

ACTI

VITY

REP

ORT





Since 2009, when it was accidentally introduced from Asia, *Drosophila suzukii* has been giving cherry crops and other small fruits such as blueberries and raspberries quite a bit of grief. Currently, the only way to monitor *drosophila* is by collecting fruit samples and looking for the entry holes the insects make with a microscope. Within the framework of the INSTINCT project, together with the Laimburg Research Center, the Free University of Bolzano/Bozen and two companies specializing in the development of artificial intelligence-based technologies, we are experimenting with the use of a tool called a spectroradiometer. The hypothesis is that cherries colonized by drosophila larvae reflect light differently from healthy cherries.

Where research touches lives

In a world that is spinning ever faster, it is becoming increasingly difficult to get to the bottom of things. In view of some of the political, economic, and social dogmas that prevail today, independent research is more important than ever. Research that takes a close look, listens, makes connections, questions, verifies, and separates facts from fakes. Our researchers do this with impressive perseverance. They investigate what keeps us healthy – long before we become ill. They observe how alpine ecosystems change – before irreversible consequences occur. They ask how people can live together successfully in a diverse society – before conflicts escalate.

It is impossible to mention even the most important changes of 2024 here, but one that stands out was the founding of the Center for Migration and Societal Change. South Tyrol will thus become a driving force for research that not only analyzes social upheavals but also makes them tangible – with an open mind for people and possibilities.

Our research is both measurable and acclaimed. It is visible, tangible, and relevant to everyday life. Eurac Research is made up of 700 individuals from over 40 countries who demonstrate that research occurs where politics, nature, society, and everyday life intersect. Their curiosity, courage, and sense of community are essential. They show that when various perspectives converge, the outcome is not only knowledge but also direction.

Roland Psenner, President



Roberta Bottarin, Roland Psenner, Stephan Ortner

Water research

Since our very beginnings, Eurac Research has been dealing with water and everything that revolves around it – now the topic is more relevant than ever. In the past year we published findings on avalanche accidents made more dangerous by wetter snow (p. 27), snowfall reduction across the Alps (p. 23), and post-ski winter tourism (p. 26). And we organized the Adige Water Fair: a platform shared by research and different stakeholders in the Adige River Basin. On this occasion and in the pages of this Activity Report, we highlighted how we can best manage the risks involved by working together.

Roberta Bottarin, Vice Director

Research that bears fruit

A bright cherry opens the report this time. The beautiful image comes from a project that uses sensors and artificial intelligence to control pests with fewer pesticides. The Free University of Bolzano/Bozen, Laimburg and local companies are our partners in the undertaking. Collaboration and ambition always drive our work, whether we are supporting companies in innovative developments, investigating discrimination, or helping with climate adaptation. Our unchanging goal is contributing to a livable future through research and strong networks.

Stephan Ortner, Director

Table of contents

7

Research partner: society

8

Good for the climate, good for democracy

8

ClimaBZ: imagining the future of Bolzano

9

Skills in multilingual classrooms: an ad hoc survey system for Ladin schools

10

Addressing climate risks together

11

Agents of connection

12

Preventing chronic renal failure

13

Shepherds and their helpers

14

Our network

16

Nature for everyone

17

Bridges between East and West

18

exCHANGE: pathways of collaboration between art and science

19

Reducing our emissions: initial measures and impacts

21

Snow and rain: changes and consequences

22

Our water studies at G7 planet week

22

Climate, Energy and Environment 2024

22

A hydrological atlas for South Tyrol

23

Snowfall in the Alps: one third less in 100 years

24

Know the river, stop fighting over it

26

Ways to reduce dependence on snow

27

Avalanches: more victims survive, but the time to intervene has decreased

28

A marmot from the Neolithic Age

31

Tools for science and practice

32

Welcome Winemap

32

Reform potential in public administration (E-Government)

33

Watch out for ants

34

1972 til now (Autonomy Dashboard South Tyrol).

35

Supporting the development of non-standard photovoltaic modules

36

Renovating large property portfolios and saving money

37

Focus on safety

38

Publications and Open Science

39

High altitude diseases: the paper

39

One year of blogging

40

CHRIS study: self-determined participation thanks to dynamic informed consent

40

Paper and poster awards

41

Gender Report

42

The thousand and one sciences

42

Science on stage

44

BEEhold

45

Digitalization and autonomy

45

The AI challenge

46

EU projects

48

Who we are

49

Organigram

50

People

52

Awards and nominations

54

Institutes and Centers

64

Scientific Advisory Councils

66

Committees

67

Finance

Research partner: society

Science thrives on dialogue – and that dialogue does not end in laboratories. Whether the focus is on climate protection measures, more livable cities, or the question of how we can counteract growing inequality, diversity of perspectives is key to new insights.



Good for the climate, good for democracy



More and more states, regions and cities are convening climate councils to involve citizens in shaping climate policy – including Austria, South Tyrol and the city of Trento. A round table has analyzed the three experiences. Environmental Law Expert Federica Cittadino shares the results.

Why are citizen climate councils important from a legal perspective?

Federica Cittadino: Citizens' councils are generally an important instrument of participatory democracy. They give a voice to people who are normally excluded from decision-making processes and thus complement representative democracy. When it comes to climate protection, it is particularly obvious that positive ecological turnaround can only be achieved with the support of the population.

The three processes analyzed were designed very differently – what were the interesting findings from each experience?

Cittadino: In South Tyrol, the Climate Council has been working on a technical document, the climate plan of the Autonomous Province of Bolzano/Bozen; however, the proposals made go beyond its objectives demon-

strating the citizens were more ambitious than the provincial government. This confirms the studies that show citizens can make bolder decisions than politicians because they are not under comparable pressure. In Trento, the citizens' assembly was designed as a simulation to test the instrument. A lot of time was devoted to exchanges with city officials, and this dialogue was perceived as highly relevant to the discourse.

The Austrian Climate Council had the task of helping the country to achieve climate neutrality – a very general request. This proved to be a disadvantage: the Council had difficulties drawing up relevant recommendations, precisely because the subject area was far too broad.

The recommendations of citizens' assemblies are not binding – how do you assess their effectiveness?

Cittadino: Sometimes citizens' assemblies do have a concrete impact at the legislative level, but their other aspects are also important. Citizens' councils raise public awareness and reduce polarization. Regardless of the specific issues, these initiatives always aim to strengthen democracy.

CLIMABZ: IMAGINING THE FUTURE OF BOLZANO

Thirty citizens residing Bolzano with different socio-demographic characteristics and the Stakeholder Forum – composed of 12 representatives of city stakeholders (businesses, trade associations, civil society, commerce, public sector) joined forces to develop ClimaBZ. The collaboration created a pathway implemented with the municipality of Bolzano to update the PAESC – Sustainable Energy and Climate Action Plan to propose concrete actions to reduce emissions as well as mitigate and adapt to climate change. During five meetings the working group met with experts who presented the city's climate change issues and strategies for mitigating impacts and reducing emissions. All citizens were also able to take part in a portal where it was possible to submit their own ideas and suggestions on how to reduce emissions and adapt to climate change. The results will be presented publicly and submitted to the municipal council.



Skills in multilingual classrooms: an ad hoc survey system for Ladin schools



National and international tests that are used to assess school proficiency, such as the PISA and INVALSI tests, usually take for granted that there is a primary language of instruction. But the Ladin school system is one of the few educational systems in Europe that is truly multilingual, where teaching takes place in Ladin, Italian and German, and in this context, traditional tests are often limited.

This is why the COMPLETT (Competenzen Plurilinguistisches Ladin Tudësch Talian) study was born. Initiated by the Provincial Evaluation Service for Education and Training in Ladin localities, the study's ultimate goal is to design a viable and sustainable method for the detection and critique of monolingual and multilingual proficiency in written language. Eurac Research is currently grappling with the first part of the study, which focuses on German. The team collected data in the third-year classes of five Ladin middle schools: more than 200 students wrote two texts in German starting from



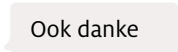
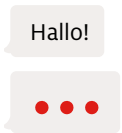
input in other languages and a Whatsapp-style conversation to employ multiple language

Nein. Wir treffen uns im SLZentrum und arbeiten bis 15:00 Uhr. ✓✓

registers. Finally, both the classes and the families received a questionnaire to collect socio-linguistic data. The teaching staff are also

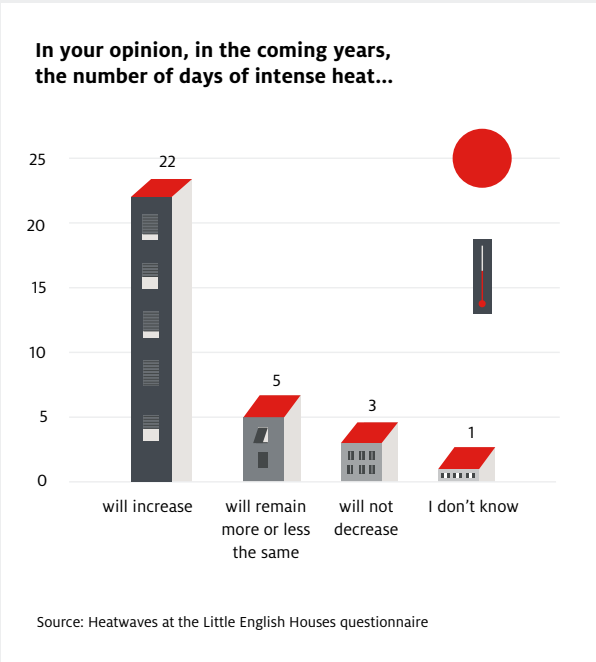


involved in the project with interviews, focus-groups and a questionnaire. Evaluation and interpretation of the results will follow; transcribed texts will be compiled in a multilingual student corpus and made publicly accessible.



Addressing climate risks together

People living in the so-called Little English Houses – a social housing complex in Bolzano, South Tyrol, Italy and who participated in Eurac Research's study on the effects of heat waves have a high awareness and perception of the risks related to this phenomenon (see graph below). In fact, most of the people who responded to the questionnaire were also intensely concerned about the negative impact on their own social lives. As a result of heatwaves, the number of visits made to parents, friends and family decreased, as did the number of creative activities carried out. During the event to present the results of the study, the research team responded to residents' questions and discussed what technical improvements could be made to improve their quality of life. This small participatory initiative is part of RETURN, a PNRR project that is highly articulated on the risks associated with disasters, both natural and caused by environmental factors in the context of climate change. Within the framework of the same project, and on the same theme of participatory approaches, a handbook was also written in collaboration with Fondazione Cima and the Politecnico di Milano that shows, step by step, how to involve a community in the definition and monitoring of a strategy, plan or measures for adaptation to climate change.



The common puffball is often found in deciduous and coniferous forests.

Forest ecologist Marco Mina and a colleague take dead wood samples to examine them for fungal DNA.



Agents of connection

Fungal diversity, now part of Biodiversity Monitoring South Tyrol.

Only a small proportion of fungal species have been studied, but the vital role that these organisms play in our environment is undisputed. They decompose organic material and store it in the forest soil, not only returning nutrients to the earth and helping to regenerate the soil but also helping forests to mitigate climate change. Fungi form symbiotic relationships with plants and trees: supplying the roots with nutrients such as nitrogen and phosphorus, thus promoting their growth. In return the plants in question give sugars to the fungus. Healthy forests exist due to intact fungal networks.

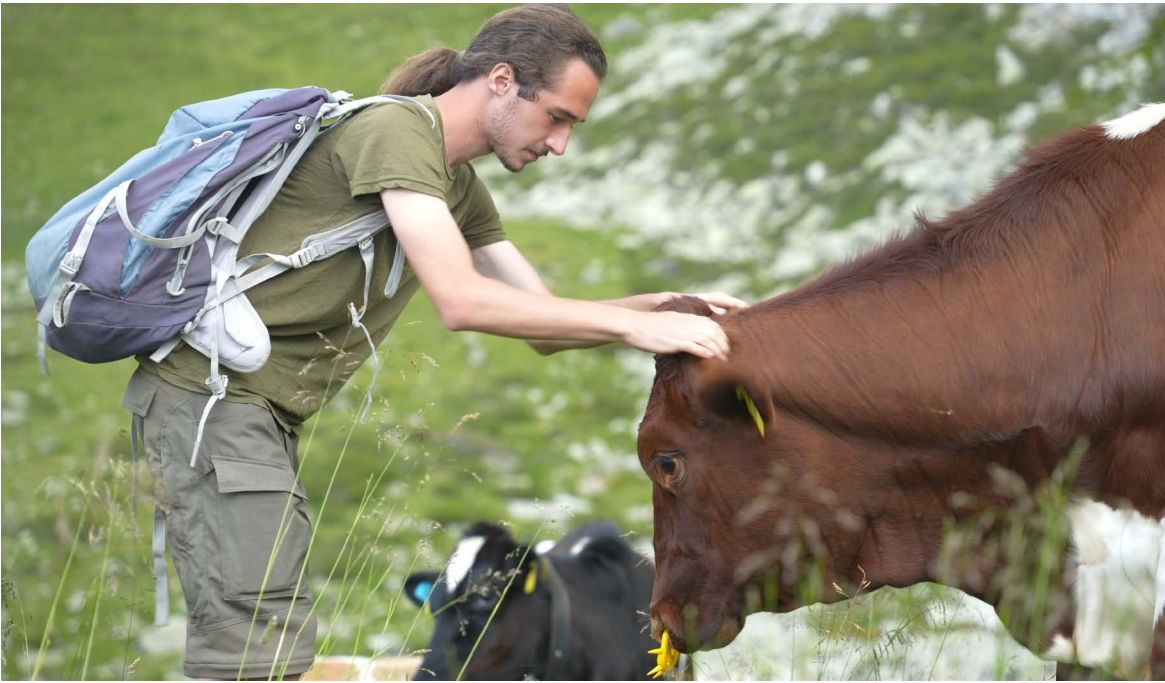
In order to better understand their impact on ecosystems, a research team is now collecting data on these species, working closely with a mushroom society – the South Tyrolean branch of the Associazione Micologica Bresadola. Fifty forest sites will have been surveyed for mushroom diversity by 2028. As certain species of fungi form associations with particular trees or plants, the traditional method of collecting the fruiting bodies and documenting where and in association with which trees they grow will be used. In addition, at some of the locations, the team will also carry out environmental DNA (eDNA) analyses of soil and dead wood samples, as well as using special filters, called spore traps, to capture the reproductive cells of the fungi that are spread by the wind.

