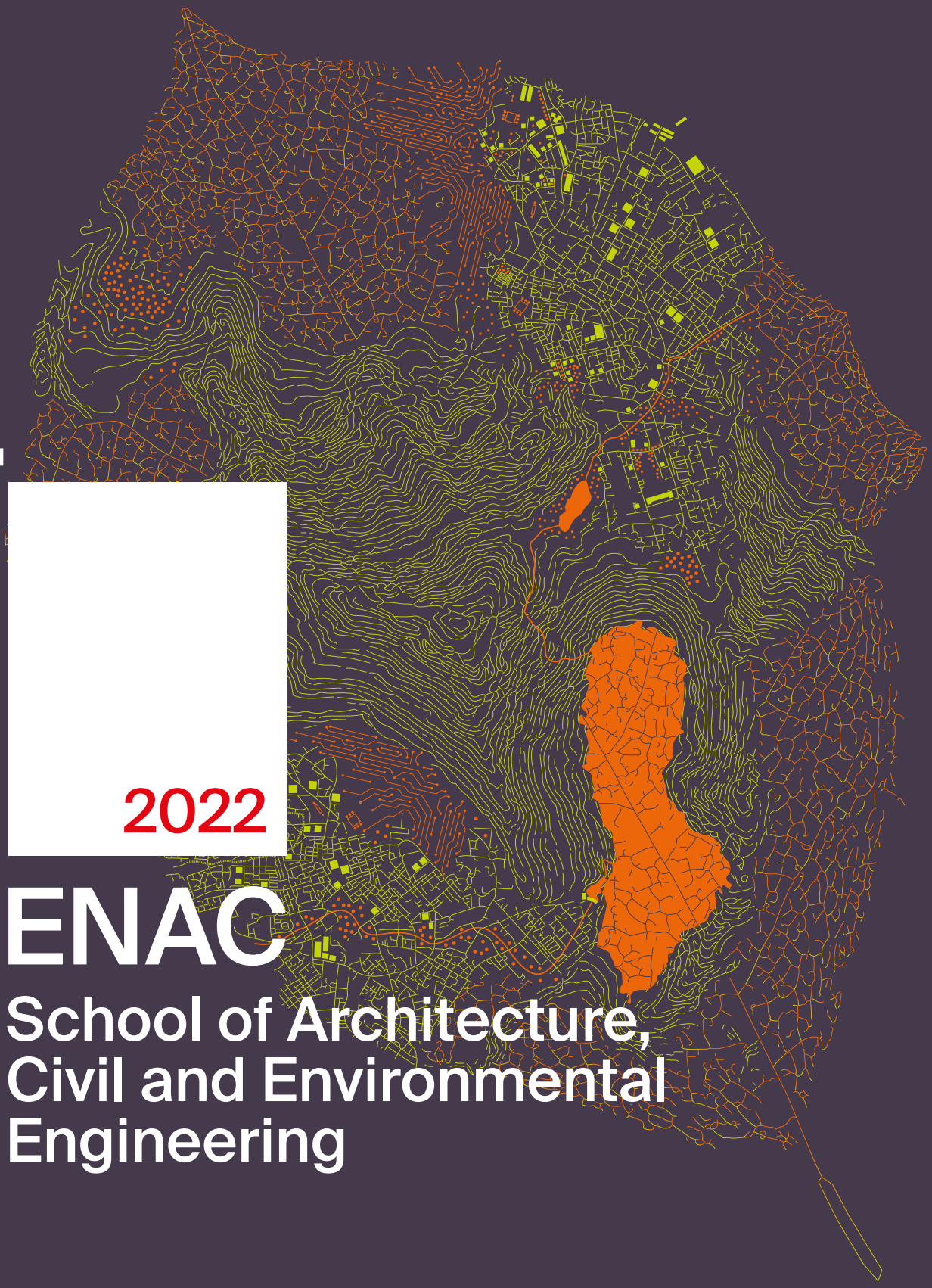
EPFL

Annual Report

2022

ENAC

School of Architecture, Civil and Environmental Engineering



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Foreword

In 2022, ENAC celebrated its 20th anniversary in style. Some 700 people attended a major event to mark this important milestone, with an exciting program featuring keynote speakers, a 90-booth exhibition showcasing our research and innovation, and a panel discussion with all former ENAC Deans on the future challenges in education. I'm immensely grateful to everyone who attended the event, and to the team who worked hard behind the scenes to make it happen. Once again, our school demonstrated its unique ability to develop solutions that will help shape a more sustainable future.

Also last year, we welcomed no less than 13 new professors across our school's three disciplines. Through their fresh ideas and new research interests, they're strengthening our degree programs, research activities and capacity for innovation as well as contributing to the transition to a more sustainable natural and built environment.

In 2022, ENAC continued to support single- and interdisciplinary research at the cutting edge. Our scientists and engineers won a number of prestigious international distinctions for their work. Furthermore, our school continued to support forward-thinking, interdisciplinary research tackling key sustainability-oriented topics such as climate change, digitalization and urban development. We awarded grants to eight research groups that combine expertise from two or more disciplines.

It was also a busy year for the ENAC Diversity Office, which ran a series of initiatives throughout 2022. These included a survey on hiring practices for non-teaching staff, awareness-raising workshops on discrimination and harassment, film screenings with commentary from experts on the topic of discrimination, and the compilation of statistics on gender diversity at ENAC.

The Design Together program and the Student Kreativity and Innovation Laboratory (SKIL), which opened in 2018, testify to the fact that project-based learning is hardwired into our school's DNA. This learning method is especially popular among students, with around 1,000 of them using SKIL's facilities in 2022. Also last year, EPFL opened the Student Prototyping and Outreach Tank (SPOT), a new makerspace that builds on SKIL's pioneering vision and is intended to run alongside it. SPOT has already served as a springboard for a number of ambitious student projects, such as rebuiLT, which focuses on sustainable building methods.

As in previous years, we continued to push ahead

on open science. For instance, we held our first summer school to build awareness of the issue; the program was put together by PhD students, including several from ENAC. Another highlight was the hiring of an Open Science Catalyst – a new, strategically important role created to drive the implementation of our ambitious open science strategy. In 2022, our school obtained five grants through the ETH Domain open science call. Highlights of our work in this area are now published on our website as a way to raise the profile of open research within our school. Last but not least, we welcomed several new hires to our ENAC-IT4Research team, which provides a vital service at a time when the scientific community is increasingly recognizing the value of open-science practices.

In addition to making scientific breakthroughs, ENAC researchers pushed ahead in 2022 with implementing their innovative ideas in practice. They built bridges between the public and private sectors, facilitated technology transfer, and supported the incorporation of startups through Innosuisse funding programs. These programs are particularly beneficial for researchers who have discovered innovative ideas with significant market potential. And as further evidence of the breadth of our innovation capability, four startups were founded last year by ENAC researchers and students. Finally, also during our 20th anniversary year, the Future Sustainable Territories, Infrastructure, and Cities (FUSTIC) association held its first annual general meeting. FUSTIC was founded by EPFL, under the lead of ENAC. Its goal is to bring together change-makers and subject-matter experts working to shape sustainable cities, regions and infrastructure.

In 2022, our communications team again worked hard to support the various events and highlights described above. We also opened an Instagram account and filmed our first series of science videos, adopting a deliberately informal, humorous, social media-ready format as we looked to appeal to prospective students and explain our school's role in building a more sustainable world. We think you'll enjoy the videos too – turn to page 65 for more.

The Alpine and Polar Environmental Research Center (ALPOLE) was inaugurated in December 2022. ALPOLE is a new facility based at the EPFL Valais Wallis campus in Sion that brings together researchers from eight ENAC laboratories. The scientists and engineers at ALPOLE are working to better understand and predict climate-induced impacts on the environment, investigate environmental adaptation to climate change, and explore mitigation and adaptation strategies. My thanks go to Prof. Andrew Barry for driving the project to its completion, and to Prof. Jérôme Chappellaz for agreeing to serve as ALPOLE's academic director.

My term of office as the Dean of ENAC will end in December 2023. Together with my Associate Deans, Katrin Beyer and Vincent Kaufmann, we have achieved the majority of the strategic objectives we set ourselves, despite the challenges caused by the pandemic. We have carried out our duties with conviction and enthusiasm, guided by the recommendations of the 2019 academic evaluation and by the needs of the ENAC community. In particular, we have sought to tackle the most pressing issues facing our school: addressing sustainability and climate change, strengthening interdisciplinary practices, boosting diversity, promoting data science, building closer ties with outside stakeholders, and championing innovation and communication.

Going forward, we hope that ENAC continues to thrive, and that the school remains as determined and steadfast as ever in contributing to the transition to a sustainable natural and built environment.

Claudia R. Binder

Claudia R. Binder
Dean, ENAC

An integrative approach to tackling major sustainability challenges

The School of Architecture, Civil and Environmental Engineering (ENAC) is the leading faculty addressing sustainability challenges in the built and natural environment.

In Switzerland and beyond, issues such as infrastructure upkeep and renewal, rapid urbanization, energy-intensive lifestyles and the threat of ecosystem collapse require holistic responses.

ENAC takes an integrated approach to major global challenges such as climate change, digitalization and rapid urbanization while also considering economic, technical and social demands.

With joint expertise in architecture, civil engineering and environmental sciences and engineering, ENAC has a unique capability – and indeed a responsibility – to present visions and develop solutions for the future.

THREE SUSTAINABILITY CHALLENGES

CLIMATE CHANGE

Who will be affected by climate change and how can we act on it? ENAC develops knowledge, technology and tools to anticipate, mitigate and adapt to climate change. We aim to understand the impact of climate change in polar environments, health impacts in cities, and to innovate in the area of CO_2 sequestration and the development and deployment of renewable energies.

