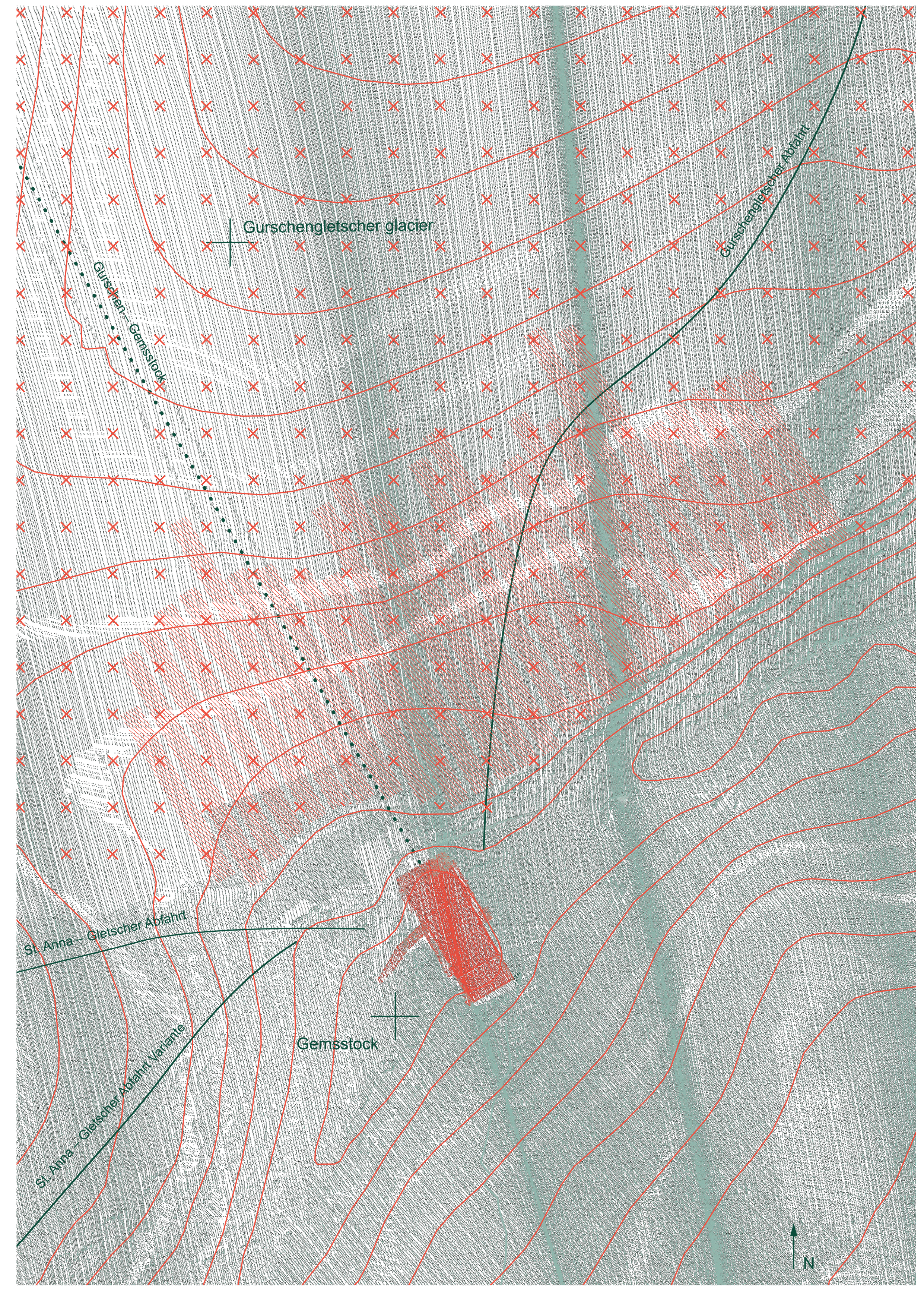
Imagine trying to spread and secure massive tarps over vast, remote ice fields. It requires meticulous planning, sturdy anchoring systems to withstand fierce winds and heavy snowfall, and ongoing maintenance to ensure they stay effective.

Environmental impact is another crucial concern. While tarps can potentially reduce melting by reflecting sunlight, they also risk altering local ecosystems. Glacier-fed environments support unique plant and animal life, so any changes to their microclimates could have unintended consequences. Plus, the materials used in the tarps could pose environmental risks if they degrade over time and release microplastics into these sensitive areas.