Preventing chronic renal failure

We investigated the prevalence of chronic kidney disease and its connection with diet in South Tyrol’s general population. The study yielded important information for prevention – the only real weapon to fight the disease.

As part of CHRIS, the Cooperative Health Research in South Tyrol study that investigates the genetic and molecular factors underlying our health, a research team studied kidney health status in a sample of 11,000 CHRIS study participants. After having given their informed consent, participants then gave blood, a urine sample and underwent arterial pressure and anthropometric measurements as well as various clinical tests. The test findings reveal that around 15 percent of the people living in the Venosta Valley have had some kind of renal disease (e.g., infections, calcifications or genetic diseases of the kidneys) at some point, while nine percent have a chronic renal disease, or have experienced a failure of the regular kidney function. “Though the results are completely in line with the values of Western societies, the factor that baffled me was something else: many of the participants with reduced kidney function had not been diagnosed with it,” says Giulia Barbieri, who was in charge of the analysis. The research team also wanted to investigate the connection between chronic kidney failure and nutrition in the general population. “Usually research on nutrition focuses on subjects

who have already been diagnosed and are in specific stages of the disease, such as patients who are to undergo dialysis. The general population is still poorly studied,” says Cristian Pattaro, biostatistician and principal investigator of the CHRIS Study. “Providing general information helps us to act in a prevention context, which is even more important and necessary. Renal function naturally tends to diminish with advancing age, and the aging of the population will cause the incidence of this disease to increase even more in the coming years.” Projections suggest that by 2040, chronic kidney failure will rank fifth among the world’s leading causes of death. To study the connection between kidneys and nutrition researchers used an innovative approach: analyzing diets as a whole. According to the research team, if you study the impact of a single nutrient, you risk having biased results. “We are often focused on single foods or single nutrients: for example, we know that items such as protein, sodium, phosphorus, and potassium should be consumed less by people with chronic kidney disease. But what we eat every day consists of very varied combinations of these nutrients and the interactions of these individual parts is not so simple to analyze. Elements like protein and phosphorus actually often combine because processed meat contains numerous additives that are usually high in phosphorus,” Giulia Barbieri warns. The referenced papers came out in the “Journal of Nephrology and Journal of Renal Nutrition”.



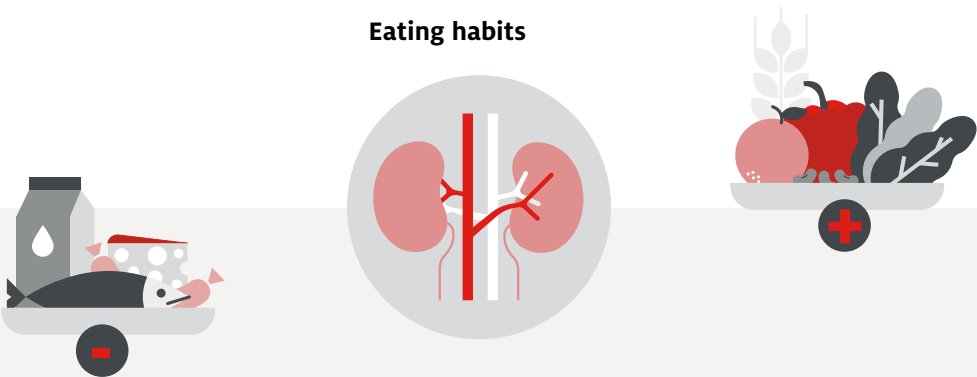
A volunteer helps the shepherds as part of the LIFEstockProtect project.

Shepherds and their helpers

Professional herding has almost disappeared in South Tyrol: you can count the men and women who herd cattle all day in guided grazing on one hand. As part of the European LIFEstockProtect project, a research group is working to revive old grazing practices – not out of nostalgia, but because this is a way of adapting to change in the Alps. A central aspect of this is herd protection: herding can protect against attacks by predators, falls, lightning strikes and the onset of disease, dangers that cost the lives of more than a thousand animals in South Tyrol every year. Guided grazing also contributes to the preservation of the cultural landscape and promotes habitats with great biological diversity, such as clearings and grasslands

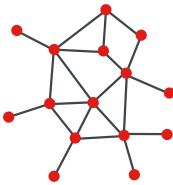
that are at risk of disappearing due to intensification or abandonment. The research group, led by wildlife ecologist Julia Stauder, works with both seasonal and year-round shepherds. “We support the exchange of knowledge and best practices not only between herders and animal owners, and also among the herders themselves,” Stauder explains. Another important part of LIFEstockProtect are volunteer programs that give interested people the opportunity to help out on the mountain pastures and learn the associated skills. As a result of the project, the Technical College for Domestic Science and Agriculture in Salern has also developed a certified shepherd training course.

Eating habits



Our network

Research facilities and institutions, universities, companies and administrative departments: our partners are diverse, ranging from South Tyrol to far beyond. Most collaborations fall within the framework of funding programs, but not only – we also carry out commissioned projects. Last year, for example, we analyzed ancient human remains for Mahidol University in Thailand and provided training in climate risk analysis for experts in Bhutan on behalf of the United Nations Environment Programme.



Over 1,500
The number of our partners, spread across the various continents. For the most part, these collaborations come in the form of international research projects.



Over 60
The number of countries we had active partnerships with in 2024.

We collaborate with



international partners

62.2%



national partners

24.1%

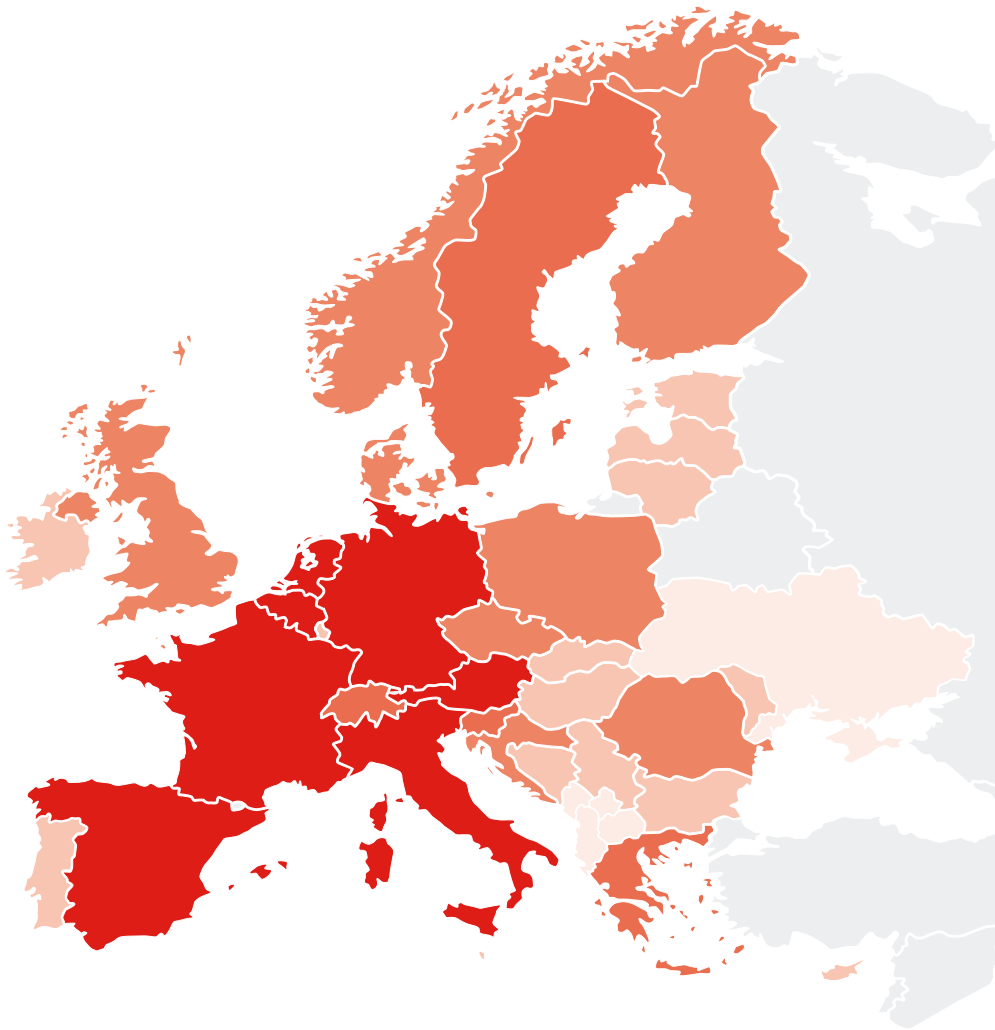


local partners

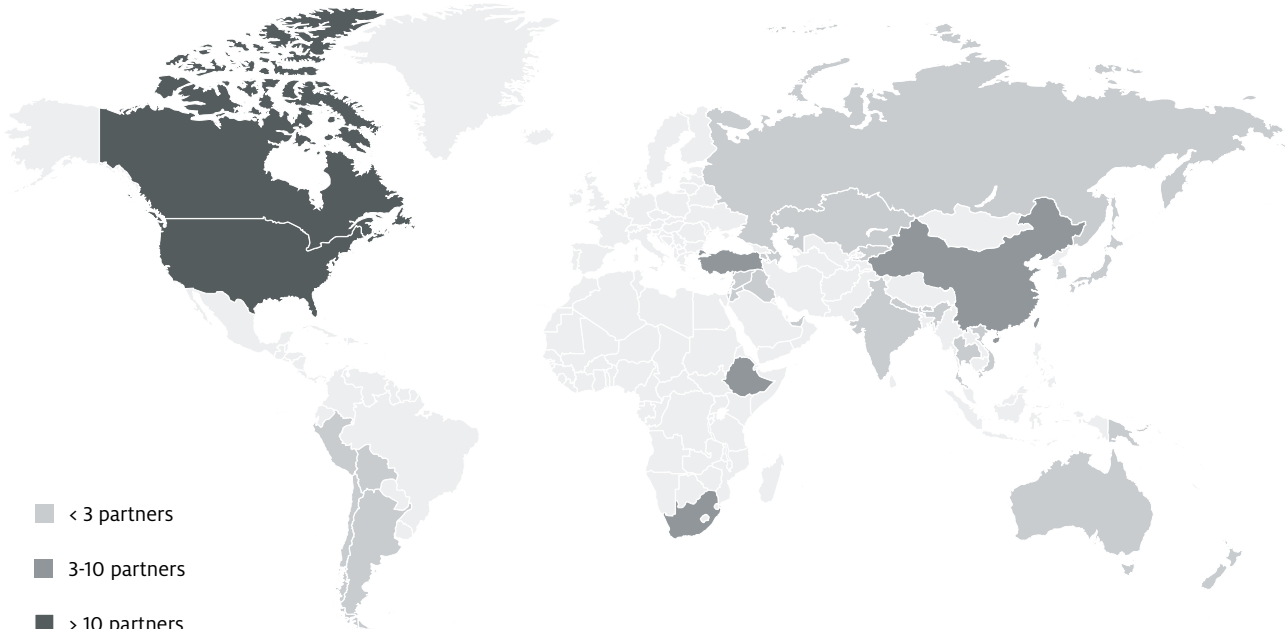
13.7%

Each partner is only counted once, regardless of how many collaborations there were during the year. Data refers to the period between 01.01.-31.12.2024 (exported 02.2025); Source: internal databases.

- < 3 partners
- 3-10 partners
- 11-30 partners
- 31-50 partners
- > 50 partners



- < 3 partners
- 3-10 partners
- > 10 partners





NATURE FOR EVERYONE

A stream provides respite from the summer heat, a wildflower meadow delights both the eye and the insects, vegetables are growing in raised beds, and a fruit stand is nestled in a corner. A small triangular plot of land in Merano’s Obermais has been transformed into a “garden for everyone.” Created as part of the EU project JUSTNature, the green oasis, which was developed together with the neighborhood in three workshops, is intended to serve as inspiration, embodying the core idea of the project: even if you live in the city, you have a right to freely accessible ecological space – to clean air, green spaces and biodiversity. More nature in the city is also proven to counteract urban heat islands. Bolzano, one of the two South Tyrolean cities among the seven project cities, suffers from this particularly badly due to its basin location and dense development. Here the project focuses on green roofs, which provide cooling and better air quality while also promoting biodiversity.

Video



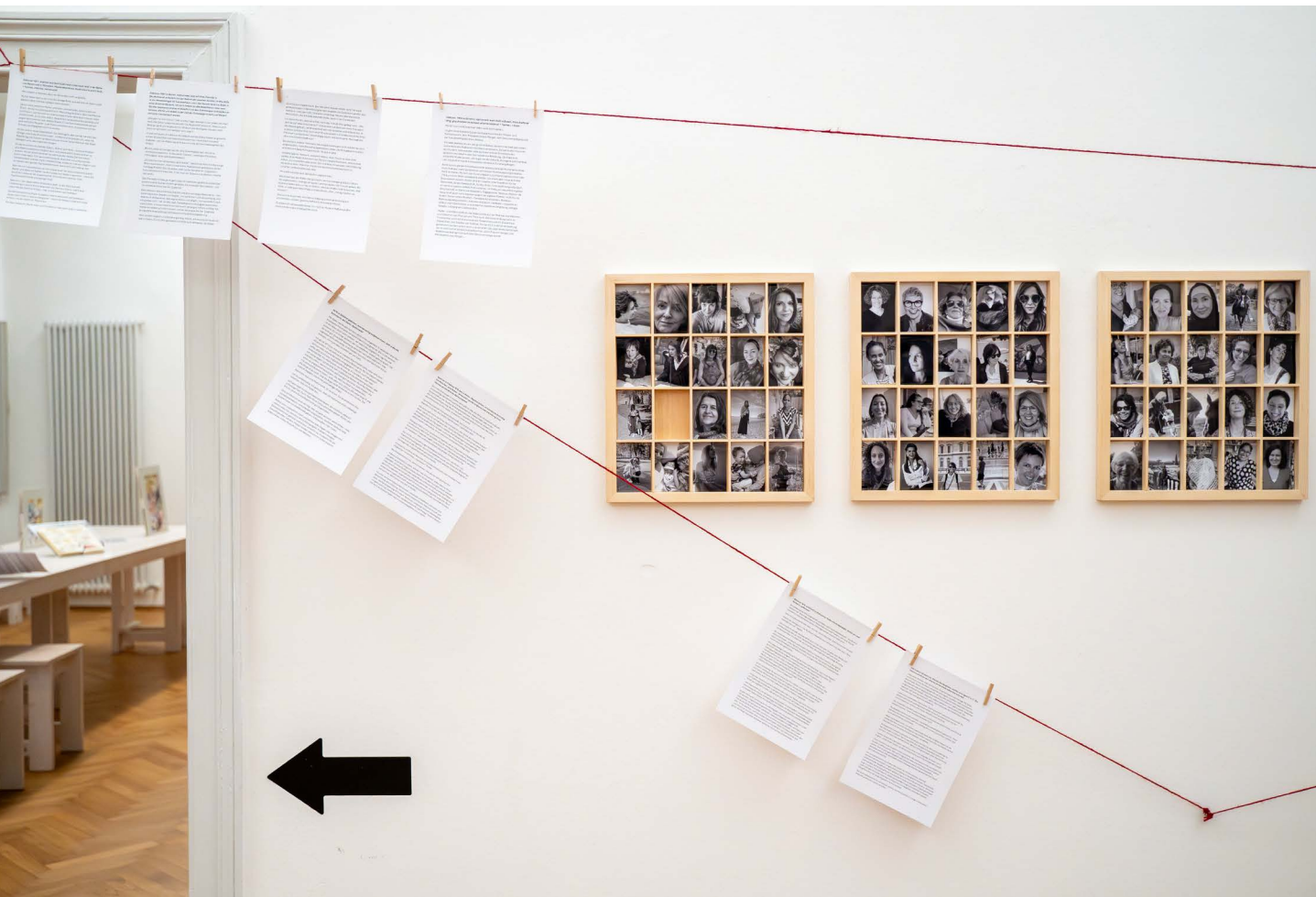
Bridges between East and West

Knowledge exchange, cooperation and the promotion of high scientific standards: with these goals in mind the International Education and Research Alliance (IERA), which connects research and educational institutions from Italy, France, England, Armenia, Ukraine, Tajikistan and Iran was established. The initiative for the alliance came from the European University of Armenia (EUA), driven by the desire “to acquire knowledge and skills that will advance our country,” Rector Heghine Bisharyan explains. Eurac Research is one of the founding members. The relationship between the research center in Bolzano and the private university in Yerevan goes back to Armenia’s first post-Soviet years, when the initiators of the European University sought the advice of the European Academy of Bolzano – as Eurac Research was then called.