DIGITALIZATION

How can digital tools support the transition towards a more sustainable natural and built environment? ENAC uses digital technologies for sustainable design, construction and monitoring. Novel sensor technologies coupled with remote sensing, AI and machine learning provide new ways for managing urban systems and monitoring environmental conditions.

URBANIZATION

How should future territories be designed to assure livable conditions for its inhabitants while maintaining the ecosystems? ENAC adopts a people-centric system-of-systems approach to rethink the relationships between the rural and urban ecosystems. We study the food-water-energy nexus as a way to shape sustainable cities and territories.

FIVE STRATEGIC GOALS

1. **Disciplinary excellence, inter- and trans-disciplinarity**
2. **Diversity and community feeling**
3. **Data-driven approaches and open science**
4. **Strong partnerships and innovation**
5. **Integrated communications**

Learn more

ENAC celebrates its 20 years and three disciplines in style

Author: Rebecca Mosimann
Photo: Communication ENAC

On 2 September 2022, EPFL's School of Architecture, Civil and Environmental Engineering (ENAC) celebrated its 20th anniversary at a high-energy event featuring expert perspectives on the challenges lying ahead.

The day-long event at EPFL's SwissTech Convention Center was attended by over 700 people: students and faculty members, researchers, alumni, partner universities, businesses and public-sector organizations. "EPFL is one of the few universities in the world where the three disciplines of civil engineering, environmental engineering and architecture come together in a single school," said EPFL President Martin Vetterli in his opening remarks. ENAC Dean Claudia Binder added: "Our school is unique in its ability to develop responses for a more sustainable future."

Engaging with the public

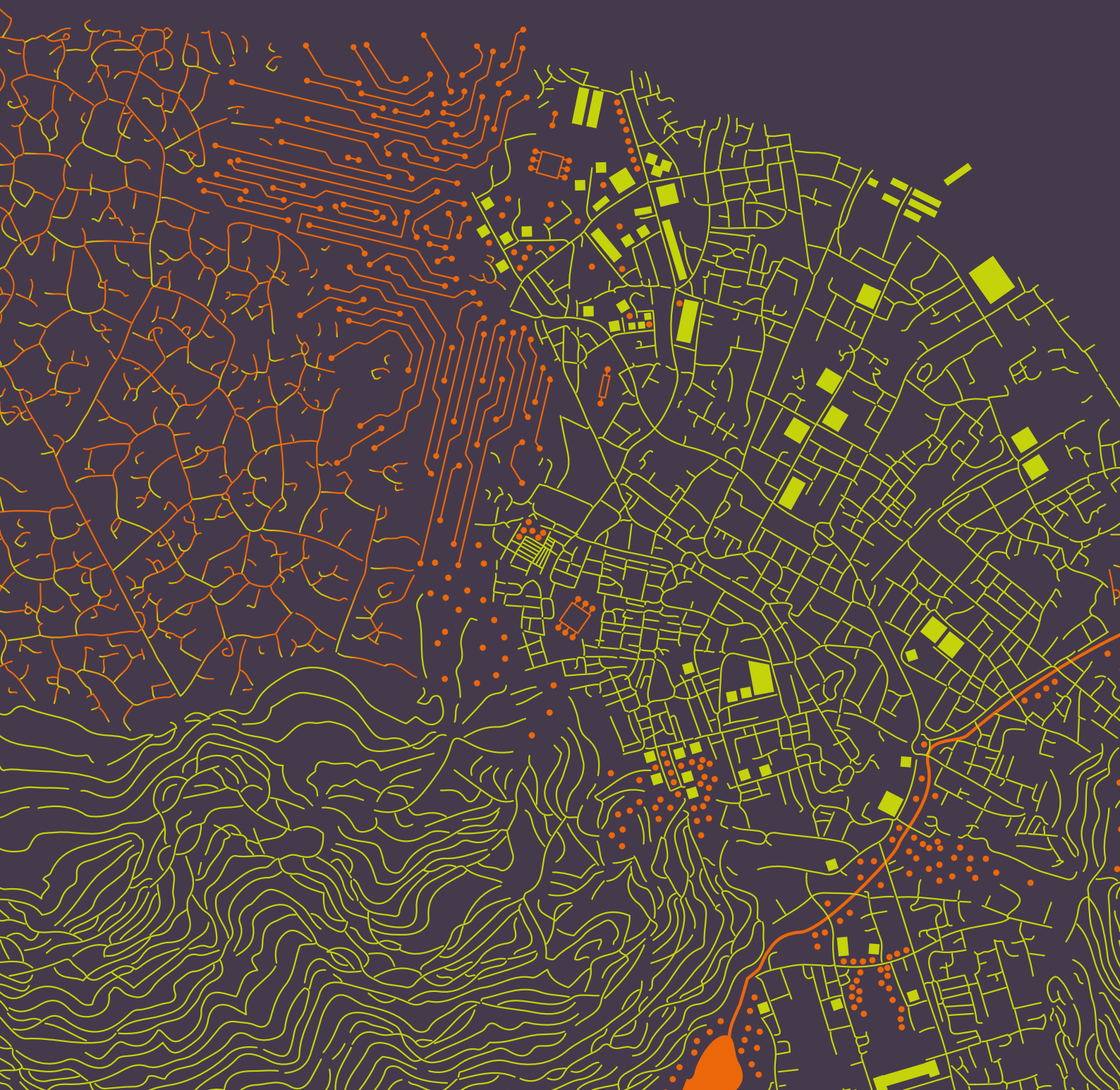
The event's packed schedule included talks by three renowned experts on the sustainability-related challenges facing the built and natural environments: climate change, the digitalization of infrastructure and cities, and sustainable urban development. Each talk was followed by a panel discussion where the general public could weigh in.

The first speaker was Prof. Peter Messerli, the director of the Wyss Academy for Nature at the University of Bern, who outlined his vision for a more holistic approach to addressing climate issues. The second was Prof. Gesa Ziemer, the head of the CityScienceLab at HafenCity University Hamburg, who explained how new data-analysis tools can enhance urban-planning processes. And the third was Prof. Mimi Sheller, the dean of the Global School at the Worcester Polytechnic Institute in Massachusetts, who discussed the concept of mobility justice and urban planners' need for more equitable approaches in coping with the effects of climate change.

A fourth and final panel discussion united ENAC deans from the past 20 years. They looked at the future of ENAC's cross-disciplinary education, pinpointing the key skills that future engineers and architects will need to meet the challenges awaiting them.

Research groups display their work

In the entrance hall of the SwissTech Convention Center, visitors were given an opportunity to explore the innovative work being done by ENAC researchers. Some 90 booths showcased the technology – such as models, drones, touch screens and robots – being developed at over 60 ENAC labs and a handful of startups. Visitors got a hands-on look at the inventions and spoke with the research groups directly. The booths were grouped into four categories: transforming landscapes and cities, natural resource preservation and management, renewable energy, and the efficient use of resources in the built environment. The exhibits were open throughout the day, until the caterers rolled out a giant cake designed specifically for the event.

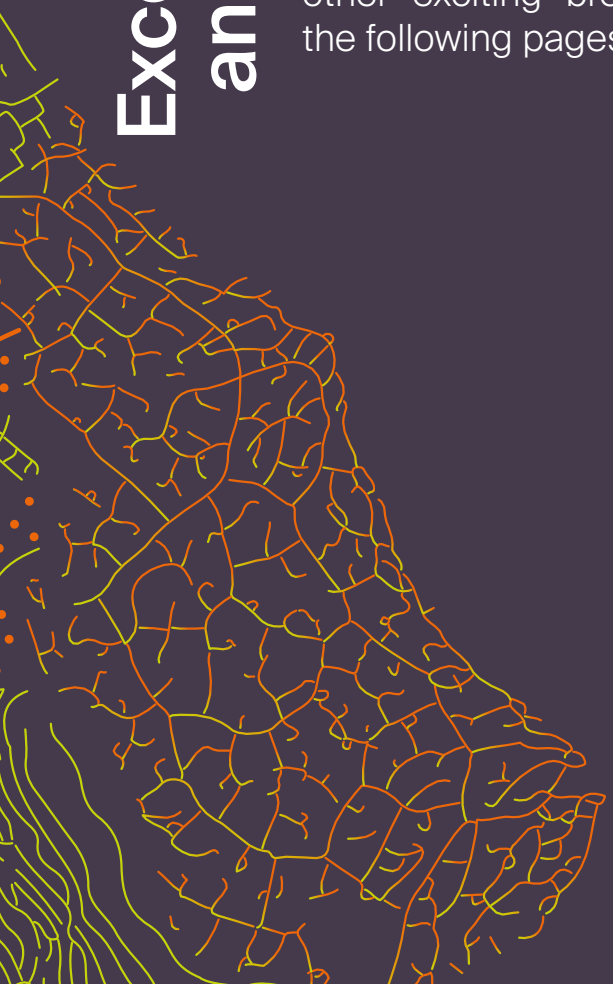


Excellence in disciplinary, inter- and transdisciplinary research

At ENAC, we conduct both fundamental and applied research, gaining fresh insight and knowledge that lead to the development of innovative, sustainable solutions to societal and environmental problems.

ENAC researchers are at the forefront of architecture, civil engineering and environmental engineering. Their groundbreaking work in 2022 addressed many of the key challenges our society is currently facing. In this annual report, we're proud to give some examples of these achievements, such as the use of AI in animal conservation, the renovation of old properties – including energy-efficiency improvements – without compromising their original charm, and the use of drones to mitigate traffic congestion through a cross-disciplinary approach. You'll learn more about these and other exciting breakthroughs on the following pages.

Today's global challenges in the area of sustainability call for skills and expertise that go beyond any single discipline. In 2022, we continued to support innovative, cross-disciplinary research and awarded eight grants to project teams who draw on fundamental knowledge from at least two different disciplines to tackle an ambitious research challenge. Such joint efforts will further strengthen dialogue and teamwork among our three institutes.