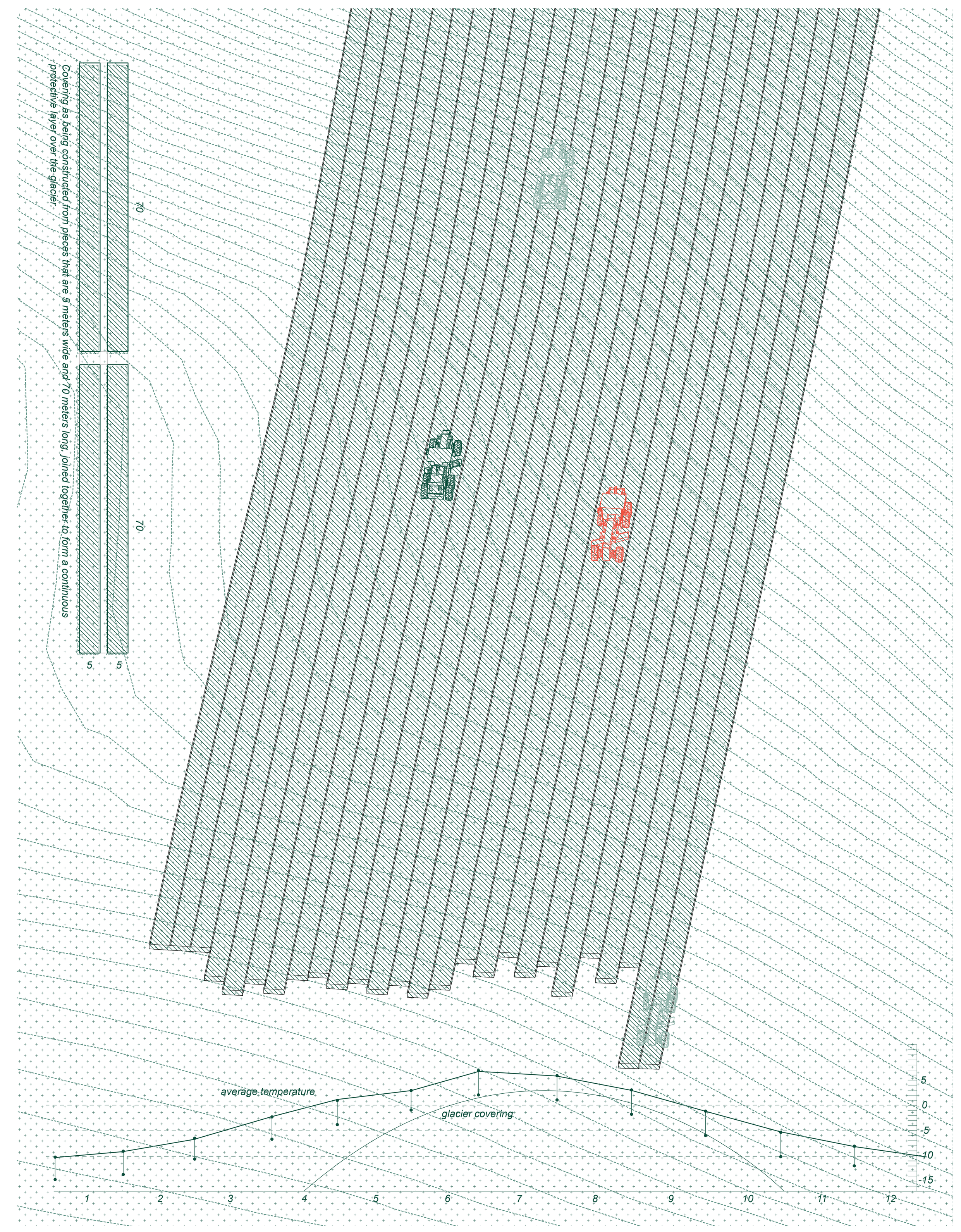
Financial sustainability is a major consideration too. It's not just about the initial cost of materials and installation but also the ongoing expenses for monitoring and upkeep. Securing funding for such projects can be challenging, especially without clear economic benefits or regulatory incentives supporting glacier conservation efforts.

Effectiveness is another key issue. While early results might show reduced surface melting, the long-term impact on overall glacier health and dynamics is still uncertain. There's a risk that focusing too much on these technological solutions might distract from addressing the root causes of glacier retreat—like reducing greenhouse gas emissions globally.

Ethically, there are questions about where priorities lie in combating climate change. Some argue that investing in high-tech fixes for glaciers could overshadow efforts to promote broader changes in policies and behaviors needed to tackle the climate crisis comprehensively.



Site plan.



Axonometry. Machines lay fabric over the glacier to reduce melting.