Eurac Research also hosted the alliance’s first major meeting last September. Director Stephan Ortner, Professor honoris causa at the EUA and member of the IERA Executive Board, places the initiative in the wider social and political context: “Many countries in the region are in a similar situation to Armenia: still dependent on Russia, which supplies energy and promises security, among other things, and they are under strong pressure from China, which wants to expand its influence. Now, the younger generations are looking to Europe and are guided by European values.”



- ~100
- The number of appointments to scientific and executive committees
- gained by our researchers whose specialized skills have earned them
- key roles.



exCHANGE: pathways of collaboration between art and science

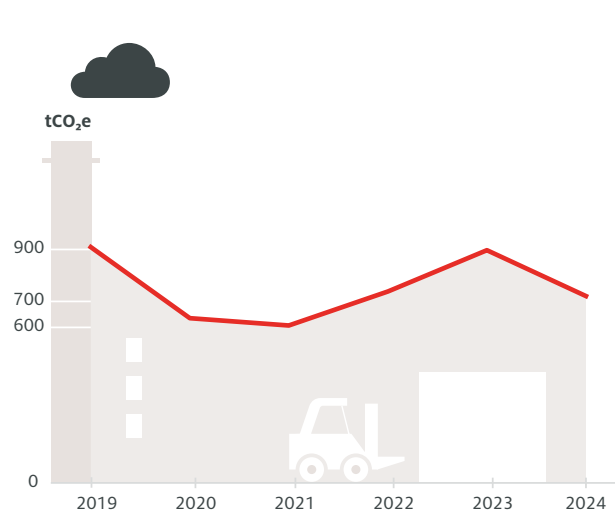
What happens when people from fields as diverse as art and science venture beyond the boundaries of their respective disciplines to explore complex social issues such as inequality together? Last October, the results were presented in an exhibition at the headquarters of the Südtiroler Künstlerbund – the artistic partner of the project. There was also an immersive experience in

the terraXcube, the extreme climate simulation center of Eurac Research at NOI Techpark. In the framework of the exCHANGE: pathways of collaboration between art and science project, six tandems, combining artistic and scientific practices, developed innovative approaches aimed at promoting social change.

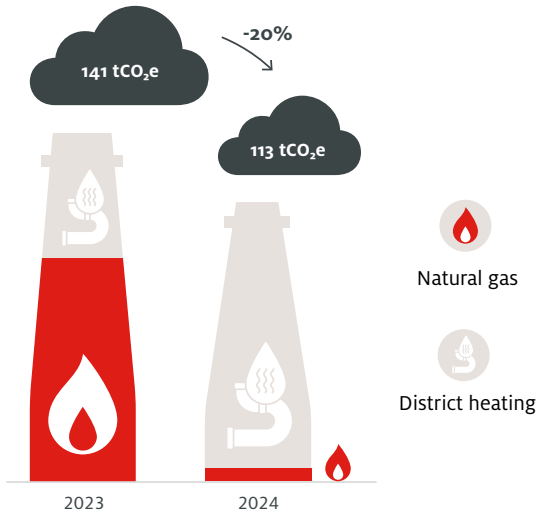
Reducing our emissions: initial measures and impacts

A key goal of our work is that the results of our research contribute to a more sustainable future. At the same time, it is important that the work itself is as sustainable as possible – resource-conscious, climate-friendly as well as socially and economically responsible. Over the past two years, we have identified the most relevant topics to achieve this; these range from the reuse of research data to equal opportunities. One particularly significant and transversal effect of our activities concerns greenhouse gas emissions. To reduce them, we first comprehensively mapped where our activities directly or indirectly generate emissions and developed a methodology to calculate them. We are now able to track how our emissions progress, define targets and develop action plans.

A large proportion of our emissions come from our consumption of electrical and thermal energy. Since 2019 we have been collecting data on our total emissions – figure 1 below. However, the trend of the first few years is not typical given the coronavirus pandemic. However, if we compare 2024’s data with the previous year, we see a significant reduction of almost 20 percent despite having expanded our activities and our number of employees. We primarily achieved this by replacing our natural gas heating with a connection to the district heating network – figure 2 shows the effect of this change.



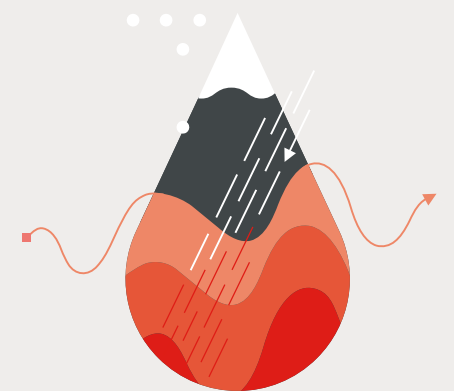
Total emissions over time
The emissions are expressed in tons of carbon dioxide equivalent [tCO₂e]. The data was calculated using the so-called market-based approach, in which no emissions are attributed to electricity from renewable sources such as hydropower. The methodology developed for the calculation is in line with the GHG Protocol (<https://ghgprotocol.org/>).



Heating emissions 2023 and 2024
Heating emissions are mainly related to natural gas and district heating. Moving away from natural gas-powered plants has significantly reduced the share of emissions from fossil sources at our HQ.

Snow and rain: changes and consequences

Trends show that precipitation is not in absolute decline, but it rains more and snows less than it used to in the past. Storm events are becoming more frequent, with periods of excessive precipitation alternating with droughts. We continue to monitor the situation in order to understand the implications of these changes, especially with regard to water availability and sporting activities. We also develop projects to support the adaptation of our socioeconomic system to these changes.





• 187

- The amount of datasets we published in 2024 on Eurac Research's Environmental Data Platform (EDP). More than 1,600 people have
- accessed the portal. Solutions developed for the EDP will also
- support the hydrological atlas (see below).



PLANET WEEK OF THE G7 CLIMATE, ENERGY AND ENVIRONMENT 2024: OUR WATER STUDIES

What can research do and what are we working on at Eurac Research to differentiate and utilize the most precious element on our planet in the most efficient way? Our Vice Director Roberta Bottarin and Scientist Giacomo Bertoldi presented some of our activities during a G7 event in Turin on the topic of "Who Needs Water"? From studies on the effects of climate change on the biological quality of rivers, to satellites measuring snow cover and gauging needs in agriculture, documenting melting glaciers and social challenges to supply, as well as new winter tourism, the subject of water runs through most of our research.

A hydrological atlas for South Tyrol

Hydrological data is available in large quantities for South Tyrol, with some time series even dating back to the 19th century. This data comes from many different sources and is therefore currently stored in a correspondingly large number of places; in addition, some data is not freely accessible. Together with the Autonomous Province of Bolzano and the University of Padua, Eurac Research is now working on integrating all this data and making it available via a data portal. The research team has two central roles in the recently launched project: the technical processing and storage of the data and enabling user-friendly visualization. For experts, the atlas is a valuable tool for modelling water availability at a specific location and time. The data portal should be online by early 2028.

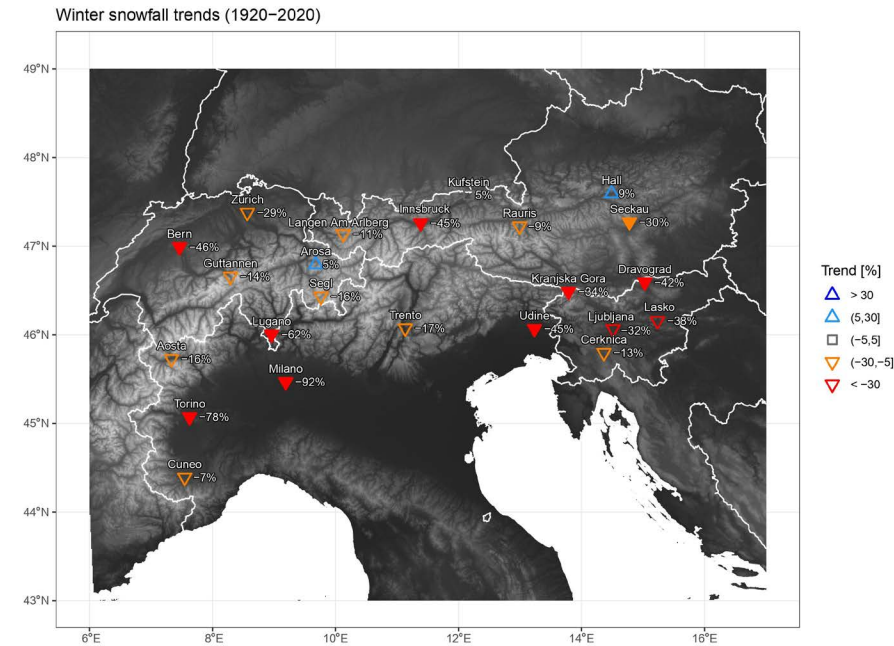
• 25

- The number of datasets in the open access digital archive ZENODO shared in 2024. One of these collects data on snow cover
- in mountain areas around the world and was presented in a paper solely written by Claudia Notarnicola. It was published in Data in Brief last October.
- We also shared eight pieces of software in ZENODO in 2024.

Snowfall in the Alps: one third less in 100 years

A 34.4 percent decrease in the entire mountain range, 23 percent in the northern Alps and almost 50 percent in the south-west: a new study reveals the decline in snowfall in the Alps between 1920 and 2020. A research team led by Eurac Research analyzed precipitation data from 46 locations across the Alpine region, ranging from handwritten entries made by specially commissioned observers to records from modern weather stations. The information was compiled thanks to the cooperation of numerous meteorological services, environmental agencies, associations of amateur meteorologists, and the University of Trento. "A notable decrease was observed after 1980. This date also coincides with an equally sharp increase in temperatures," explains Michele Bozzoli, environmental meteorologist at Eurac Research and lead author of the study. The sharpest decline has been experienced in places below an altitude of 2,000 meters and in southern areas, such as Italy, Slovenia and parts of the Austrian Alps.

In the northern Alps, in Switzerland and North Tyrol, altitude plays a key role and although precipitation has increased during the winter season, snowfall is increasingly turning into rain at lower altitudes due to rising temperatures. In the south-western and south-eastern regions, temperatures have risen so much that it is no longer snowing but raining, even at higher altitudes. As Bozzoli emphasizes, this development does not only have an impact on winter sports: "Snow is essential for water availability. Without meltwater in spring, water reserves cannot be replenished. Snow also protects glaciers from melting and evaporation in soils." The study was published in the International Journal of Climatology: <https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.8597>

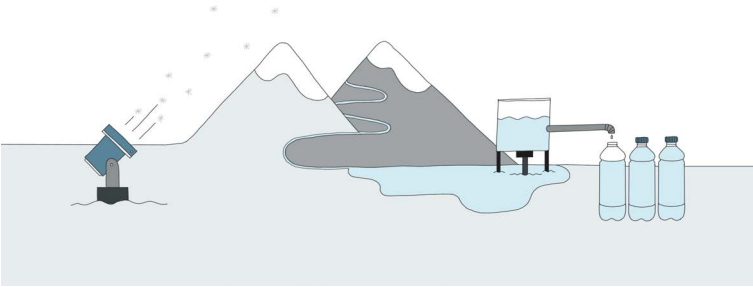


Infographic: Eurac Research/Michele Bozzoli

Know the river, stop fighting over it

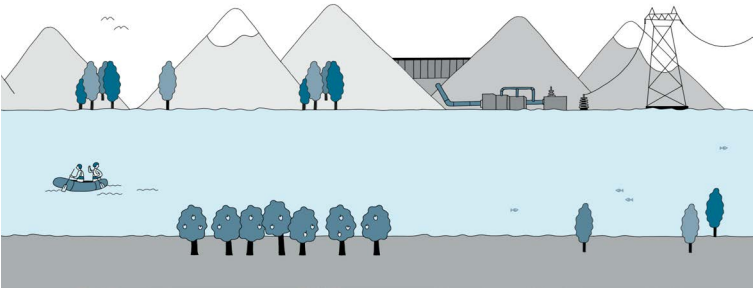
Water in the Adige/Etsch river basin which stretches from South Tyrol to the Po Valley, is used in many sectors, both connected and interdependent – from agriculture to energy, from supplying cities to tourism. Analyzing the water available in the basin and predicting its capacity as well as periods of drought is a way of improving river management – limiting conflicts between different sectors. Another way is to promote new tools and methods for the sustainable management of water: at Eurac Research there are over ten projects in progress that are dedicated to this topic. On 19-20 May, 2025, the Adige Water Fair – a transdisci-

plinary project and inter-institutional event organized by Eurac Research engaged both researchers and the various stakeholders in the Adige/Etsch Basin. The focus: water availability and demand and identifying solutions to be undertaken at the technological, management and research levels. In these pages we follow the course of an alpine river – such as the Adige/Etsch – to discover how the water is used and how conflicts arise between different categories of user.