Artificial intelligence and big data can help preserve wildlife

Author: Cécilia Carron
Photo: iStock

A team of experts in artificial intelligence and animal ecology have put forth a new, cross-disciplinary approach intended to enhance research on wildlife species and make more effective use of the vast amounts of data now being collected thanks to new technology. Their study appears in *Nature Communications.*

The field of animal ecology has entered the era of big data and the Internet of Things. Unprecedented amounts of data are now being collected on wildlife populations, thanks to sophisticated technology such as satellites, drones and terrestrial devices like automatic cameras and sensors placed on animals or in their surroundings. These data have become so easy to acquire and share that they have shortened distances and time requirements for researchers while minimizing the disrupting presence of humans in natural habitats. Today, a variety of AI programs are available to analyze large datasets, but they're often general in nature and ill-suited to observing the exact behavior and appearance of wild animals. A team of scientists from EPFL and other universities has outlined a pioneering approach to resolve that problem and develop more accurate models by combining advances in computer vision with the expertise of ecologists. Their findings, which appear in *Nature Communications*, open up new perspectives on the use of AI to help preserve wildlife species.

Building up cross-disciplinary know-how

Wildlife research has gone from local to global. Modern technology now offers revolutionary new ways to produce more accurate estimates of wildlife populations, better understand animal behavior, combat poaching and halt the decline in biodiversity. Ecologists can use AI, and more specifically computer vision, to extract key features from images, videos and other visual forms of data in order to quickly classify wildlife species, count individual animals, and glean certain information, using large datasets. The generic programs currently used to process such data often work like black boxes and don't leverage the full scope of existing knowledge about the animal kingdom. What's more, they're hard to customize, sometimes suffer from poor quality control, and are potentially subject to ethical issues related to the use of sensitive data. They also contain several biases, especially regional ones; for example, if all the data used to train a given program were collected in Europe, the program might not be suitable for other world regions.

"We wanted to get more researchers interested in this topic and pool their efforts so as to move forward in this emerging field. AI can serve as a key catalyst in wildlife research and environmental protection more broadly," says Prof. Devis Tuia, the head of ENAC's Environmental Computational Science and Earth Observation Laboratory and the study's lead author. If computer scientists want to reduce the margin of error of an AI program that's been trained to recognize a given

species, for example, they need to be able to draw on the knowledge of animal ecologists. These experts can specify which characteristics should be factored into the program, such as whether a species can survive at a given latitude, whether it's crucial for the survival of another species (such as through a predator-prey relationship) or whether the species' physiology changes over its lifetime. "We used this approach to improve a bear-recognition program a few years ago," says Prof. Mackenzie Mathis, a neuroscientist at EPFL and co-author of the study. "A researcher studying bear DNA had installed automatic cameras in bear habitats in order to recognize individual animals. But bears shed half of their body fat when they hibernate, meaning the generic programs she used were no longer able to recognize the bears once the season changed. We therefore added criteria to the program that can not only look at whether an animal has a given characteristic, but also be tweaked manually to allow for possible deviations."

Getting the word out about existing initiatives

The idea of forging stronger ties between computer vision and ecology came up as Tuia, Mathis and others discussed their research challenges at various conferences over the past two years. They saw that such collaboration could be extremely useful in preventing certain wildlife species from going extinct. A handful of initiatives have already been rolled out in this direction; some of them are listed in the *Nature Communications* article. For instance, Tuia and his team at EPFL have developed a program that can recognize animal species based on drone images. It was tested recently on a seal population. Meanwhile, Mathis and her colleagues have unveiled an open-source software package called DeepLabCut that allows scientists to estimate and track animal poses with remarkable accuracy. It's already been downloaded 300,000 times. DeepLabCut was designed for lab animals but can be used for other species as well. Researchers at other universities have developed programs too, but it's hard for them to share their discoveries since no real community has yet been formed in this area. Other scientists often don't know these programs exist or which one would be best for their specific research.

That said, initial steps towards such a community have been taken through various online forums. The *Nature Communications* article aims for a broader audience, however, consisting of researchers from around the world. "A community is steadily taking shape," says Tuia. "So far we've used word of mouth to build up an initial network. We first started two years ago with the people who are now the article's other lead authors: Benjamin Kellenberger, also at EPFL; Sara Beery at Caltech in the US; and Blair Costelloe at the Max Planck Institute in Germany."

References

«Perspectives in machine learning for wildlife conservation», 9 February 2022, *Nature communications*. https://www.nature.com/articles/s41467-022-27980-y

Learn more

BETTER USE OF OFFICE DAYLIGHTING CAN IMPROVE PEOPLE'S WELL-BEING

A recent PhD graduate from ENAC's Solar Energy and Building Physics Laboratory (LESO-PB) studied the use of automated control systems for blinds and electric lighting to regulate the amount of daylight in an office. She found that such systems can cut a building's power requirement and stimulate occupants' circadian rhythms, improving their health and well-being.

REVEALING THE MAGNIFICENT COMPLEXITY OF THE ALHAMBRA

Scientists from ENAC's Laboratory of Numeric Cultures for Architectural Projects (CNPA) have studied the unique features of muqarnas in Spain's Alhambra palace and fortress complex. Muqarnas are commonly found in Islamic architecture, yet they are poorly understood by the architectural community and the little data that exist on them have been simplified over time. This study firmly anchors the Alhambra's wonders in our world heritage.

SCIENTISTS COMPILE AN INVENTORY OF ENDANGERED MICROORGANISMS

Cryospheric ecosystems are some of the oldest on the planet. Scientists at ENAC's River Ecosystems Laboratory (RIVER) have found that the microorganisms living in them have a unique genetic signature. They performed an inventory of the microorganisms in these ecosystems and compiled the information in a database, which will be a useful resource for future studies on climate-change microbiology.

Learn more

THE SIZE OF RENTAL PROPERTIES MUST BE REDUCED

A PhD thesis carried out at ENAC's Laboratory of Urban and Environmental Economics (LEURE) has shown that, based on realistic forecasts, the only way we'll be able to shrink the environmental footprint of residential dwellings in Switzerland by 2050 is through a joint effort between housing owners and tenants.

MAPPING ARCTIC AEROSOLS TO BETTER UNDERSTAND REGIONAL WARMING

Scientists at ENAC's Extreme Environments Research Laboratory (EERL) and the Paul Scherrer Institute (PSI) have studied the chemical composition and origin of aerosols in a region spanning from Russia to Canada. Their findings provide unique insights, helping researchers to better understand climate change in the Arctic and design effective pollution-mitigation measures.

CHIP LETS SCIENTISTS STUDY BIOCEMENT FORMATION IN REAL TIME

Scientists from ENAC's Laboratory of Soil Mechanics (LMS) and the University of Lausanne have used a chip that was originally designed for environmental science to study the properties of biocement formation. This material has the potential to replace traditional cement binders in certain civil engineering applications.

Renovating 19th-century buildings without losing their character

Author: Sandrine Perroud

Catarina Wall Gago, a researcher and architect, has published a guide to best practices in renovation, drawing on a study of historic housing in Lisbon, Porto and Geneva. Her book explains how to make such homes fit for modern living while retaining their original features.

European cities underwent a period of rapid expansion between the late 18th and early 20th centuries. Some cities, such as Haussmann-era Paris, saw the construction of "revenue houses" comprising multiple apartments for rental, while in the United Kingdom and elsewhere, rows of narrow, tightly packed terraced houses were built to accommodate a growing population.

Over time, these historic homes have been renovated and upgraded to keep pace with new standards, technological advances and changing lifestyles. Yet converting old houses so that they're fit for the modern age while preserving their original character is no easy task. Wall Gago studied this delicate balancing act as part of her PhD thesis, which she completed at EPFL's Laboratory of Construction and Conservation (LCC).

As anyone who's set foot in an old apartment knows, these properties ooze character and style: from creaking floorboards and long corridors to fireplaces, molded coving and high ceilings. "Back then, homes were often built using premium materials such as natural stone, molasse, timber frames and wood paneling," says Wall Gago. These features pose an added challenge because 21st-century tenants and homeowners want houses that combine original charm with the comforts of modern living.

Selected best practices

Wall Gago has recently published a book that builds on the findings of her research. Entitled *Entre sauvegarde et confort domestique : Rénovation d'un héritage bâti* (MētisPresses), it compares changes in the design and layout of revenue houses in Lisbon, which were rebuilt after the 1755 earthquake, and terraced houses constructed as part of the urban expansion of Porto. It also examines Geneva's so-called "Fazyste belt," a ring of residential complexes combining these two architectural styles that began to take shape in 1850 after the city's fortifications were demolished.

In one section of the book, Wall Gago discusses recent renovation projects where old properties were upgraded to reconfigure the spaces, reduce noise and improve thermal efficiency – without compromising their original charm. "These houses were designed and built in a uniform way across Europe, albeit with several variations," she explains. "As a result, my research doesn't apply only

Clockwise from top:

Semi-autonomous flying blocks of flats, Rua dos Fanqueiros, Lisbon. Photo: FG + SG.

Transformed alcoves, Rua da Alfândega, Lisbon. Photo: Leonardo Finotti. Project: Atelier do Bugio.

Kitchen and living room, Rua do Pinheiro, Porto. Photo: Attilio Fiumarella. Project: architect Bernardo Amaral.

to the three cities I focused on: it's intended to serve as a guide for other cities with similar architectural heritage." She hopes her research will inspire practitioners in other countries.

In her book, Wall Gago identifies two key phases in the renovation of the three cities' housing stock. The first phase, which spanned the late 19th and early 20th centuries and focused on hygiene and sanitation, saw the installation of bathrooms and central heating as houses were connected to urban gas, water and electricity systems.