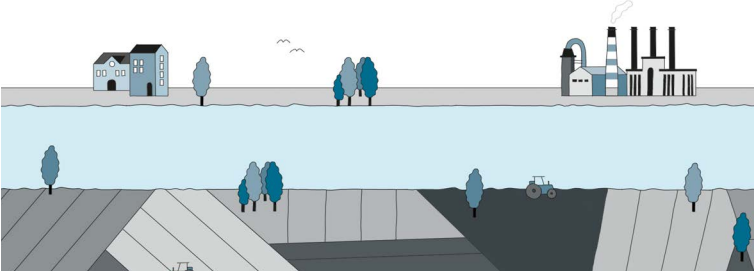
THE SOURCE AND THE FIRST STRETCH

- **Water supply and bottling.** Water at the source can be acquired for public supply or used for bottling.
- **Artificial snowmaking** on ski slopes takes advantage of reservoirs that siphon water from the course of a river.



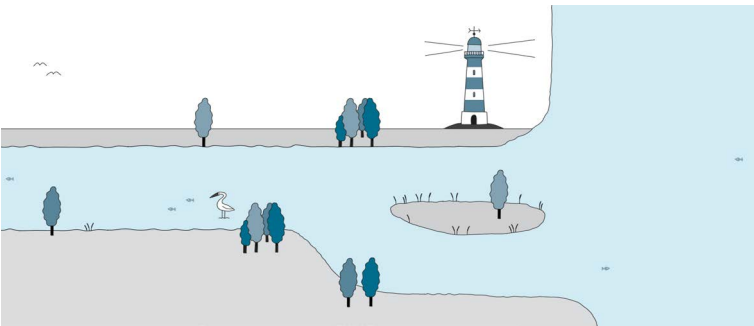
THE UPPER COURSE

- **Tourist activities** such as rafting, canyoning and excursions do not consume water, but are influenced by the salinity of the water.
- Large **hydropower plants** are among the main consumers of water throughout a river's course. Water used by these plants is only temporarily "diverted" from the river's natural flow and then released back into the river further downstream
- **Mountain agriculture** is very specialized: apple orchards and vineyards usually use little water.
- An increased use of water by apple orchards occurs in early spring **with deicing irrigation** whereby leaves and blossoms of apple trees are soaked to form a kind of ice envelope.



THE LOWER COURSE

- **Industry** utilizes water in various ways, either as a raw material or for cooling machinery and washing equipment.
- **Lowland agriculture** is a major consumer of water. Corn, soybean and rice fields are irrigated by sprinklers, however, a lot of the water evaporates or is not distributed exactly where it's needed.
- In **cities**, both residents and tourists use a river's water.



THE MOUTH

- River deltas represent unique ecosystems where specialized fauna and flora can be observed. This is why they are often zones of high **naturalistic and touristic importance**.



HYDROPOWER PLANTS: CONFLICTS UP AND DOWN-STREAM

Mountain agriculture and the hydroelectric sector operate on different schedules that do not always align. This can lead to small, localized conflicts that only emerge during certain periods or at specific times of the day. The hydroelectric plant follows the logic of the energy market: when there is a higher demand for electricity and prices rise – in the morning for example. This is when the plants begin to operate. But is this really also when this water is needed by the nearby agricultural businesses? Not always. The use of irrigation methods that only consume little water help keep potential conflicts very localized.



HYDROELECTRIC POWER PLANTS VS. EXTENSIVE AGRICULTURE

Hydropower plants and lowland agriculture both use a lot of water. This also applies in periods of prolonged drought: in these cases, agricultural associations can advance the claim of increased water release from upstream reservoirs. On the other hand, centralized systems often criticize the low efficiency with which water is used in intensive agriculture. Trans-regional comparison tables and drought observatories serve precisely to seek shared solutions, both in emergencies and the long term.



SALTWATER INTRUSION

The effects of water scarcity are most visible at the river mouth. Those who live, work, or visit these areas experience the consequences of how the water has been used and the policies implemented along the river's entire course. One of the most evident consequences is saltwater intrusion. When the river's flow decreases, seawater pushes up the river, increasing the concentration of salt in both the water and the surrounding soil. Salt endangers the balance of ecosystems, damages crops, and makes groundwater undrinkable. This issue can be mitigated by constructing anti-salinity barriers at the river's mouth and releasing more water from upstream reservoirs. However, the question of who should act first always remains?



Métabief in the French Jura is one of the pilot destinations of the BeyondSnow project. Climate scenarios indicate that by 2040 at the latest, conditions for ski tourism will no longer exist here.

Avalanches: more victims survive, but the time to intervene has decreased

The survival rate of avalanche accidents has risen by ten percent over the past forty years. However, a new study using Swiss data reveals that the critical window for the highest survival probability has shrunk from 18 to just 10 minutes, likely due to changes in snow density. Therefore, it is crucial that participants in the hike are able to provide first aid.

“In a 1994 study published in ‘Nature,’ we divided the survival curve into different phases and for the first time, found that the first phase, in which the survival rate is very high, lasted up to 18 minutes. This data, which has become global reference point in mountain rescue, should now be corrected,” says Hermann Brugger of Eurac Research, author of the 1994 study and co-author of the current study. The reasons for this drastic reduction in the survival curve have not yet been proven, but hypotheses are being put forward. “Climate change and other factors may have increased snow density and, the denser the snow, the less air it contains, making it harder to breathe under it,” explains Simon Rauch, first author of the study.

However, this consideration still needs to be backed up by data. “Time becomes a deciding factor, ten minutes is nothing. Therefore, it’s essential to understand that the survival chances in an avalanche burial are three times higher when excursion companions are able to dig out the victims, rather than when organized rescue teams are involved,” Rauch insists. At the same time, the study shows that preventive measures such as avalanche warning services, training for ski mountaineers, techniques for locating and rescuing buried victims, and emergency medical interventions have also significantly reduced mortality in recent decades. The Swiss WSL Institute for Snow and Avalanche Studies provided the data for the study. Biostatistician Markus Falk contributed to the data analysis using a complex statistical model.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2824053>

Ways to reduce dependence on snow

Small winter tourism destinations in the Alps are struggling with the consequences of climate change: ski seasons are getting shorter and costs are rising. The EU Alpine Space Programme project BeyondSnow, led by Eurac Research, is helping these businesses to adapt to the new reality: “Moving away from a tourism model that is heavily dependent on snow and towards one where this is increasingly less the case is going to be indispensable,” explains Andrea Omizolo, who is responsible for the international project along with his colleague Philipp Corradini. With this aim in mind, 13 partner institutions and ten pilot destinations from all Alpine countries are working with local populations to develop new sustainable development paths and solutions. To support informed

decision-making, analysis tools have been developed and made available to all Alpine communities. These include the climate resilience tool, an innovative digital tool that allows tourism managers to make an initial assessment of the risks and opportunities and helps them to prioritize measures and allocate resources efficiently. As Corradini says, “It is important to prevent a destination from choosing an adaptation strategy that does not suit it or even has negative effects.” An English summary of the approaches and solutions developed in the project, which can serve as inspiration for other destinations, is available on the project website: www.alpine-space.eu/project/beyondsnow/



A MARMOT FROM THE NEOLITHIC AGE

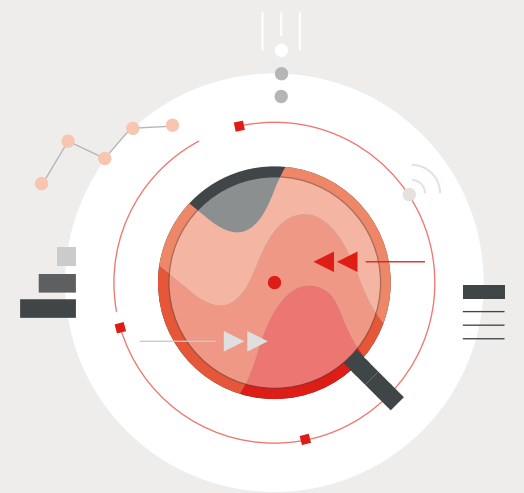
In 2022, a mummified marmot was discovered on the Lyskamm mountain in the Monte Rosa massif at an altitude of 4,300 meters. After being recovered from the glacier, the mummy was protected and preserved in a Conservation Soft Box (CSB) developed by Eurac Research and then sent to the Institute for Mummy Studies in Bolzano. Radiocarbon dating confirmed that the marmot dates back to the Neolithic period: at 6,600 years old, it is the oldest animal mummy in Italy. The marmot is now on display at the Efsio Noussan Regional Museum of Natural Sciences in the Aosta Valley, in a display case specially designed and patented by Eurac Research. In addition, a multidisciplinary team from Eurac Research and the Museum is continuing its research on the previously procured samples.

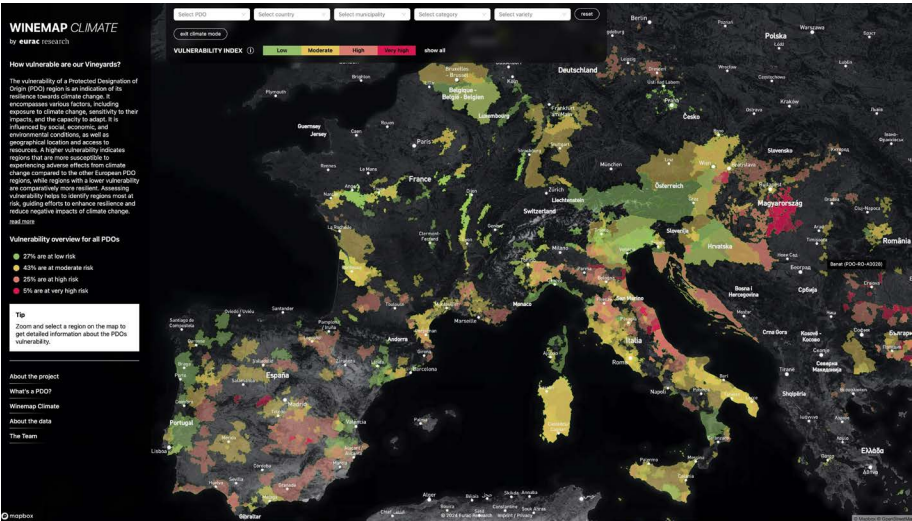
Mummy preservation expert Marco Samadelli developed a special display case for the marmot which is being exhibited at the Regional Museum of Natural Sciences in Valle d'Aosta. Alongside museum director Santa Tutino (standing) and biologist Velca Botti, Samadelli is part of the multidisciplinary team of eleven experts examining the animal mummy.



Tools for science and practice

Whether it's high-precision simulations that help to make the best decisions or data visualizations that show developments – technologies open up new ways of advancing research and making it usable. Innovations in technology also mean that anyone can contribute to environmental monitoring during a walk in the woods.





Welcome Winemap

How will climate change affect wine-growing regions in Europe? Which areas will be most affected? And how can viticulture become more climate-resilient? Answers to these questions are provided in WINEMAP by eurac research, a web application which correlates comprehensive data on grape varieties, growing areas and climate from 1,085 European wine regions – for the first time. Unsurprisingly, this valuable tool has aroused great interest among experts: Der Winzer of the Austrian Winegrowers' Association, the German Wine Magazine and the renowned specialist blog Intravino have all reported on it extensively.

Reform potential of public administration (e-government)

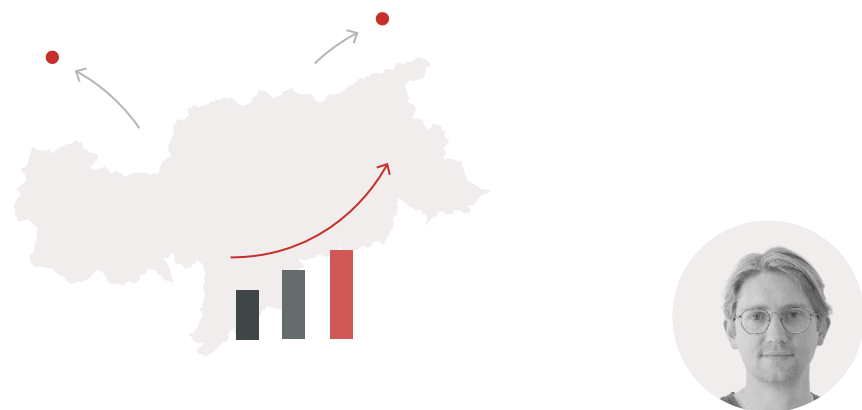
Digitalization and artificial intelligence open up new opportunities to make administrative structures more citizen-friendly, efficient and future-proof – especially in peripheral regions where access to public services is often limited. We are investigating how AI can optimize administrative processes by automatically reviewing applications, taking over routine tasks and facilitating data-based decisions. To do this we are collaborating closely with the Department of Information Technology and Digitization of the Autonomous Province of Bolzano/Bozen.



Watch out for ants

Know what this is? It's a red woodland ant, known for its distinctive nests made of conifer needles. Not much is known about this ant because there are quite a few very similar species. However, all of them are very important for forest health. Not surprisingly, in some countries such as Germany and Switzerland they are strictly protected by law. To learn more about their distribution in Europe and the characteristics of the various species – of which there are about ten – we are working on the MonitAnt project. Within the framework of this study, we have launched a Citizen Science initiative whereby anyone who spots a red woodland anthills can help us in our monitoring by uploading photos and information to a dedicated web page:





1972 ‘til now

The Autonomy Dashboard South Tyrol is a platform that collects a large amount of data about South Tyrol from various sources. The challenge is to update it regularly as well as to possibly integrate it. The useful tool can be used for research, monitoring and fact-checking, or just to get personal insight. Jakob Volgger lead the dashboard’s development.

In what ways has South Tyrol changed most in recent decades?

Jakob Volgger: One very important aspect is certainly the demographic changes; data supporting the development of non-standard PV modules shows that many people with Italian citizenship are moving abroad from South Tyrol and that about 80 percent of South Tyroleans registered with AIRE (Anagrafe degli italiani residenti all’estero) live in Germany, Austria and Switzerland – German-speaking countries. Anyone can interpret what this means for a minority region. At the same time, it should be noted that South Tyrol is experiencing positive demographic growth solely thanks to the immigration of people from the rest of Italy and abroad. In other words, South Tyrol is undergoing a major demographic change. One indicator that I noticed only during my research for the dashboard concerns the resident population by region of birth: of the people living in South Tyrol today, only 77 percent were born here; many have come to South Tyrol in recent decades.

What does the data say about the ethnic quota system?

Volgger: If you look at the past decades, you can see that ethnic quota system has been observed in the provincial administration and the municipalities – even if the Ladin minority is always slightly underrepresented

there because it never quite reaches the 4.5 percent share of positions that it would be entitled to. In public state institutions, there are deviations from the ethnic quota system requirements, but because the number of state employees in South Tyrol has continued to fall, they are less significant. Of course, this does not release the state institutions from the obligation to comply with ethnic quota system when it can. We also have a small deviation in the healthcare sector; the figures for 2023 show that 65 percent of the sector’s staff belong to the German language group, whereas according to the language group census it should be 68.5 percent. This is an example of how the application of the ethnic quota system has become more flexible.

Were there any particular developments that surprised you?

Volgger: Yes, the proportion of primary school pupils in the three school systems: in 1992, 79.2 percent of children attended a German elementary school. For comparison: in the 1991 language group census, the proportion of the German language group was 68 percent. In that year, 16.6 percent of children were enrolled in Italian elementary schools, the proportion of the language group was 27.7 percent; this changed in the following years, the proportion in Italian elementary school increased. If you then look at the figures up to 2022, you can see a small increase in German elementary school again from 2017. I find that an interesting point.



Supporting the development of non-standard PV modules

It starts with the cells and the materials needed to connect and protect, and then leads to a prototype of photovoltaic module. Thanks to this new infrastructure – which completes Eurac Research’s series of laboratories in the photovoltaic field, renewable energy experts from our research center are supporting companies at every stage of the supply chain. In the laboratory, the characteristics of the building materials can be analyzed, the effectiveness of combinations between components ascertained, and photovoltaic modules with dimensions of up to one square meter can be assembled. The infrastructure, built with PNRR funds allocated to the Nest (Network 4 Energy Sustainable Transition) Extended Partnership, also allows the prototypes produced to be tested once they have been, installed them on ad hoc structures. It also permits their integration in facades, roofs or other architectural solutions and in power grids to be evaluated. The workshop is designed to support companies in developing custom modules designed to meet specific needs. Using for example, stained glass modules, for particular architectural contexts such as historic buildings. Another case is for modules intended for the

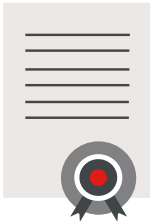
agrivoltaic sector which can be installed over cultivated land to produce energy without completely shielding solar radiation to plants. The laboratory was officially presented at the Italian Photovoltaic Network conference, organized in 2024 by Eurac Research in Bolzano. The event brought together around 250 people representing companies, professionals, associations and research centers in the solar sector.

- ~180
- The number of commissioned projects we received from companies, public bodies, and administrations. Almost 30 percent of these companies and commissioning bodies are based outside Italy.

Renovating large property portfolios and saving money

CERPlan is the name of a software program developed by our research group that deals with energy efficiency in buildings. Fed with a series of data on consumption and building characteristics, its algorithms suggest packages of measures to optimize the energy consumption of public buildings while saving as much money as possible. This means no blanket measures or indiscriminate restrictions, but the most rational combination of initiatives possible: from applying insulation to setting thermostats, changing boilers to replacing windows and doors. “There are management software programs available to monitor energy consumption,” explains engineer Marco Castagna, a researcher at Eurac Research and part of the team supporting the Bolzano’s energy transition. “CERPlan, however, offers simulations that suggest the most appropriate measures taking into account

available incentives and scheduled maintenance – excellent opportunities to combine energy efficiency measures.” Schools and offices alone account for about three-quarters of Bolzano’s real estate assets. There is no shortage of opportunities to combine energy efficiency measures with scheduled maintenance. Last December saw the launch of the Building Renovation Plus project, which will lead to the renovation of 25 public buildings for an investment of 56 million euros. The expected energy savings will be 40 percent, equivalent to a saving of 36,000 tons of CO₂. Eurac Research supported the public body in the preliminary study for the preparation of the tender, which was won by the energy operator Engie.



- 10
- The number of Eurac Research patents currently in force, two of which were registered last year.
- One of these patents led to the founding of a start-up which we are involved in with the company elektro a.haller. The start-up is called Recept and is testing a prototype automatic system for tracking and locating work tools – one way it could be used is on construction sites.



Several rescue organizations came together for an avalanche simulation in the terraXcube.



Realistic training – in this case, a helicopter landing briefing – using virtual reality headsets.

FOCUS ON SAFETY

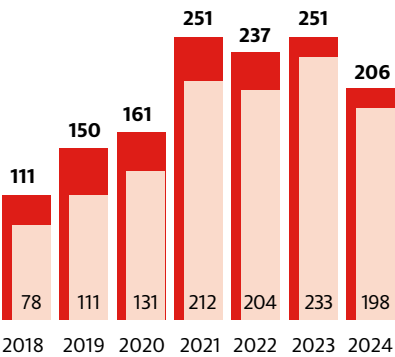
How will rescue workers train for extreme missions in the future? At the Civil Protect fair from 14-16 March 2025, terraXcube demonstrated how virtual training environments make mission simulations more realistic and safer. At the same time, our sensor technology experts presented drones and sensors that are able to facilitate search and rescue missions. For three days, participants trained, discussed and networked with the aim of making civil protection even more efficient using state-of-the-art technology.

Publications and Open Science

55 percent of our scientific publications in 2024 were articles in peer reviewed journals. The remaining part, approximately 500 publications included books, contributions in conference proceedings and reports.

OPEN ACCESS

Two out of three articles we published in 2024 were open access (OA).



All OAs
Gold OA

Graph showing number of open access and the proportion of gold open access publications which are accessible via specific journals or publisher's websites. In 2024, almost all open access publications (96%) were gold.
Source: Scopus



64,6% of the articles we published in 2024 were Open Access.



11 How many data papers we published in 2024. Since 2013, we have issued 37 in total.

A special category of articles: data papers

An effective way to share research data is through the publication of data papers. These papers describe and link to new datasets, making the data more findable, understandable and more widely usable. Among the 37 data papers we have published so far, the significantly top cited are "The MERLIN corpus: Learner language and the CEFR", which presents a corpus for Czech, German, and Italian with authentic learner data and Global transpiration data from sap flow measurements: The SAPFLUXNET database which is the first global compilation of whole-plant transpiration data.

BIA

The scientific articles, books and reports from Eurac Research in the digital archive BIA (Bolzano/Bozen Institutional Archive) exceeded 10,000 in 2024 with more than 30,000 downloads/file views. This represents an increase of over 50 percent compared to the previous year. In addition, since 2024, BIA content is available from Unpaywall. This is an important milestone for exposing Eurac Research's publications and facilitating their discovery. Unpaywall is a service that maintains a database of links to full-text articles from open-access sources all over the world. It's open source, has an open API, and is run by a non-profit organization. Through its browser extension and integration into Web of Science, Scopus, Dimensions, Europe PMC and thousands of library link resolvers, it helps users access academic contents without the need for subscriptions.

High altitude diseases: the paper

One of the Eurac Research articles that had the best results in 2024 has Hannes Gatterer as first author and deals with high altitude diseases such as acute mountain sickness and cerebral and pulmonary edema. By the time it was published it had already been cited 21 times in other scientific articles and had received 69 mentions according to Altmetric.com – notably high for a scientific article. Altmetric.com is an online platform that monitors where, how, and how often scientific publications are cited on news sites, blogs, or social media. It is an alternative system to traditional metrics that primarily count citations in other scientific publications. Gatterer's article highlights how the incidence of high-altitude diseases depends on several aspects: how susceptible a person is, how acclimatized, and how quickly the subject ascended to altitude. It was published in the prestigious Nature Reviews Disease Primers journal.

www.nature.com/articles/s41572-024-00526-w



150 The number of new blog posts that were published in 2024 – over 50 percent more than in the previous year. The total number of views: 128,000.

A YEAR OF BLOGGING

In 2024, Eurac Research blogs gained two new additions: Gender Matters, which deals with gender dynamics, and Midas, which links minority language newspapers. The most read post in the Ask a Linguist column was the article How do language and power interact?

CHRIS study: self-determined participation thanks to dynamic informed consent

Anyone who takes part in a medical study is passing on very personal data, which is why concern for the protection of privacy is a major factor determining involvement. However, an absolute guarantee of anonymity is by no means all that people should consider before agreeing to participate in a study, explains Deborah Mascalzoni, Associate Professor for biomedical ethics at Uppsala University and head of the research group that deals with the ethical, legal and social implications of research at Eurac Research. “In addition to privacy protection we should increasingly talk about ethical research,” says Mascalzoni. “Scientific research does not legitimize itself as such in absolute terms”. In the spirit of ethical research that respects the self-determination of the participants as well as the scientific work, dynamic informed consent was developed for the CHRIS study, the population study that Eurac Research and the South Tyrolean medical service in Val

Venosta/Vinschgau have created. As the first of its kind, it allows participants to decide exactly what they agree to – for example, whether they only want to share their data with European research partners or also with other research databases. Participants can also choose whether to have their data deleted in cases of mental illness or death. More importantly, participants can change their mind and reshape their choices over time. Developing such procedures is time-consuming, but it is an investment “in people’s conscious trust,” explains Mascalzoni. The numbers from the first phase of the CHRIS study, in which around 13,000 people took part over a period of ten years, seem to prove her right with the vast majority of participants having given full consent to the use of their data and very few made use of the option to change their consent – an option that is nevertheless appreciated in comparison with most other studies in which dropping out is the only alternative option.

- **99,66%**
- The percentage of CHRIS study participants who agreed to be contacted for new studies.
- 100% gave their consent for the data and samples to be stored in the biobank for 30 years. 22 people changed their consent between 2011 and 2018.

PAPER AND POSTER AWARDS



The paper on ten years of dynamic consent in the CHRIS study, published in the Nature Group’s European Journal of Human Genetics, earned first author **Deborah Mascalzoni** the GertJan van Ommen Citation award, 2024 edition.



A research team from the Institute for Alpine Environment was honored by the Austrian Entomological Society for a study on watercourses fed by rock glaciers. The study shows that these habitats are important refuges for species threatened by climate change.



Marzia De Bortoli received an award at the Frontiers in CardioVascular Biomedicine 2024 congress for her poster on genetic research.



For the presentation of her research into the sublimation of snow **Katharina Scheidt** received the Best Poster Award at the 4th International Conference on Snow Hydrology in Grenoble.



Gender Report

What is the difference between sex, gender, and sexual orientation? Do women have fewer opportunities than men, even in a region as prosperous as South Tyrol? What is inclusive language? Based on scientific findings, the Gender Report – Südtirol/Alto Adige 2024 offers the first interdisciplinary overview on gender issues in South Tyrol. The report highlights the many ways in which gender influences life in our region and combines locally developed knowledge with experiences and best practices from the rest of Italy and other countries. The publication was presented at more than ten events organized by various organizations, including schools, associations such as Rete al femminile and Spazio 77, and the Diocese of Bolzano - Bressanone. An informative dossier in the form of questions and answers is also available online: eurac.edu/en/dossiers/genderdefinitionsedata

Here is an excerpt: Unfortunately, the weakness lies in the “roughly”. Although it may sound repetitive, the example of the workplace is very clear. At present, Iceland and Norway are the only states in the world where the gender employment gap is considered to be almost closed, that is, they are the only countries where women and men have almost equal job opportunities. In the other countries, women are concentrated in certain occupations which are usually related to education or care, they earn less for the same tasks and fail to reach top positions. Even in South Tyrol, a province where things are significantly better than elsewhere, the problem is perceived: according to the local public statistics agency ASTAT’s data from the 2021/22 school year, about 75 percent of girls attended a high school compared to 63 percent of boys. University attendance and graduation rates are also significantly higher for women. Yet in the workplace, the proportions do not add up.

THE THOUSAND AND ONE SCIENCES

Last November, we once again took part in Le mille e una scienza, an event organized by the Teslab - Arciragazzi youth cultural center together with the Accatagliato association and supported by Bolzano’s Office for Youth Policy. Around 3,600 people visited the science stations in the wonderful halls of Mareccio/Maretsch Castle in Bolzano/Bozen. We showed the visitors the extent to which glaciers have changed, tried to resolve a conflict through role play, took portraits with a hyperspectral camera and explored the past with the help of three-dimensional reconstructions of mummified human remains from Bolivia.

- **100+**
- The number of participants in at least eight of the scientific conferences and congresses we organized in 2024. In first place, with around 250 people, was the second National Conference of the Italian Photovoltaic Network for Research and Innovation.



Photo above: Giada Cattelan (left) and Paola Fontanella Pisa (right), joint winners of the second evening
Photo right: Katharina Scheidt



Matthias Mühlberger (right) honors Pietro Postacchini.

Science on stage

The second edition of the Science Slam Bolzano/Bozen saw 19 female researchers perform over the three events. With ten minutes to captivate the audience with a complex theme, the audience determined who fared best. Our researchers earned two wins: Katharina Scheidt spoke on snow monitoring, Giada Cattelan and Paola Fontanella Pisa – who tied – slammed about genetic heart research and natural hazard management in Japan. The podium for the third evening went to Pietro Postacchini, from the Free University of Bolzano/Bozen.

The event was organized together with NOI Techpark and Free University of Bolzano/Bozen, with support from the Fondazione Cassa di Risparmio/Spar-kasse Stiftung. In spring 2025, a selection of slams was presented to more than 160 high school students from Bolzano/Bozen and the surrounding area and during the IN MOTION - Tech Festival, at the NOI Techpark in Bruneck/Brunico.

TWO QUESTIONS TO TWO WINNERS

Is it more difficult to present your work to a non-expert audience or at a conference?

Giada Cattelan: It depends. When I was rehearsing my slam at home, I got some criticism for speaking too simply, but I ignored it (laughs) and explained what I do almost as if I were talking to a child, trying not to take anything for granted. Compared to a conference, however, I was a little embarrassed by the idea of making people laugh.

Pietro Postacchini: For me, in both cases, it's about telling things clearly and quickly, which isn't easy to do. At conferences, the hardest part is the final questions, while when presenting to a non-expert audience, the critical aspect is overcoming the initial awkwardness of being on stage. Once you've taken the first step, lots of ideas come to mind on how to “break out” of the scientific way of explaining things and how to entertain people. Another difficult thing about slam for me was finding the right metaphors: if they're not spot on, instead of making the topic more understandable, they risk distracting the audience.