The second phase, which began in the 20th century and continues to present day, has seen homes become smaller and lofts converted to meet growing demand for apartments. Indoor spaces are being reconfigured for privacy and other reasons, and there is an increased focus on accessibility and acoustic and thermal insulation.

Cooking in front of guests

"I found the relationship with the street fascinating," says Wall Gago. "Originally, the rooms where guests were received – such as the living and dining rooms – almost always overlooked the street. The kitchen and servants' quarters were hidden away at the rear of the building. But these days, people often prefer open-plan kitchens and living areas; such areas are no longer considered an inconvenience or eyesore. Cooking has become part of the social experience."

In some cases, kitchen extensions have been added to old homes. In homes where space is at a premium, the kitchen or living room is usually relocated to bring the two side by side. Wall Gago also points to the fact that alcoves – small recesses behind doors, often with transom windows and originally designed as bedrooms, dressing rooms or children's rooms – are often converted into bathrooms, studies, libraries or other versatile spaces.

Smart insulation choices

One question renovators often face is whether to replace old, energy-inefficient windows. Answering it involves a delicate balancing act between modern comfort and original features. "The advent of double insulated glazing or vacuum glazing means we have the technology to renovate old windows without sacrificing the original frames," says Wall Gago, now a researcher at ENAC's Laboratory on Human-Environment Relations in Urban Systems (HERUS). "People can always find a compromise if they look hard enough. When insulating walls and floors, for instance, it's best to judge each case individually and consider the property's original interior and exterior features."

Download the ebook

References

Catarina Wall Gago, *Entre sauvegarde et confort domestique: Rénovation d'un héritage bâti*, MētisPresses, translated from English by Martine Sgard, 2022.

Engineers monitor city transportation from the sky

Author: Anne-Muriel Brouet
Photo: Dan Muniu/WeRobotics

A team of ENAC engineers has used swarms of drones to measure city traffic with unprecedented accuracy and precision. These data were employed to develop algorithms that can identify the sources of traffic jams and recommend solutions for alleviating traffic problems.

Given the wealth of modern technology available – roadside cameras, big-data algorithms, Bluetooth, RFID connections and smartphones in every pocket – transportation engineers should be able to accurately measure and forecast city traffic. However, today's systems are oriented primarily towards observing the problem and regularly fail to find the root cause, let alone solve it. A team of ENAC engineers has developed a monitoring system that overcomes many of the problems with using drones. "Drones provide excellent visibility, can cover large areas, are relatively affordable, offer greater precision than GPS technology and eliminate the behavioral biases that occur when people know they're being watched. And our system uses drones in a way that protects people's identities," says Manos Barmpounakis, a postdoc at ENAC's Urban Transport Systems Laboratory (LUTS).

Using the vast amounts of traffic data collected by drones, the ENAC team – led by Prof. Nikolas Geroliminis, the head of LUTS – developed an algorithm-based method for identifying the sources of traffic congestion and recommending ways to alleviate complex, multimodal traffic problems. The engineers tested their pioneering method in a series of experiments in Athens in 2018 and 2019, and

in Pully last summer in an experiment to evaluate parking areas at the port.

The team ran yet another experiment (probably the largest in an urban environment so far) in Nairobi, Kenya – the fourth-most congested city in the world – in mid-May 2022. In addition, they've received an Innosuisse grant to conduct more experiments and bring their system, called CityDronics, to market through a Swiss-based start-up that will be the first to successfully integrate drones into urban transportation design. "Our goal is not to monitor traffic, but to find the causes of congestion and provide solutions based on facts," says Barmpounakis.

Developing the new method entailed overcoming three technical challenges. First, designing the drone experiment: deciding how many drones are needed, where they should fly and for how long, for example. Second, turning video images into usable data. And third, analyzing these data to find the sources of traffic congestion. In Nairobi, the engineers faced additional challenges related to the unique local environment. "We worked closely with WeRobotics, which is a local NGO, and Kenya Flying labs, as well as with local policymakers and other stakeholders like the Kenya Urban Roads Authority and the Presidential Delivery Unit. Nothing would've been possible without their support. Data protection is another extremely sensitive issue we addressed, in that our drones keep all data private, which enabled us to get approval from even the most conservative public officials," says Jasso Espadaler Clapés, a research associate at LUTS.

Road chaos

"Our Nairobi experiment was unique not only because of its size but also because we flew the drones in a very demanding environment," says Barmpounakis. "Nairobi is one of the most congested cities in the world and it's very difficult to model and monitor its traffic." Anyone who's been there knows that most transportation is done with matatus, or collective minibuses that pick up and drop off passengers based on demand – creating extensive road chaos in the process. Matatus are essentially a self-organized, self-managed public transportation system, and while they have many similarities with conventional systems, the approaches we typically use aren't directly applicable."

In this experiment, a fleet of 10 drones flew over the city for four days, collecting data over a 1.5 km^2 area along two avenues that lead to the central business district. The drones flew during the morning and evening rush hours. The data they collected will now be analyzed to identify traffic patterns. "It's a huge challenge because the models we've been working with so far had relatively structured traffic patterns based on traffic lanes. But the streets of Nairobi – where cars, matatus, bicycles, motorcycles, pedestrians and livestock all merge together – are new for us. We'll have to factor in not only the traffic characteristics but also the cultural aspects," says Barmpounakis. The engineers will spend a few months crunching the data and then will team up with a local university and other organizations to implement long-term monitoring campaigns.

Turning drones into multi-sensors for smart cities

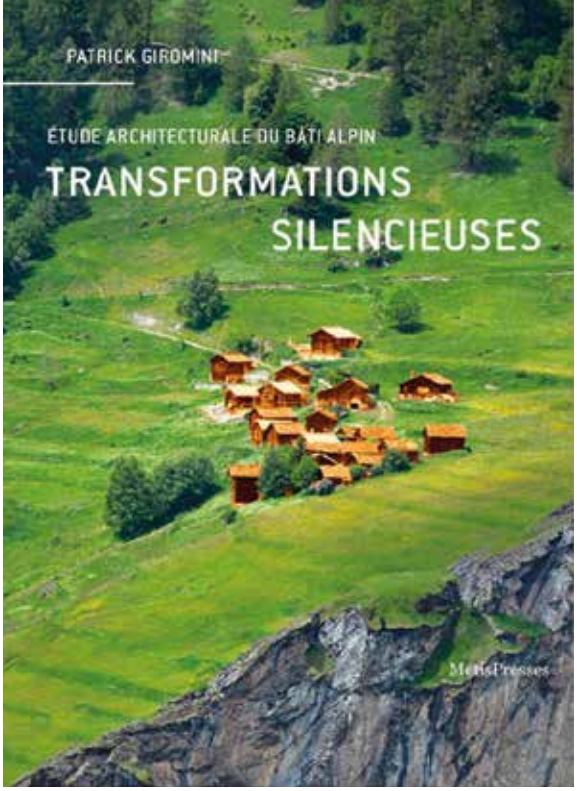
A big strength of the LUTS system is its flexibility. It can be used to investigate a particular aspect of a transportation-related problem. In Pully, for example, the focus was on the port parking areas during the summer (on both weekdays and weekends), but in Nairobi, the team studied the behaviors leading to traffic congestion. "Our system allows for a tailor-made approach," says Barmpounakis. Finally, drones open up interesting prospects for measuring characteristics other than traffic. For example, drone cameras can be turned into multi-purpose sensors for measuring CO_2 emissions and noise pollution. "The added value of our system isn't the drone, but rather the cross-disciplinary approach it uses to fight traffic congestion," says Barmpounakis. Several cities have already expressed an interest.

Open science

The researchers recognize the wide range of possible applications for their work. They therefore decided to publish their data on an open-science platform. "It's in our DNA as researchers to promote open science. Genuine transportation data are often hard to come by, which is why we wanted to share ours with engineers not just in our field, but also those working on machine learning and artificial intelligence algorithms, for example," says Barmpounakis.

The open data initiative can be found online at https://open-traffic.epfl.ch

Learn more



CHALETS PROVIDE INSIGHT INTO OUR RELATIONSHIP WITH MOUNTAINS

Chalets have been widely adopted as the standard form of architecture for mountain homes – but it's worth taking a close look at why. In a well-documented book, a PhD student at ENAC's Arts of Sciences Laboratory (LAPIS) explores how chalets reflect a societal construct established in the 18th century that has largely shaped our relationship with mountains.

ACIDS HELP REDUCE AIRBORNE VIRUSES

A new study by a group of Swiss university research labs, including ENAC's Environmental Chemistry Laboratory (LCE) and Laboratory of Atmospheric Processes and their Impacts (LAPI), has found that indoor air aerosols have varying levels of acidity. This acidity plays a key role in how long viruses such as influenza and SARS-CoV-2 remain infectious in the air – with profound implications for virus transmission and for strategies to contain the spread of disease.

ONE STEP CLOSER TO PROVIDING CUSTOMIZED CLIMATE CONTROL IN THE OFFICE

Scientists at ENAC's Laboratory of Integrated Comfort Engineering (ICE) have shown that people's perception of office temperature can vary considerably. Personalized climate control could therefore help enhance workers' comfort – and save energy at the same time.

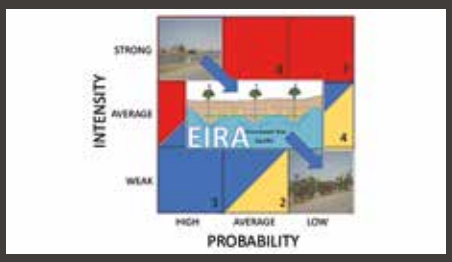
ENAC funds interdisciplinary research initiatives

Two internal calls were launched in 2022, the "Interdisciplinary Cluster Grants" and the "Flagship projects", aimed at supporting excellent interdisciplinary research in the areas of climate change, digitalization and urbanization. The calls resulted in eight new projects involving at least 2 ENAC laboratories, and will be running over the next two to three years.