Did preparing for the slam give you a chance to see your research from a different perspective?

Cattelan: Yes, it allowed me to focus on the context, rather than on the detail. I was “pulled out” from my project. It was important for me to get across the prominence of my research area, rather than the results of my project specifically.

Postacchini: The slam was very fulfilling for me. As I was slamming I could see 200 people listening and enjoying it – when you write a paper you don't know how many people will actually read it. It's a useful experience for the future, when I would like to be able, thinking in a very ambitious way, to convince an investor to make an investment of one million euros to finance my research.



BEEhold

South Tyrol’s wild bees: biodiversity on display

The BEEhold project celebrates the diversity and importance of South Tyrol’s wild bees through thirty photographs. They were displayed in shops in Bolzano’s historical center in the spring, and in the summer, they will be at our headquarters. The bees are then buzzing off on tour from autumn.



Digitalization and autonomy

The DigiImpact study was presented at a scientific conference held at the Landhaus (the provincial council building) in September, in front of a large audience that included 124 online participants. The study examined the question of how increasing digitalization affects South Tyrol’s autonomy. Legal experts from Eurac Research and the University of Innsbruck analyzed legal requirements of the EU and experiences in Italy, Austria, Germany, and Estonia, as well as in the autonomous provinces of Bolzano and Trento and the federal state of Tyrol. The study, funded by the Autonomous Province of Bolzano/Bozen, shows that increasing digitalization can, but does not necessarily, lead to a centralization of powers and as such could jeopardize regional autonomy. The study recommends that the provincial government play as active a role as possible in the legislative process, adapt the legal basis for autonomy, and use the Euregio Tyrol-South Tyrol-Trentino as a platform for cross-border digital cooperation.

THE CHALLENGE OF AI

New technologies were also the focus of Artificial intelligence: challenges for public administration and law – a conference organized in February in collaboration with the Friedrich Ebert Foundation. At the event, experts from Germany and Italy discussed the legal challenges posed by the use of artificial intelligence in public administration, particularly in healthcare.

EU – Projects

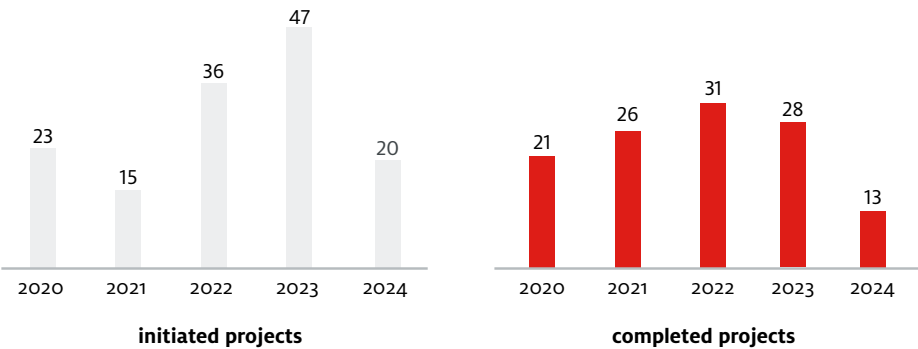
We submitted 88 projects in 2024, one in four received funding. Some projects are still in the evaluation stage.

As of December 2024, there are more than 100 ongoing projects, funded through 14 programs:

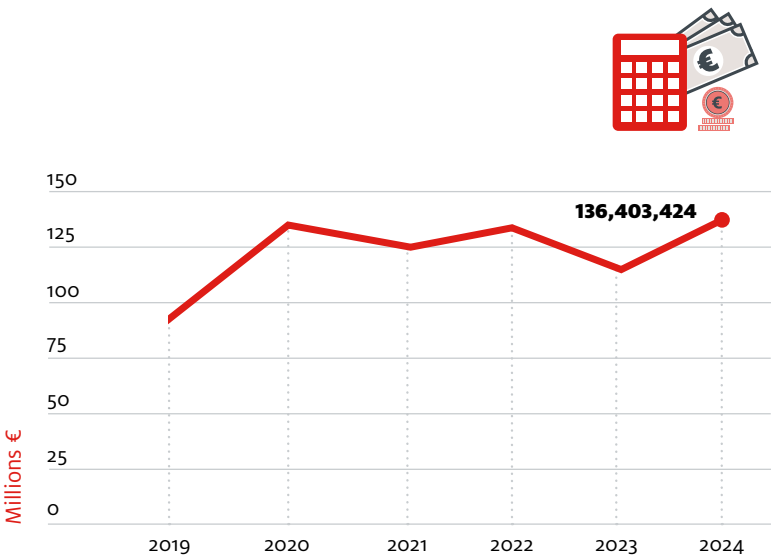


EU PROJECTS INITIATED AND COMPLETED IN THE PAST FIVE YEARS

In 2024, fewer new projects were initiated compared to the previous year, but many of them were large-scale. The average funding per project remained nearly unchanged at approximately 300,000 euros.



> 50%
The share of new projects in which we are lead partners has grown to 7 out of 13 – more than half.



Over 100 million
For the fifth consecutive year, our cumulative budget is in excess of 100 million euros. This is the total amount we administered in 2024 for all the ongoing EU projects that we coordinate: this budget has remained in part in Eurac Research (around 31 percent this year) and also been redistributed to our project partners. From the EU projects launched in 2024 Eurac Research received funds of about 6 million euros.

PRESERVING THE FUTURE BY ENHANCING WHAT WE ALREADY HAVE

A substantial budget is being administered by Eurac Research for three projects launched in 2024 for which we are lead partners. Of these three projects, two are led by female researchers.

FUTURHIST – An integrated typology-based approach to guide the future development of Europe’s historic buildings towards clean energy transition (€719,780, Horizon Europe, Daniel Herrera).

ALPSLIFE – Protecting Alpine life by monitoring and managing Alpine biodiversity for the future “Observing globally, acting locally” (€453,775, Interreg Alpine Space, Chiara Paniccia).

SLEEPING BEAUTY – Waking dormant potential: unlocking Bauhaus and nature-based solutions in Europe values for a more sustainable, inclusive and resilient society (€370,750, Horizon Europe, Sonia Gantioler).

Data refers to the period between 01.01.-31.12.2024 (exported 02.2025). Source: internal databases.

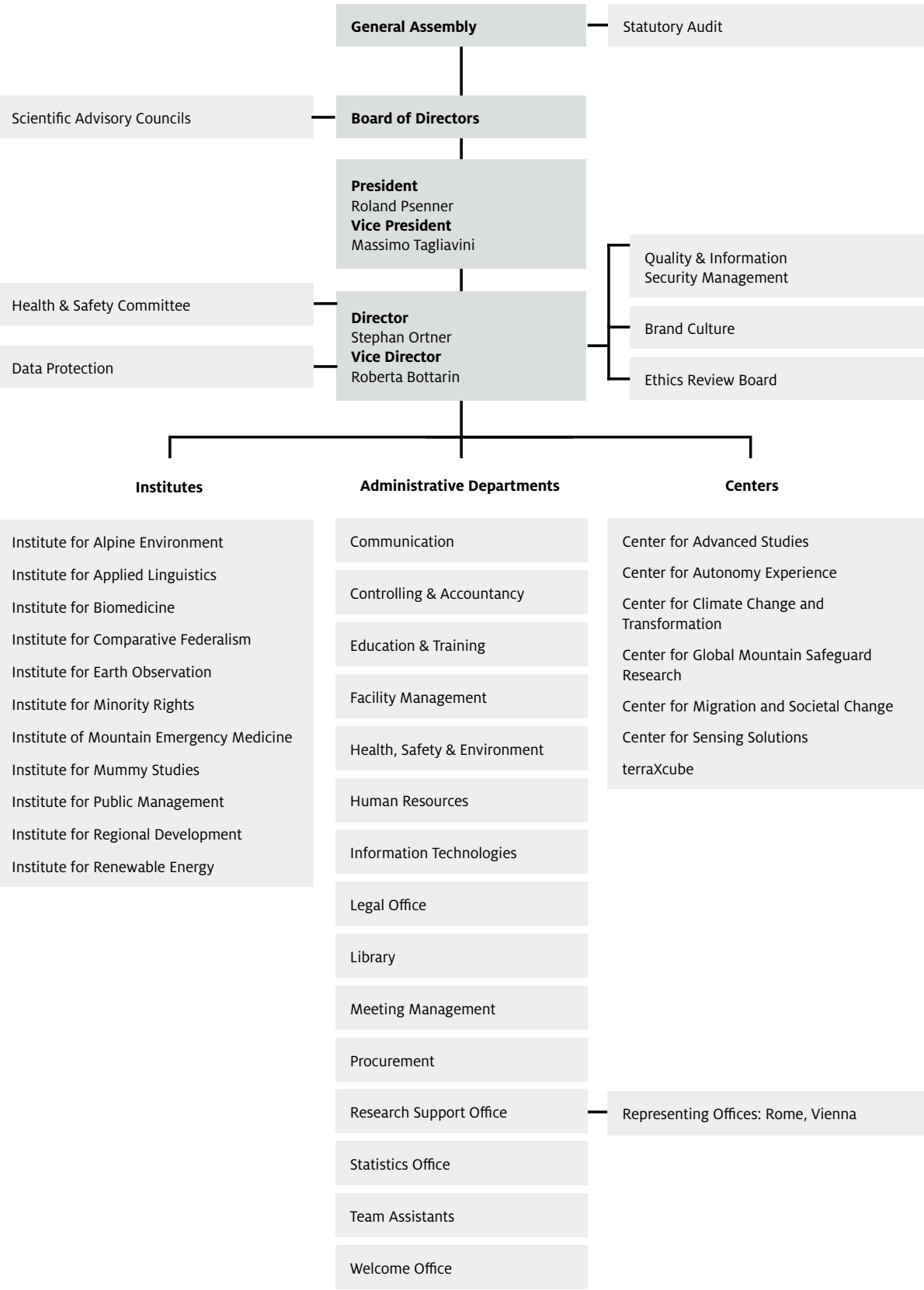
NOT ONLY EU
In addition to our EU projects, other partnership programs, organized at the European level but actually funded by national ministries or provincial governments have also come in this year. One example is the Biodiversa+ project focusing on biodiversity monitoring, ecosystem protection and the adoption of nature-based solutions.

There are also funding programs exclusive to the Autonomous Province of Bolzano. In 2024, we submitted 44 projects and 38 percent of the proposals were approved; two are still being evaluated.

This is us

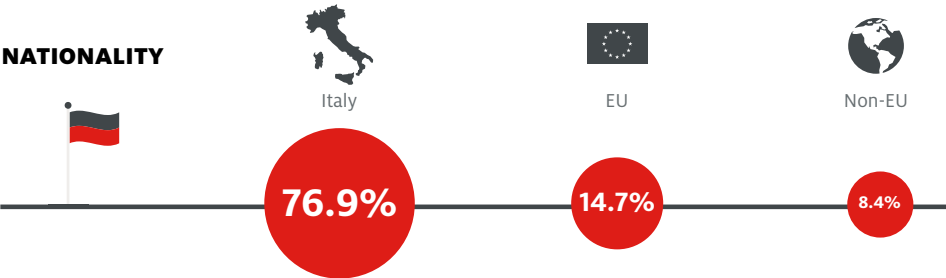
Organigram,
people,
institutes and centers

Organigram



People

We keep growing. 38 more employees than in the previous year. There were 97 new hires, almost a third of them from abroad. The share of employees from other continents has increased notably – helping to strengthen our international network.



COLLABORATORS



In Eurac Research, the majority of staff are researchers: 68.2 percent. Alongside them are more technical profiles who ensure, for example, that the laboratories always run smoothly (5.2 percent) as well as over ten administrative departments. In these departments, a staff of 26.6 percent make sure that researchers can work at their best thanks to those who deal with statistics, various legal and ethical issues, application support in funding programs, and workplace maintenance and wellbeing.

NATIONAL SCIENTIFIC QUALIFICATION

Anyone who wants to participate in the tenders that Italian universities hold to recruit first and second-tier professors needs a National Scientific Qualification. To obtain it, one must apply to the Ministry of University and Research, and specific committees then evaluate the applications. In 2024, Eurac Research secured four new qualifications in four different tender sectors.

In total, we have 26 employees with a habilitation.

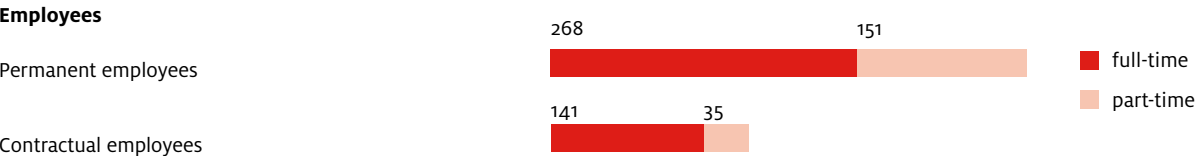
Marzia De Bortoli
Applied biology

Deborah Mascalzoni
Bioethics, History of medicine

Claudia Notarnicola
Astronomy, Astrophysics, Earth and planetary physics

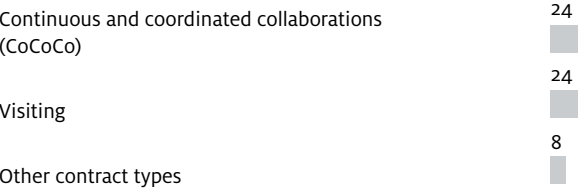
Matteo Prina
Machines and systems for energy and environment

CONTRACTS AND WORK ORGANIZATION

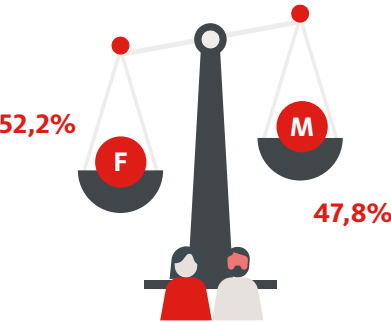


86.9% of us have a smart working contract.

Other contractual formats



In addition, through external funding, there are 34 scholarships and 4 research grants



GENDER DISTRIBUTION



AVERAGE AGE



28 children joined the families of our employees over the last year.

TRAINING AND LIFELONG LEARNING

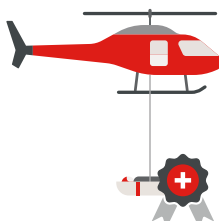
Leadership and project management, methodological and research skills, communication skills development, health and wellbeing, and safety: just some of the topics of the courses for employees offered at Eurac Research's locations in 2024. The 59 courses received 800 enrollments – a result that exceeds the total number of our staff. In fact, more of us attended courses than those who didn't. Training on health and safety and the processing of personal data is mandatory for all staff, both upon hiring and later in regular refresher courses. In addition, our Career Center offers individual counseling modules to support employees and to accompany staff, including the staff that are leaving Eurac Research to further develop their careers. In 2024, 45 people benefited from this, with an average of ten hours of advice per person.

Data as of 31.12.2024 (exported 31.01.2025).
Source: internal databases

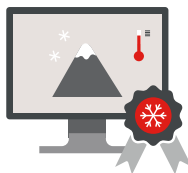
Awards and nominations



The Neurogeneticist **Irene Pichler**, received **South Tyrol's Women in Science Award 2024** for her work on Parkinson's disease and restless legs syndrome. "Her work contributes to the condition, recognizes its causes and finds therapeutic solutions," highlighted the jury.



The Physician **Hermann Brugger**, founder and long-standing director of the Institute of Mountain Emergency Medicine, was honored with **South Tyrol's Research Award 2024**. At the prizegiving ceremony the judges commented, "Brugger conducts basic research and at the same time develops concrete, visible and measurable solutions."



The Geographer **Agnese Moroni** received the first prize at the **Alpine Convention's Young Academics Award** for her Master's thesis on Snowmaking and climate change.



Marc Röggl, head of the Center for Autonomy Experience, and the Social Anthropologist **Johanna Mitterhofer** were included in the "The Minds of the Future" in the magazine ff. The feature showcased the most successful under 40s in South Tyrol. Mitterhofer recently received further acknowledgement for her study published in 2024 on the topic of "Apprentices and discrimination" (see article on this page).

WORLD TOP 2% SCIENTISTS

Just like the last time we reported, it was the same for 2024, Physicist **Claudia Notarnicola** and Bioinformatician **Christian Fuchsberger** were both among the World's Top 2% of Scientists: in the top percentile of frequently cited researchers worldwide. The prestigious list is compiled by Stanford University after analyzing the Scopus scientific database, published by Elsevier. Notarnicola was represented in the Geological and Geomatics Engineering category both for her entire career and for 2024, while Fuchsberger was represented in the Genetics & Heredity category for 2024. In addition, 2024 also saw **Peter Pramstaller** represented in the Neurology & Neurosurgery category and **Hermann Brugger** in the Emergency & Critical Care Medicine category.

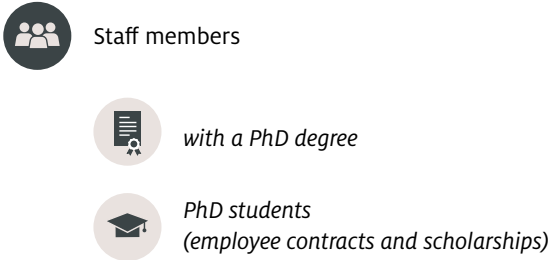
APPRENTICES AND DISCRIMINATION

In South Tyrol, the percentage of apprentices with a migrant background is increasing. In German and Ladin vocational schools apprentices make up six percent, in the Italian equivalent, 33 percent. Apprentices play an increasingly important role in the labor market too. A significant proportion experience marginalization and racism on a daily basis, but are often unaware of it, as a study commissioned by the AGB-CGIL union shows. These acts are manifested in situations such as jokes being made about their accents or not being invited for coffee breaks. The reported experiences range from the marginalization being so subtle that it could be dismissed as a "minor" or "unintentional" incident, to stories of very evident discrimination, such as being assigned worse working hours than "native" colleagues, or structural discrimination, such as the fact that secondary school leavers with an immigrant background are more often advised to choose vocational school, regardless of their skills and interests. "A large proportion of people with migrant backgrounds do not know their rights nor what their employers can or cannot do. As a result, these apprentices can easily become victims of unfair treatment or exploitation," says Social Anthropologist Johanna Mitterhofer. This treatment can also extend to local apprentices too, however, apprentices with a migrant background often do not have parental support in these matters. works.eurac.edu/Apprendistato-discriminazione-e-razzismi-quotidiani-in-Alto-Adige.pdf

Institutes and centers

LEGEND

STAFF



SCIENTIFIC OUTPUTS

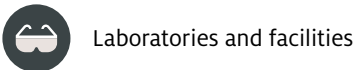


* Books, contributions in books, journal publications, contributions in conference proceedings, scientific reports, PhD theses

ONGOING CO-FINANCED AND COMMISSIONED PROJECTS



LABORATORIES AND FACILITIES



Source: internal databases. Personnel data as of 31.12.2024; other data refers to the period between 01.01.-31.12.2024 (exported 01.2025); All titles were correct at the time of print.
Note: some people work in more than one institute or center; some research outputs are also collaborative.

INSTITUTE FOR ALPINE ENVIRONMENT

Head of Institute
Ulrike Tappeiner

Vice Head of Institute
Roberta Bottarin

Staff



Co-financed and commissioned projects



Scientific publications



*Ecology Lab, Microscopy Room, Open Air Laboratory Matsch-Mazia

Laboratories and facilities*



Scientific presentations and posters



INSTITUTE FOR APPLIED LINGUISTICS

Head of Institute
Andrea Abel

Research Group Leaders
Jennifer-Carmen Frey

Natascia Ralli

Staff



Co-financed and commissioned projects



Scientific publications



Scientific presentations and posters



INSTITUTE FOR BIOMEDICINE

Head of Institute
Peter P. Pramstaller

Vice Heads of Institute
Vera Amon, Andrew A. Hicks, Francisco M. Lopes da Silva Domingues

Research Group Leaders
Christian Fuchsberger, Deborah Mascalzoni, Cristian Pattaro

Technical Group Leaders
Alessandro De Grandi, Clemens Egger, Claudia Volpato

Staff



Co-financed and commissioned projects



Scientific publications



Laboratories and facilities*



Scientific presentations and posters



*Biomedicine laboratory, Biobank, CHRIS Center

INSTITUTE FOR COMPARATIVE FEDERALISM

Head of Institute
Francesco Palermo

Coordinator
Carolin Zwilling

Research Group Leaders
Elisabeth Alber, Karl Kössler, Alice Valdesalici

Staff



Co-financed and commissioned projects



Scientific publications



Scientific presentations and posters



INSTITUTE FOR EARTH OBSERVATION

Head of Institute
Claudia Notarnicola

Vice Head of Institute
Alexander Jacob

Research Group Leaders
Mariapina Castelli, Carlo Marin

Staff



Co-financed and commissioned projects



Scientific publications



Scientific presentations and posters



INSTITUTE FOR MINORITY RIGHTS

Head of Institute
Günther Rautz

Research Group Leaders
Alice Engl, Roberta Medda-Windischer

Staff



Co-financed and commissioned projects



Scientific publications



Scientific presentations and posters

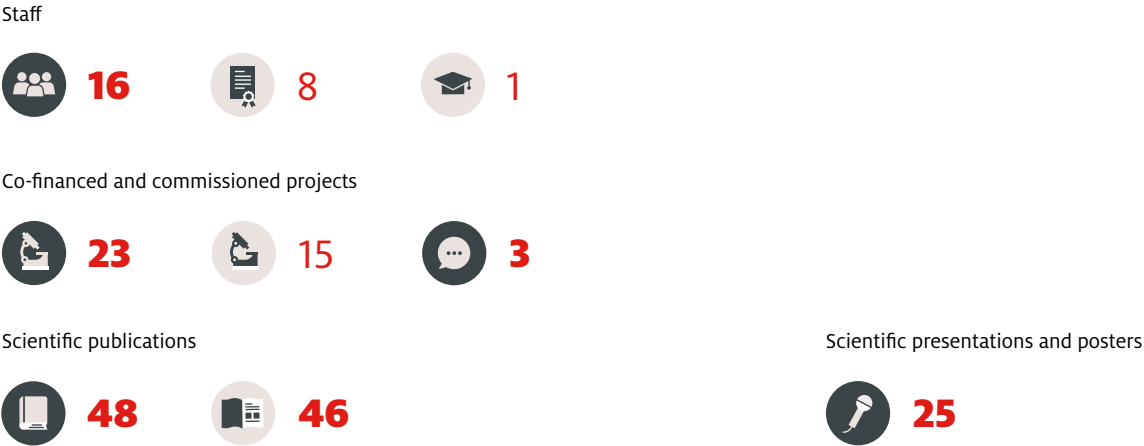


INSTITUTE OF MOUNTAIN EMERGENCY MEDICINE

Head of Institute
Hannes Gatterer

Vice Heads of Institute
**Hermann Brugger,
Simon Rauch,
Christoph Siebenmann**

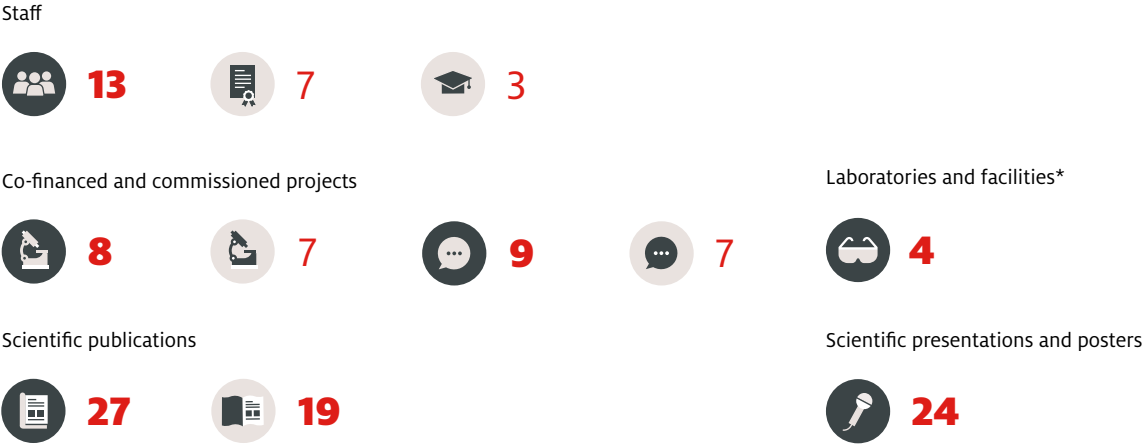
Head of the soon-to-be opened Mountain Clinic
Giacomo Strapazzon



INSTITUTE FOR MUMMY STUDIES

Head of Institute
Albert Zink

Vice Head of Institute
Frank Maixner

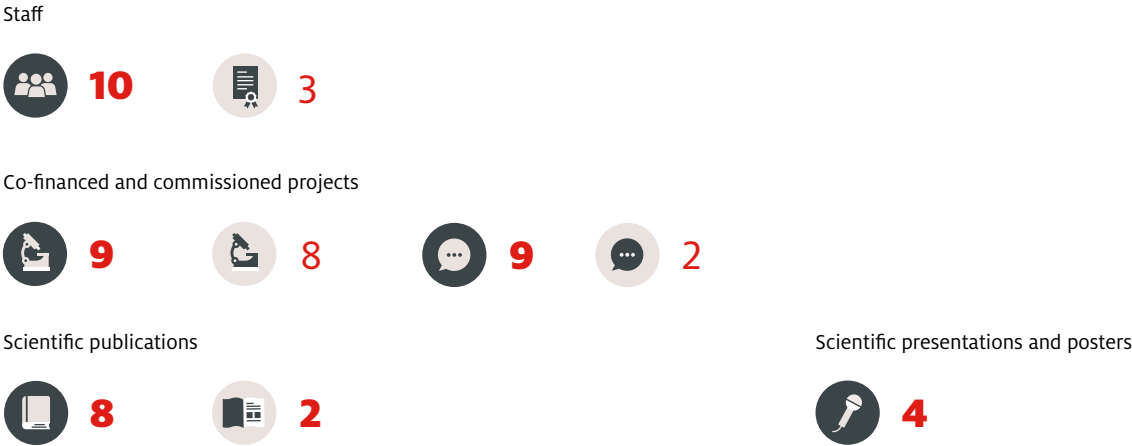


*Ancient DNA Lab, Modern DNA Lab, Anthropology Lab, Conservation Lab

INSTITUTE FOR PUBLIC MANAGEMENT

Head of Institute
Kurt Promberger

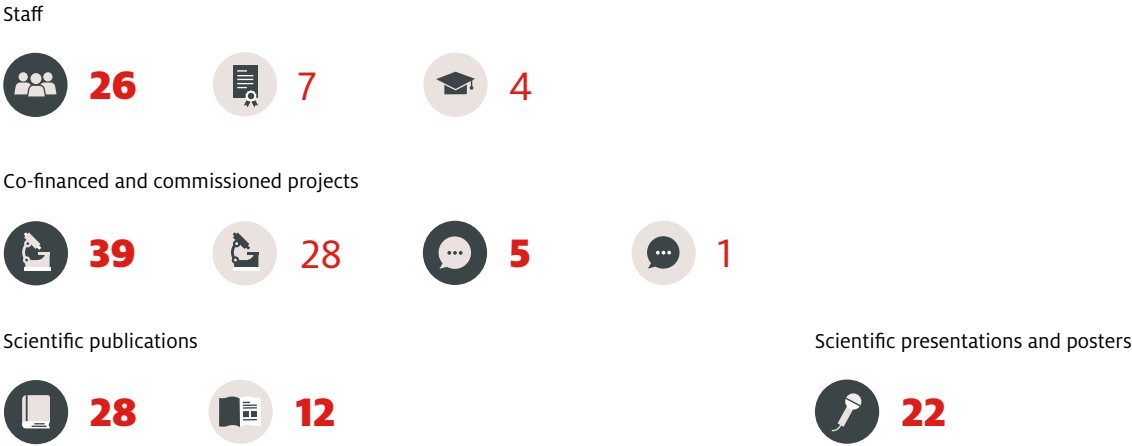
Vice Head of Institute
Josef Johann Bernhart



INSTITUTE FOR REGIONAL DEVELOPMENT

Head of Institute
Thomas Philipp Streifeneder

Research Group Leaders
**Filippo Favilli,
Christian Hoffmann,
Elisa Ravazzoli**



INSTITUTE FOR RENEWABLE ENERGY

Head of Institute
Wolfram Sparber

Vice Head of Institute
Alexandra Troi

Research Group Leaders
Roberto Fedrizzi, Daniel Herrera Gutierrez-Avellanosa, Roberto Lollini,

Luis Pereira Fialho, Daniele Vettorato



*G-value Lab, Hygrothermal Testing Lab, Volatile Organic Compounds Lab, PV Integration Lab, PV Operation & Maintenance Lab, Energy Exchange Lab, Façade System Interactions Lab, Photovoltaic Test Field and 1785L, accredited according to ISO 17025:2018 by Accredia: Solare PV Lab, Accelerated Life Testing Lab, Multifunctional Façade Lab, Heat Pumps Lab

CENTER FOR ADVANCED STUDIES

Head of Center
Harald Pechlaner

Co-Head of Center
Roland Benedikter



CENTER FOR AUTONOMY EXPERIENCE

Head of Center
Marc Röggla



CENTER FOR CLIMATE CHANGE AND TRANSFORMATION

Head of Center
Marc Zebisch

Vice Head of Center
Elisa Ravazzoli

Research Group Leader
Massimiliano Pittore



CENTER FOR GLOBAL MOUNTAIN SAFEGUARD RESEARCH

Head of Center
Stefan Schneiderbauer
(Eurac Research)

Vice Head of Center
Jörg Szarzynski
(UNU)

Global Mountain Safeguard Research (GLOMOS) is a collaborative programme and scientific alliance between Eurac Research and the United Nations University Institute for Environment and Human Security (UNU-EHS) based in Bonn.