ECOLE

Intelligent systems for automated inspection of steel infrastructure.

- PIs: Alcherio Martinoli (DISAL / IIE) and Dimitrios Lignos (RESS-LAB / IIC)
- Start date: 1 June 2022
- Duration: 24 months



EIRA

Enhancing infrastructure resilience to flooding using afforestation: the case of Nouakchott city, Mauritania.

- PIs: Paolo Perona (PL LCH / IIC) and Charlotte Grossiord (PERL / IIE)
- Start date: 1 October 2022
- Duration: 18 months

explAIn

Detecting critical events in a trustable way with explainable artificial intelligence.

- PIs: Devis Tuia (ECEO / IIE) and Olga Fink (IMOS / IIC)
- Start date: 1 September 2022
- Duration: 24 months

OSGEOCGS

An open-source platform for geomechanical assessment of CO_2 geological storage.

- PIs: Brice Lecampion (GEL / IIC) and Jean-François Molinari (LSMS / IIC)
- Start date: 1 June 2022
- Duration: 24 months

RECONFIG

On-the-fly building reconfiguration for post-emergency recovery: collaborative human/robot decision-making and structural safety.

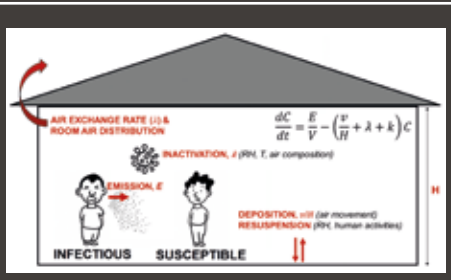
- PIs: Stefana Parascho (CRCL / IA) and Corentin Fivet (SXL / IA)
- Start date: 1 October 2023
- Duration: 24 months

FLAGSHIP PROJECTS

ECO-Plains

Ecological and climate impacts of Greenlandic glacial outwash plains.

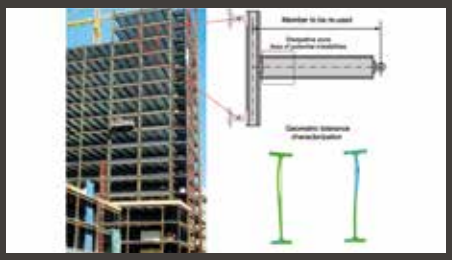
- PIs: Julia Schmale (EERL / IIE) & Ianina Altshuler (MACE / IIE) & Devis Tuia (ECEO / IIE)
- Start date: 1 March 2023
- Duration: 36 months



ICARUS

Balancing indoor climate regulation and pathogen control to minimize energy use and public health burden in urban environments.

- PIs: Dusan Licina (HOBEL / IIC) & Tamar Kohn (LCE / IIE)
- Start date: 1 June 2023
- Duration: 36 months
- This Flagship project is co-financed by EPFL Fribourg (Smart Living Lab)



LASTING

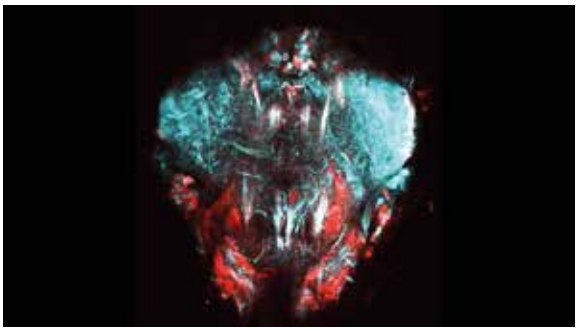
Methodological framework for enabling re-use of steel structures after extreme loading.

- PIs: Dimitrios Lignos (RESSLAB / IIC) & Olga Fink (IMOS / IIC)
- Start date: 1 March 2023
- Duration: 36 months

Active collaborations with interdisciplinary centers

Interdisciplinary research is a core value at our school. ENAC is involved in the work of various research centers because tackling issues holistically is the surest path to innovative new solutions on climate change, digitalization and urbanization.

ALPOLE
The establishment of ALPOLE recognizes the global relevance of changes taking place in high-altitude and high-latitude environments, which are sentinels of climate change.



Center for Imaging
The Center for Imaging aims to nurture advanced imaging at EPFL, from development to use. The Center strives to offer the EPFL community the best possible environment for creating and operating innovative imaging technology.

Center for Intelligent Systems (CIS)
The Center for Intelligent Systems brings together researchers working on various aspects of creating intelligent systems.

CLIMACT Center
CLIMACT is affiliated with the University of Lausanne and EPFL and seeks to promote integrated economic, societal and environmental resilience by developing low-carbon pathways through continuous innovation in societal, ecological and technological systems.

EcoCloud Center
EcoCloud is the only university research center of its kind. It promotes eco-friendly smart data through the development of resilient, efficient, secure and trustworthy data platforms.

ECOTOX Center
The Swiss Center for Applied Ecotoxicology (Ecotox Center) detects and assesses the environmental effects of chemical compounds and develops strategies for minimizing the associated risks.

Energy Center (CEN)
The EPFL Energy Center (CEN) promotes EPFL-led energy research by drawing on state-of-the-art technology and addressing society's challenges together, in order to shape tomorrow's energy systems.

Habitat Research Center (HRC)
The Habitat Research Center is a cross-disciplinary research platform designed to explore urban phenomena and outline visions, strategies and projects to address this fundamental topic.

Limnology Center (LIMNC)
The Limnology Center was established to conduct socially relevant, multi-disciplinary research to ensure the sustainable use and conservation of natural water resources at both the national and international levels.

Smart Living Lab
The Smart Living Lab is a research center for the built environment. Its aim is to create technology for achieving energy efficiency, supporting the digital transformation and enhancing the well-being of building occupants.

Swiss Polar Institute (SPI)
The Swiss Polar Institute (SPI) was created to provide services to and promote synergies within Switzerland's polar community.

Transportation Center (TRACE)
The Transportation Center sits at the crossroads between EPFL and society when it comes to issues related to transportation and the movement of people and goods.

CLIMACT enters its second year with high ambitions

Authors: Aïcha Besser & Nicolas Tetreault

The Center for Climate Impact and Action (CLIMACT), affiliated with UNIL and EPFL, officially opened in June 2021. It facilitates the development of systems for climate change mitigation and adaptation through a collaborative, cross-disciplinary approach.

CLIMACT works with key pillars of society – including the press, policymakers and business leaders – to encourage joint initiatives and foster dialogue and collaboration.

In 2022, CLIMACT worked towards the following four main goals:

1. Enhance cross-disciplinary climate and sustainability research through joint efforts between UNIL, EPFL and other organizations.

CLIMACT Starting Grants

The seven recipients of the 2021 CLIMACT Starting Grants are carrying out cutting-edge research on topics such as the brain (including cognition and mood) and deep carbon capture and storage technology. They presented their first concrete results in January 2023. Recipients of the 2022 Starting Grants kicked off a second series of five promising projects in November 2022. This research stands to offer new, exciting perspectives on sustainable cities, climate-friendly biodegradable plastics, robots for the study of glacier melting, mountain grassland irrigation and a high-speed subway system in the Alps.

CLIMACT Scholars

CLIMACT Scholars is a program bringing together early-career UNIL and EPFL researchers engaged in climate research. So far, more than 90 PhD students and postdocs have signed up for the program's networking events and workshops.

CLIMACT seminar series

The third series of CLIMACT online seminars was held in 2022, on the topic of "A Climate of Transformation." These seminars bring together key figures in Switzerland's environmental sector and help UNIL and EPFL researchers keep up to date with the latest in climate science. The goal is to spark discussion, idea sharing and collaboration with outside stakeholders.

Cross-disciplinary collaboration

An important aspect of CLIMACT's work is to encourage collaborative approaches that draw on the expertise of each partner organization, with a view to designing concrete solutions. CLIMACT works with groups within UNIL and EPFL – such as L'Eprouvette, IMI, CCD, FUSTIC, VPT, VPI, CIS, E4S, Ecocloud and CEN – along with outside organizations including Romande-Energie, WWF, SIG, Nous Prod and others. Lots of new projects are on the way!

2. Further implement projects with climate-positive impacts

SWEET projects: Edge and Swice

CLIMACT is coordinating the implementation of two Swiss Energy Research for the Energy Transition (SWEET) projects: Edge and Swice. The Edge project consortium, led by EPFL and the University of Geneva, raised over CHF 21 million in funding for the 2021–2027 period. The goal is to fast-track the roll-out of locally sourced, decentralized renewable energy in Switzerland. The Swice consortium, led by Prof. Marilyne Andersen at EPFL, is made up of 10 universities and 30 businesses across Switzerland. It has raised a total of CHF 22 million over eight years and aims to develop sustainable systems that can increase the comfort and well-being of building occupants.

ETH joint initiatives

The ETH Board defined a set of "Strategic Areas" in its 2025–2028 strategy and has launched joint initiatives on two of them. These initiatives are intended

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to enhance cooperation and coordination among ETH Domain institutes in the Strategic Areas.

CLIMACT's research community is behind four of the six ETH Domain joint initiatives that were selected for funding in the Energy, Climate and Environmental Sustainability Strategic Area. The four initiatives – UrbanTwin, ReClean, Engage and Speed2Zero – have together raised more than CHF 35 million.

ERC synergy projects

Prof. Julia Steinberger, CLIMACT's academic co-director, along with two scientists from ICTA-UAB in Barcelona, were awarded funding for a 6-year, €10 million research project called "Post-Growth Deal" (REAL). Their revolutionary project will explore the transformative ideas needed to protect humanity from the multiple crises we'll face in the coming decades.