*The team is made up of employees from both institutions.

Staff*

 **3** (+7)

 **3**

Co-financed and commissioned projects

 **10**

 **8**

Scientific publications

 **29**

 **15**

Scientific presentations and posters

 **21**

CENTER FOR MIGRATION AND SOCIETAL CHANGE

Head of Center
Verena Wisthaler

Staff

 **10**

 **3**

Co-financed and commissioned projects

 **11**

 **3**

 **1**

Scientific publications

 **7**

 **4**

Scientific presentations and posters

 **11**

CENTER FOR SENSING SOLUTIONS

Head of Center
Roberto Monsorno

Staff

 **14**

 **5**

 **1**

Co-financed and commissioned projects

 **22**

 **10**

 **11**

 **2**

Scientific publications

 **6**

 **2**

Laboratories and facilities*

 **2**

Scientific presentations and posters

 **4**

*Sensor System Technologies Lab, Environmental Data Platform

TERRAXCUBE

Head of Center
Christian Steurer

Research Group Leaders
Riccardo Parin

Staff

 **15**

 **3**

 **4**

Co-financed and commissioned projects

 **19**

 **8**

 **14**

 **4**

Scientific publications

 **9**

 **6**

Laboratories and facilities*

 **1**

Scientific presentations and posters

 **11**

*Extreme climate simulator terraXcube (1785L, accredited according to ISO 17025:2018 by Accredia)

Scientific Advisory Councils
(2025-2028)

INSTITUTE FOR ALPINE ENVIRONMENT	Traduzione, Università di Bologna, Italy	Ylva Trolle Lagerros Clinical Epidemiology Division, Department of Medicine, Karolinska Institute, Stockholm, Sweden	Marie Dumont Snow Study Center CNRM (UMR CNRS & Météo-France), St Martin d'Hères, France	Emanuele Massetti Department of Sociology and social research, University of Trento, Italy	INSTITUTE FOR MUMMY STUDIES	Daniel G. Bradley Smurfit Institute of Genetics, Trinity College, Dublin, Irland	Manfred Röber Wirtschaftswissenschaftliche Fakultät, Universität Leipzig, Germany	Renovation, Build-wise, Brussels, Belgium	National Research Council of Italy, Milano, Italy	Massimiliano Zampini CIMEC – Centro Interdipartimentale Mente e Cervello, Università di Trento, Rovereto, Italy
Monika Egerer School of Life Science Weihenstephan, Technische Universität München, Germany	Magali Paquot Institut Langage et Communication, Université Catholique de Louvain, Louvain-la-Neuve, Belgium				Lars Engstrand Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet, Stockholm, Sweden	Paolo Rondo-Brovetto Fakultät für Wirtschafts- und Rechtswissenschaften, Universität Klagenfurt, Austria	Giampaolo Manzolini Department of Energy, Politecnico di Milano, Italy	Hans-Martin Neumann Division Planning, Technology and Environment, Linz, Austria	Martin Werner TUM School of Engineering and Design, Technische Universität München, Germany	
Michele Freppaz ULF Chimica Agraria e Pedologia, Università di Torino, Italy	Barbara Plank Center for Information and Language Processing (CIS), LMU Munich, Germany	Paolo Vineis Environmental Epidemiology, School of Public Health, Faculty of Medicine, Imperial College London, UK	Willigis Gallmetzer Ufficio Centro funzionale provinciale/Amt Landeswarnzentrum, Agenzia per la Protezione civile/Agentur für Bevölkerungsschutz, Autonomous Province of Bolzano/Bozen, Italy	Alexandra Xanthaki Law School, Brunel University of London, UK	INSTITUTE FOR REGIONAL DEVELOPMENT				CENTER FOR CLIMATE CHANGE AND TRANSFORMATION	
Heidi Hauffe Fondazione Edmund Mach, San Michele all'Adige, Italy	Donatella Pulitano Central Language Services, State Chancellery of the Canton of Bern, Switzerland	INSTITUTE FOR COMPARATIVE FEDERALISM			Vito Claudio Fernicola INRIM – Istituto Nazionale di Ricerca Metrologica, Torino, Italy	Beatrice Durrer Eggerschwiler Institut für Soziokulturelle Entwicklung, Hochschule Luzern – Soziale Arbeit, Switzerland	Bonna Newman Lightyear, The Netherlands		Willigis Gallmetzer Ufficio Centro funzionale provinciale/Amt Landeswarnzentrum, Agenzia per la Protezione civile/Agentur für Bevölkerungsschutz, Autonomous Province of Bolzano/Bozen, Italy	
Dean Jacobsen Freshwater Biological Section, Department of Biology, University of Copenhagen, Denmark	INSTITUTE FOR BIOMEDICINE	Paul Blokker Department of Sociology and Economic Law, University of Bologna, Italy	William P. Kustas Hydrology and Remote Sensing Laboratory, USDA-Agricultural Research Service, Beltsville, MD, USA	Peter Hackett Institute of Altitude Medicine, Medical Center in Telluride, Colorado, USA	INSTITUTE FOR MOUNTAIN EMERGENCY MEDICINE		Marco Perino Energy Department, Politecnico di Torino, Italy		Marco Garschagen Department of Geography, Faculty of Geosciences, LMU Munich, Germany	
Marco Pietrogiovanna Ufficio Pianificazione forestale/Amt für Forstplanung, Autonomous Province of Bolzano/Bozen, Italy	Niko Beerenwinkel Department of Biosystems Science and Engineering, ETH Zurich, Switzerland	Giuseppe Martinico Comparative Public Law, Scuola Superiore Sant'Anna, Pisa, Italy	Peter Strobl Joint Research Centre (JRC), European Commission (EC), Ispra, Italy	Benjamin D. Levine Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas, USA		Georg Hauger Institut für Raumplanung – IVS Verkehrssystemplanung, Technische Universität Wien, Austria	Elena Borin Pegaso Digital University, Napoli, Italy	Manuela Celi Politecnico di Milano, Italy	Matthias Keiler Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Innsbruck, Austria	
INSTITUTE FOR APPLIED LINGUISTICS	Michael Boehnke Department of Biostatistics, School of Public Health, University of Michigan, USA	Christina Murray Emerita, Department of Public Law, University of Cape Town, South Africa	Elizabeth Craig School of Law, Politics and Sociology, University of Sussex, UK	Marco Maggiorini Department of Internal Medicine, University Hospital Zurich, Switzerland	INSTITUTE FOR MINORITY RIGHTS	Peter Kasal Ripartizione Libro fondiario, catasto fondiario e urbano/ Abteilung Grundbuch, Grund- und Gebäudekataster, Autonomous Province of Bolzano/ Bozen, Italy	Sabine Döring Universität Tübingen, Germany		Margreth Keiler Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Innsbruck, Austria	
Alexandre Duchêne Department of Multilingualism and Foreign Language Education, University of Fribourg, Switzerland	Peter Heutink Department of Medical Genomics; University Medical Center Groningen, The Netherlands	Carmen Navarro Department of Political Science, Universidad Autónoma of Madrid, Spain	Jussi Laine Karelian Institute, University of Eastern Finland, Finland	Peter Paal Abteilung für Anästhesie und Intensivmedizin, Barmherzige Brüder Krankenhaus Salzburg, Austria		Franziska Cecon Public Management, FH Oberösterreich, Linz, Austria	Michael Stampfer Vienna Science and Technology Fund (WWTF), Vienna, Austria		Dominik Matt Free University of Bozen-Bolzano; Fraunhofer Italia Research, Bolzano/ Bozen, Italy	
Adriano Ferraresi Dipartimento di Interpretazione e	Markus Ralser Institute of Biochemistry, Charité – Universitätsmedizin Berlin, Germany	INSTITUTE FOR EARTH OBSERVATION	Emma Lantschner Centre for Southeast European Studies, Karl-Franzens-Universität Graz, Austria	Ken Zafren Department of Emergency Medicine; Stanford University Medical Center, USA	INSTITUTE FOR PUBLIC MANAGEMENT	Ursin Fetz Zentrum für Verwaltungsmanagement, Fachhochschule Graubünden, Chur, Switzerland	Alessandra Proto OECD – Trento Centre for Local Development, Trento, Italy	Michael Oberhuber Laimburg Research Centre for Agriculture and Forestry, Bolzano/ Bozen, Italy	Giuseppe Quaranta Department of Aerospace Science and Technology, Politecnico di Milano, Italy	
					INSTITUTE FOR RENEWABLE ENERGY	Oreste Bottaro Innova S.r.l., Italy		Monica Pepe Institute for Electromagnetic Sensing of the Environment,		
						Marco Meneguzzo Facoltà di Economia, Università degli Studi di Roma Tor Vergata, Italy				

Committees

MEMBERS

Autonomous Province of Bolzano/
Bozen
Autonomous Region of Trentino-Alto
Adige/Südtirol
Bezirksgemeinschaft Burggrafenamt /
Consorzio comprensoriale del
Burgraviato
Brennercom AG
Free University of Bolzano-Bozen
Gemeinde Bozen / Comune di Bolzano
Gemeinde Brixen / Comune di Bres-
sanone
Gemeinde Meran / Comune di Merano
Handels-, Industrie-, Handwerks- und
Landwirtschaftskammer / Camera di
commercio, industria, artigianato e
agricoltura di Bolzano
Handels- und Dienstleistungsverband
Südtirol / Unione commercio turismo
servizi Alto Adige
Hoteliers- und Gastwirteverband /
Unione albergatori e pubblici esercenti
Wirtschaftsverband Handwerk und
Dienstleister / Confartigianato Imprese
Messe Bozen / Fiera Bolzano
NOI AG
Raiffeisenverband Südtirol / Federazio-
ne cooperative Raiffeisen
Stiftung Südtiroler Sparkasse / Fonda-
zione Cassa di Risparmio di Bolzano
Südtiroler Bauernbund / Unione
agricoltori e coltivatori diretti sudtirolesi
Südtiroler Kulturinstitut
Universität zu Lübeck
Athesia AG spa

CONTRIBUTING MEMBERS

Raiffeisenkasse Bozen / Cassa Rurale
di Bolzano
Südtiroler Volksbank / Banca Popolare
dell'Alto Adige

BOARD OF DIRECTORS
(2023-2027)

Roland Psenner
President

Massimo Tagliavini
Vice President

Evelyn Kustatscher
Philipp Moser
Peter Silbernagl

STATUTORY AUDITOR
(2025-2027)

Sara Pitscheider
Wirtschaftsprüferin und Steuerberaterin
Revisora dei conti e commercialista

Finance

Basic financing

from the Autonomous Province of Bolzano/Bozen

51%
32,268,100 €

Third party funding

49%
31,168,743 €

Partner funding	933,483 €
Project partner funding (Budget administrated by Eurac Research)*	29,206,648 €
Courses	381,888 €
Meeting management	340,068 €
Sponsorships	111,000 €
Other revenues	195,656 €

Total

100%
63,436,843 €

*
Of the budget administered in the financial year 2024 by Eurac Research (29.2 million euros) 21.7 million euros comes from EU funding. Eurac Research manages 14.1 million euros of these EU funds on behalf of EU project partners. The total budget also includes 2.6 million, which Eurac Research acquired primarily within the framework of the "Research Offensive" of the Autonomous Province of Bolzano/Bozen.

Eurac Research

Viale Druso, 1
39100 Bolzano
T +39 0471 055 055
info@eurac.edu
www.eurac.edu

Editing

Valentina Bergonzi,
Sigrid Hechensteiner e
Francesca Taponecco
(Coordination),
Barbara Baumgartner, Giovanni
Blandino, Laura Defranceschi,
Andrea De Giovanni, Sarah Gunsch,
Daniela Mezzena, Elena Munari,
Rachel Wolffe

Data Analysis

Francesca Taponecco
(Coordination),
Cinzia Bettella, Stefanie Gius,
Sabrina Zung

Graphics

Elisabeth Aster

Illustrations

Silke De Vivo

Special thanks to

Martin Angler, Maria Bellantone,
Margot Breitenberger, Marco
Cecchellero, Alexa De Marchi, Marco
Della Torre, Lorenzo Forlin, Antje
Messerschmidt, Eva Maria Moar,
Alessia Mortari, Manfred Prunner,
Monica Serafini, Mattia Valer, Verena
Zublasing, Team Assistants

Image editor

Annelie Bortolotti

Photography

02, 10, 11, 13, 33, 35, 37 (1), 43 (1):
Eurac Research/Andrea De Giovanni
04, 16, 18, 37 (2): Eurac Research/
Annelie Bortolotti
22: Eurac Research/Giacomo Bertoldi
26: Michele Maggi*
27: Eurac Research/Ivo Corrà
28: Museo regionale di Scienze naturali
E. Noussan della Valle d’Aosta*
41 (1): Eurac Research/Daniele
Fiorentino
42: NOI Techpark/Claudia Corrent*
43: unbz/Matteo Vegetti*
44: Eurac Research/Fabio Dalvit,
Andrea De Giovanni, Elia Nalini

*all rights reserved

Final edit 28 April 2025

© Eurac Research, 2025



This publication is under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

Certain portions of this Open Access publication contain copyrighted materials. These materials are protected by copyright law, and permission for their inclusion in the present work has been obtained from the respective copyright holders. Copyrighted material cannot be – by way of example but not limited – copied, modified, reused and/or redistributed by third parties in any other medium without permission from the respective copyright holder.