3. Boost the visibility of UNIL and EPFL research on the climate and sustainability, both in Switzerland and abroad

CLIMACT was featured in a number of news articles and media outlets in 2022. For instance, its scientists were interviewed by the RTS Swiss broadcasting company in April in relation to the IPCC report issued that month. In addition, a selection of Swiss scientists, including some from CLIMACT, presented the IPCC and IPBES conclusions to the Swiss parliament in Bern on 2 May.

CLIMACT's new website, launched in 2022, has become a popular hub for those eager to learn about the latest UNIL and EPFL discoveries on climate change. Articles on the website are written in the form of interviews where scientists explain their findings and why they're important in a way the general public can understand. This in turn helps citizens appreciate the role that science and scientists are playing in building a sustainable future.

4. Forge ties with the broader community to facilitate the ecological transition

Participatory meetings on science and politics

CLIMACT goes beyond traditional outreach activities to foster genuine dialogue between university researchers and key pillars of society: policymakers, businesses and the press. The center held its first participatory meeting on science and politics (Rencontre Participative Science – Politics) in 2022 with the goal of enabling participants to make personal contacts and brainstorm ideas for working together more effectively towards a sustainable future.

European energy transition conference

Every year, stakeholders in Europe's energy transition meet at an annual conference called Assises Européennes de la Transition Énergétique (introduced in 1999). The 2022 event was held in Geneva, and CLIMACT ran a (fully booked) workshop on energy-savings measures for French and Swiss practitioners.

2023 Outlook

CLIMACT plans to hold two more participatory meetings in 2023. The first will target business leaders, startups and Swiss SMEs, and the second will be geared towards news outlets and journalists. The goal will be to forge lasting ties between university researchers and outside stakeholders in order to speed the transition to a decarbonized, inclusive and sustainable Swiss society.

CLIMACT will also take part in the Enter the Hyper-Scientific artist-in-residence program at EPFL's College of Humanities. This reflects the center's belief that culture and the arts can inspire us in shaping a brighter future. Stay tuned!

www.climact.ch

ALPOLE
Alpine and Polar environmental Research Centre

Author: Jérôme Chappellaz

ALPOLE is a new research center at EPFL's Valais Wallis campus in Sion. It opened in December 2022 and is part of ENAC's Institute of Environmental Engineering (IIE).

Its researchers aim to better understand and predict environmental changes in high-altitude and high-latitude regions, in Switzerland and other locations around the world that are experiencing a rapid, unprecedented transformation. This transformation is of global, regional and local relevance for natural ecosystems, the built environment and human well-being.

ALPOLE is currently home to eight research units that are conducting process-based studies, developing forecasts of climate-induced change to the environment, investigating environmental adaptation to global warming and exploring mitigation and adaptation strategies (see next page).

ALPOLE will set new standards of excellence through its multidisciplinary approach that combines physics, chemistry, biology and computer science to address a broad range of major research topics. Those include catchment hydrology and land use, the biophysics and chemistry of Alpine rivers, biogeochemical cycling in Alpine soils and how it affects agriculture, microbial adaptation in cryospheric ecosystems, aerosol processes and the detection of greenhouse gases in polar environments, fundamental snow and atmosphere processes and how they can be applied to adapt renewable energy, as well as machine learning for mapping and monitoring specific environments, and the detection of greenhouse gases in polar environments.

Field work in high-altitude, high-latitude regions is an important part of ALPOLE's research. Its scientists and engineers work closely with the Swiss Polar Institute – located in the same building – to provide support and services to Switzerland's polar research community.

Owing to ALPOLE's location at EPFL Valais Wallis and position within ENAC's environmental engineering department, the center will act as an ambassador to strengthen EPFL's ties with local stakeholders and policymakers. ALPOLE will help these individuals and organizations address issues related to the transformation of Alpine and polar environments and the consequences on natural ecosystems.

Photo: Olivier Maire

Laboratory of Catchment Hydrology and Geomorphology (CHANGE)
Prof. Sara Bonetti

We seek to improve the current understanding and forecasting capabilities of catchment dynamics in both natural and managed ecosystems. We have developed mathematical models to quantitatively describe ecohydrological and geomorphological processes, and we combine these models with advanced data analysis.

Microbiome Adaptation to the Changing Environment (MACE)
Prof. Ianina Altshuler

We aim to understand how microbial communities adapt and thrive in cryospheric environments. Our work involves answering fundamental questions in microbiome science by compiling the results of field studies, laboratory experiments, multi-omics techniques, and modeling.

Laboratory of Cryospheric Sciences (CRYOS)
Prof. Michael Lehning

We investigate the processes that shape snow and ice in mountains and polar regions. Our research is currently focused on snow cover processes, snow-atmosphere interactions and mountain hydrology.

River Ecosystems Laboratory (RIVER)
Prof. Tom Battin

We conduct insight-driven, fundamental research that cuts across the physical, chemical and biological domains of Alpine stream ecosystems. We study biofilms – the dominant form of microbial life in streams – including the structure and function of their microbiome and their orchestration of ecosystem processes.

Environmental Computational Science and Earth Observation Laboratory (ECEO)
Prof. Devis Tuia

We extract knowledge from data that are heterogeneous, often very unstructured, and acquired at multiple scales by a number of imaging devices. We do this by running machine learning algorithms and developing new algorithms to make sense of the Earth.

Smart Environmental Sensing in Extreme Environments (SENSE)
Prof. Jérôme Chappellaz

Ferring Pharmaceuticals Margaretha Kamprad Chair in Environmental Sciences

We aim to improve the monitoring and understanding of the physical and biogeochemical processes at work in extreme environments, with a particular focus on polar and high-altitude ones.

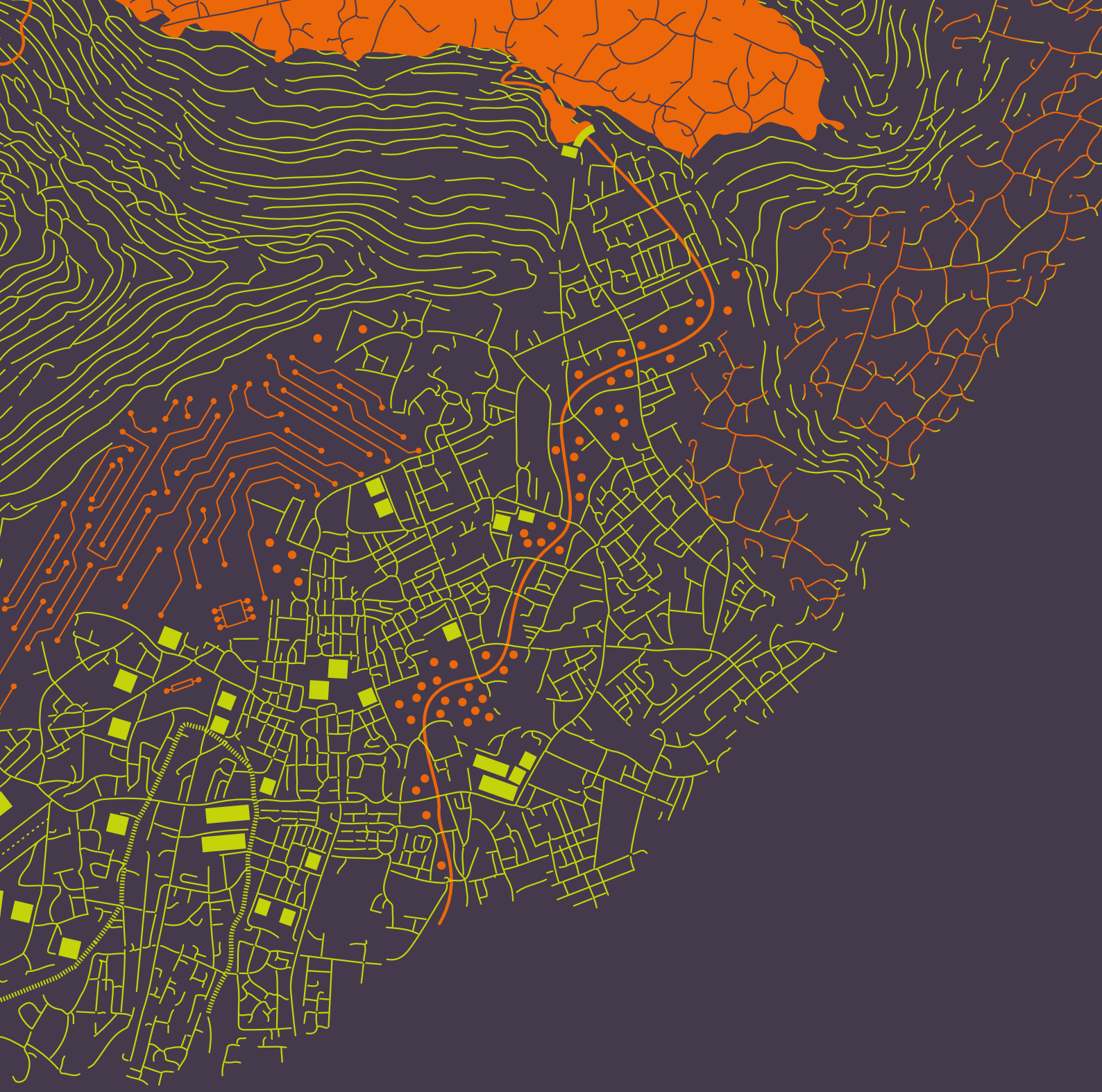
Extreme Environments Research Laboratory (EERL)
Prof. Julia Schmale

Ingvar Kamprad Chair in Extrem Environments

We aim to build an integrated, process-based perspective of the atmosphere in extreme environments by conducting field studies that examine how the atmosphere interacts with the cryosphere, ocean, land and human activities.

Soil Biogeochemistry Laboratory (SOIL)
Prof. Meret Aeppli

We aim to understand the fundamental principles and processes that govern the biogeochemical cycling of key elements such as carbon in soils. Our specific focus is on electron transfer processes and their role in element cycling.



Excellence in Education

ENAC offers an excellent education to students in its three sections, producing some of the most highly qualified young professionals in the fields of architecture, civil and environmental engineering. Our school's unique structure emphasizes the interdisciplinary nature of these fields, prioritizing excellence not only in specific areas of study but also in teaching the skills needed to work effectively with peers in other disciplines.

Our degree programs combine field-specific classes with interdisciplinary and project-based learning. That means our graduates are exceptionally well-prepared to spearhead efforts towards a more sustainable future in our built and natural environments.

Our commitment to a comprehensive education is evident in both the quality of our students' work and the scope of our interdisciplinary teaching initiatives. The following pages describe just some of the Master's projects completed by ENAC students looking to promote sustainability in construction and urban development, and also provide an overview of our Design Together and SKIL interdisciplinary programs. Our school now also offers a selection of minors for Master's students in our three sections, allowing for specializations that deepen their knowledge of a particular area.

More soil, less concrete: changing mindsets in construction

Author: Sandrine Perroud
Photos: Alain Herzog

For his Master's project in architecture, Jeremy Morris assessed the life cycle of building materials in Vaud Canton. His research shows that the construction industry could shrink its carbon footprint by making more regular use of soil. Morris proposes three courses of action, which he will present at the *Quinzaine de l'Urbanisme.*

The construction industry accounts for 39% of the world's carbon emissions, 11% of which comes from the manufacture of building materials such as steel, concrete and glass. The widespread use of concrete is one of the main barriers to reducing this high carbon footprint. Changing this established practice has become a priority for many environmentally conscious architects and engineers – including Morris, who studied the life cycle of concrete in Vaud Canton. He calls for a shift away from concrete and towards soil, proposing three courses of action to achieve this goal. He will present his findings at the *Quinzaine de l'Urbanisme*, an annual architecture and urban planning event that will be held in Geneva on 30 September.

Excavated earth is one of the biggest sources of waste globally. In Switzerland, a staggering 2 million m^3 of soil – equivalent in volume to the Great Pyramid of Giza – is removed from construction sites in each canton every year. This soil, which is considered waste under Swiss law, is treated and spread on farmland, raising crop heights by several meters until, in many cases, the land becomes saturated. Morris, who is also a filmmaker, set out to explore how this sustainable, recyclable material could be put to better use in construction.

Changing the law

As part of his research, Morris produced a map of Vaud Canton showing sites associated with the various steps in construction-industry processes, from the quarries around La Sarraz, where earth is extracted for cement-making, to the Canton's 67 landfills. "In Vaud, cement manufacturers and earthworks contractors are one and the same companies," he says. "So they have no reason to recycle the excavated earth into construction processes." Morris visited these companies to shoot images as part of his Master's project.

As a first course of action, he proposes changing the law so that soil is no longer treated as "waste" but instead as a "resource." Morris explains: "Soil-based structures can be built and taken apart. That's

much harder to achieve with concrete, which should really be used only for load-bearing sections of buildings and for civil engineering structures."

Support through funding

Despite its considerable environmental impact, concrete remains the most cost-effective building material – and it's significantly cheaper than soil. As a second course of action, Morris recommends that governments subsidize earth construction methods until a circular economy takes hold. "In a recent EU-funded project in France, around 400 new homes were built using soil extracted from construction sites in Paris," he explains, noting similar examples in Belgium. Switzerland already has relatively strong skills in earth construction but, according to Morris, these skills are under-used in practice.

Training and research

As a third course of action, Morris recommends setting up training programs in rammed earth and soil construction methods as a way to encourage existing practitioners to look beyond concrete and consider these alternative, sustainable and renewable materials. He also calls for similar changes to the degree programs for construction-industry professionals in Switzerland, adding that better-funded research into these methods would help further exploit their potential.

"I'm under no illusions," he says. "I know my recommendations would require a lot of effort. But it's high time for a radical shift in how we think about and practice architecture and construction. We need to improve cooperation among different systems as part of a transition to a more circular economy." Morris made his own earth bricks as part of his Master's project so that he could better understand how the production process works and experience the end result with his own two hands. "Making my own bricks only strengthened my belief that earth construction is an elegant method – and that it's the right way forward."

Watch the video

References

Jeremy Morris, "The Living Ground. Vers la construction d'une nouvelle culture du matériau," EPFL Master's project supervised by Dieter Dietz and Daniel Zamarbide, EPFL, 2022.

Preventing heat islands is a priority for the future of our cities

Author: Sarah Perrin
Photo: Alain Herzog

Two EPFL Master's students carried out meticulous research on heat islands – densely packed urban areas with features that can aggravate high temperatures during heat waves, posing a serious threat to vulnerable residents.

The summer of 2022 was unprecedented: the series of heat waves between June and August provided a glimpse of how climate change will make cities increasingly arduous places to live in the summer months. That's especially true in the most densely populated areas, where tightly packed buildings and ubiquitous concrete and asphalt surfaces can drive up temperatures and rapidly turn city blocks into furnaces. In addition, the darker colors used for urban structures tend to attract and absorb heat. These dense urban areas are known as heat islands, and they're what two ENAC students – Clara Gualtieri and YueWanZhao Yuan – chose to study for their Design Project, a semester-long project carried out for their Master's in environmental engineering. They conducted important research on heat islands and what can be done to mitigate the effects.

Heat islands will become an increasingly serious problem as the planet gets warmer. Most of the world's population now lives in cities, and climate change means they'll be faced with more and more of the direct consequences of extreme temperatures. These temperatures don't just diminish people's health and well-being: they can also be potentially fatal for certain at-risk categories, such as the elderly, chronically ill and homeless. And the methods most people use to cool off – like air conditioning and large fans – require a lot of power and generate even more greenhouse gas emissions, thus fueling the vicious circle of climate change.

To conduct their research on heat islands, Gualtieri and Yuan analyzed surface temperatures in two Geneva neighborhoods (Les Vernets and Pointe-Nord), based on data collected on the ground, building façades and rooftops. These two neighborhoods are undergoing a large-scale transformation and have various urban development projects in the works as part of the PAV (Praille-Acacias-Vernets) program. The two students developed a set of intricate 3D computer models for each neighborhood that describe the neighborhood's current temperature profile, the most likely temperature profile in 2050 if no changes are made, the temperature profile under the IPCC's worst-case scenario (RCP 8.5, where greenhouse gas emissions continue at the same pace, leading to the maximum level of global warming), and the temperature profile if the urban landscape is adapted in order to reduce local temperatures.

A 10°C increase

The highest ground-surface temperature that the students found in the two neighborhoods was around 35°C, but their models predicted that this temperature could rise by an average of 10°C, and under some scenarios by even 15°C in July and August.

The models also showed that mitigation strategies such as planting trees and other vegetation to create

more green spaces can lower the ground-surface temperature by around 5°C in both neighborhoods. They discovered that plants in particular can be effective, since the shade they produce has more of an impact than grass simply planted in the ground. Gualtieri and Yuan also note two further measures worth studying: the albedo effect – the capacity for lighter colors to reflect heat – and resurfacing rivers or other bodies of water to significantly cool the ambient air.

The students' findings are the result of a painstaking process whereby they precisely mapped each neighborhood in order to generate the most

Between the city and the countryside, the temperature differences are on average 4 to 5 degrees.

complete 3D models possible. Their models incorporate a huge amount of information, including the local morphology and topography, the surface of all built structures (e.g., rooftops, building façades, roads and smaller structures like ledges and guardrails) – including the structures' size, slope and thermal properties – street furniture, the different materials used, green areas, shaded areas and more. "Our simulations ended up incorporating more than 100,000 surfaces," says Gualtieri.

"A major problem"

Gualtieri and Yuan obtained their data from existing data sets, including the Swiss Federal Register of Buildings and Dwellings and weather databases. The students then ran different software programs, namely the Rhino 3D-modeling application, and CitySim, a simulation program developed at EPFL specifically for urban planners. CitySim lets urban planners estimate the thermal and physical proprerties of buildings and their power requirements, which is valuable information for designing strategies to minimize the use of fossil fuels.

"Gualtieri and Yuan's research shows that heat islands will become a major problem by 2050 if we don't start cutting back on fossil-fuel emissions," says Kavan Javanroodi, a postdoc at EPFL's Solar Energy and Building Physics Laboratory (LESO-PB). "Urban planners need to start addressing this issue early on in their projects. Their research also highlights what certain strategies can achieve in terms of heat reduction, giving Geneva's urban planners a starting point for combating temperature peaks and extreme microclimate conditions in the city's developing neighborhoods."

Reference

Gualtieri and Yuan's project was supervised by Kavan Javanroodi (lead supervisor), Dasaraden Mauree from BG Ingénieurs Conseils SA and Jérôme Henri Kämpf, a senior researcher at Idiap.

New method turns plastic waste into building bricks

Author: Sandrine Perroud
Photos: Alain Herzog

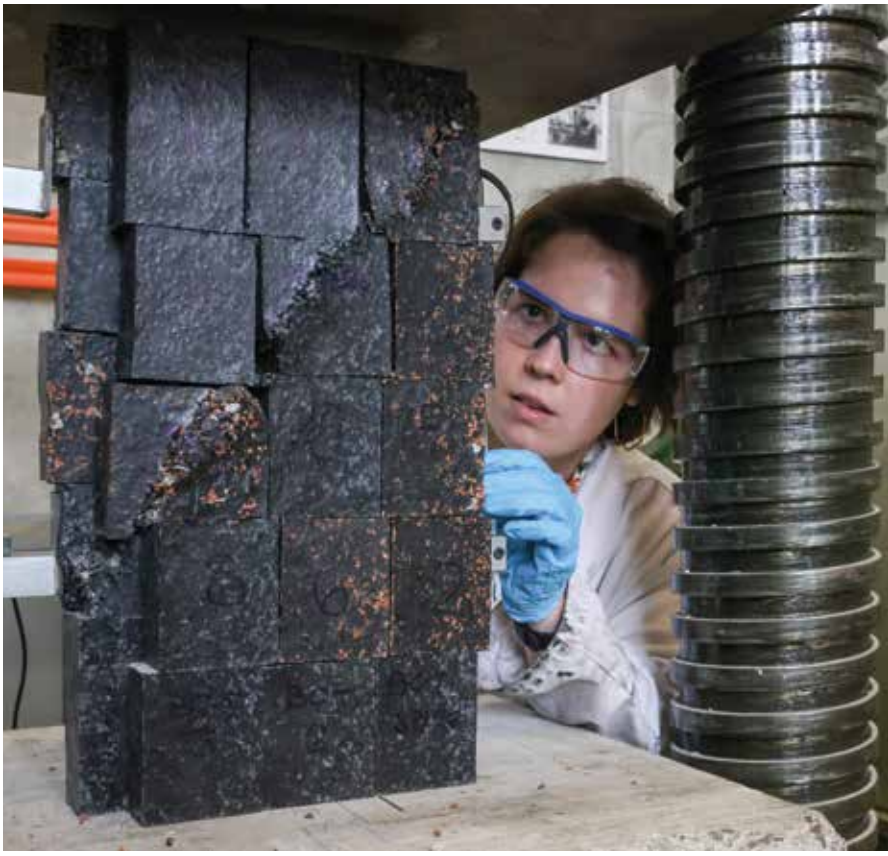
For her Master's project in civil engineering, Selina Heiniger took on a challenge that's aligned with her desire to help preserve the environment. She's developing a new building material that's made from plastic waste, concrete and terracotta.

Heiniger completed high school in Bern Canton and then enrolled in EPFL's civil engineering program – but only part time, since she also held a 30% to 50% job at a Lausanne-based civil engineering firm.

For her Master's project, Heiniger wanted to address two related challenges: reducing the amount of pollution caused by plastic waste, and developing construction methods that consume fewer raw materials.

She therefore began developing bricks made of recovered plastic – polypropylene (PP), polyvinyl chloride (PVC) and high-density polyethylene (HDPE) – along with crushed terracotta brick and recycled concrete. Her bricks are designed to interlock so that no mortar is required. Initial tests are encouraging, but her invention is still in the prototype stage, so there remain some issues to be resolved. Heiniger's work nevertheless stands to deliver significant benefits in shrinking the construction industry's carbon footprint.

Heiniger's Master's project was supervised jointly by Corentin Fivet, head of the Structural Exploration Laboratory (SXL) at ENAC, and Yves Leterrier, a senior scientist at the Laboratory for Processing of Advanced Composites (LPAC), within EPFL's School of Engineering (STI). Heiniger also received assistance from Maléna Bastien Masse, a postdoc at SXL, and Joanne Vaucher, an engineer at LPAC.



«My bricks could be used in a one or two story house, with little load on the structure.»

Selima Heiniger, EPFL civil engineering graduate

Watch the video

Reference

Selina Heiniger, «Bricks built from recycled thermoplatics», Master project, Civil Engineering, directed by Corentin Fivet and Yves Leterrier, School of Architecture, Civil and Environmental Engineering (ENAC), EPFL, 2022.

Durabilis awards given to five Master's projects on climate-change adaptation

Author: Emmanuelle Marendaz Colle
Photo: Xavier Nussbaum

The Durabilis awards, introduced in 2007, recognize Bachelor's and Master's projects that study different ways of tackling global warming, whether from a technological perspective (generally explored by EPFL students) or a cultural one (generally explored by UNIL students). Three of the five Durabilis winners in 2022 were from ENAC's environmental sciences and engineering section.

The Durabilis selection panel, chaired by Augustin Fragnière, awarded five cash prizes of CHF 1,000 each at a ceremony on 7 December 2022. Three of the winning projects were carried out at ENAC and two at UNIL.

To be eligible for an award, students must have obtained a grade of at least 5 out of 6. Twenty-four applications were submitted in 2022. UNIL was absent from the previous year's podium but came back in 2022 with two prize-winning students. Both their projects emphasized the importance of narrative and of tapping into the imagination in order to drive change. The three winning ENAC projects addressed the technological and nature-related challenges inherent in the fight against global warming.

The five winning projects

Life cycle assessment of solar panels

Alexis Barrou (EPFL-ENAC) - Life Cycle Analysis & Sustainable Technological Roadmap for Photovoltaic Panels: Case Study with the Silicon Heterojunction Technology

For his Master's project in environmental sciences and engineering, Barrou used the life cycle assessment methods to examine how photovoltaic technology can promote enhanced environmental stewardship and social equality. He collected recent data directly from solar panel manufacturers and generated comprehensive, up-to-date maps of the environmental impacts of photovoltaic systems. Then, by investigating the key drivers for each impact category (e.g., climate change, resource use and particulate matter), he identified the most promising technology for reducing these impacts. Barrou also outlined a roadmap for combining the technology with locally produced, ethically sourced materials, such as European-made silicon wafers.

Capturing carbon in biochar

Jean-André Davy-Guidicelli (EPFL-ENAC) – The Role of Biochar and Peatlands in Reaching Swiss Net Zero

This Master's project in environmental sciences and engineering explored the role of biochar production and peatland renaturation as a natural solution for reaching net zero in Switzerland by 2050. Davy-Guidicelli developed a method for estimating Switzerland's biochar production capacity based on the biomass

From left to right: Loé Maire, Alexis Barrou, Julie Grieshaber, Jean-André Davy Guidicelli, Sophie Desbiolles.

potential at the municipal level. His model can predict GHG emissions from peatlands and calculate the emissions reduction from a given rewetting scenario compared to a baseline scenario. According to Davy-Guidicelli's estimates, Switzerland could potentially offset the equivalent of one million Paris-New York roundtrip flights per year. His research calls on us to rethink our agricultural system and the typical Swiss diet and shift from a productivist model to a resilient one.

Water management, biodiversity and urban comfort

Loé Maire (EPFL-ENAC) - Adaptation des villes au changement climatique : un campus EPFL bleu-vert ("Adapting Cities to Climate Change: A Blue-Green EPFL Campus")

For her Master's project in environmental sciences and engineering, Maire developed a "Blue-Green Matrix" for quantifying and qualifying how cities are adapting to climate change. Her approach looks at three topics – water management, biodiversity and urban comfort – based on indicators for each one: water retention and storage indicators for water management; ecological continuity and environmental diversity indicators for biodiversity; and indicators of albedo (the percent of solar radiation that's reflected back into the atmosphere), shade and the quantity and quality of urban furniture for urban comfort. Maire's Matrix contains a total of eight indicators with a quantification method for each one. She tested her Matrix on three areas of EPFL's Lausanne campus.

Garnering support for the ecological transition

Sophie Desbiolles (UNIL) - La mise en récit de la transition écologique et le nouveau genre de la transi-fi ("Putting the Ecological Transition into Narrative and the New Genre of Transi-fi")

This Master's project at UNIL's Faculty of Geosciences and Environment examines how fiction can be employed to garner support for the ecological transition. By illustrating alternative scenarios, fiction can both show the way forward and make a sustainable future more desirable. Desbiolles analyzed film productions and found that stories depicting the ecological transition as a choice, along with the associated mitigation and adaptation strategies, are largely missing. She therefore put forth a new concept for filmmaking – "transition fiction" – or "transi-fi." Produced in the form of a series, transi-fi could illustrate the challenges of the Anthropocene in a more inspiring way, incorporating a broader role for the non-human and recognizing human responsibility in the damage being done to our environment. Transi-fi would cover time scales starting from the present – and not the future – on both a local and global scale, and would show examples of a successful ecological transition.

Theater as a prescriber

Julie Grieshaber (UNIL) - L'intégration d'une démarche de durabilité dans une institution culturelle: rôles, motivations et barrières. Etude du théâtre Vidy-Lausanne ("The Integration of a Sustainability Approach in a Cultural Institution: Roles, Motivations and Barriers. Study of the Vidy-Lausanne Theater")

In her Master's project at UNIL's Faculty of Geosciences and Environment, Grieshaber argues that cultural institutions, by their very nature, can serve as opinion leaders and role models for inspiring action on sustainability. Taking the example of Théâtre de Vidy, which decided to prioritize environmental awareness, Grieshaber interviewed staff members along with outside experts. She used the data to develop a conceptual model of environmental engagement for the performing arts, considering the related drivers and roadblocks at various levels. Her research confirmed that cultural institutions should be viewed as key players in the ecological transition through their ability to build narratives and create imaginary worlds.

The 2022 Durabilis awards ceremony included a keynote speech by Prof. Nicolas Senn from the Department of Family Medicine at Unisanté, Lausanne, who discussed some of the topics covered in his newly published book: *Santé et Environnement : Vers une nouvelle approche globale.*

rebuiLT, or how to rebuild a house sustainably

Author: Marwan El Chazli
Photo: rebuiLT

The Low-Tech Lab in Lausanne, part of Unipoly since 2021, aims to encourage the adoption of the low-tech approaches already found at several other European universities. Its showcase rebuiLT project is a cross-disciplinary MAKE project and involves reusing parts of a building that's being demolished to create a community pavilion in Ecublens.

Going low-tech means employing simple technology and reusable components that can be repaired easily – as opposed to high-tech approaches that rely on complicated electronics to solve all our problems. "The low-tech movement seeks to enable comfortable lifestyles that don't aggravate climate change," says Alexis Chanel, a Master's student in mechanical engineering and member of the Low-Tech Lab. "It's based on three criteria: the technology has to be useful, simple enough to be adopted by everyone and sustainable."

A solar oven is a classic example of a low-tech device, but going low-tech can also be as simple as changing our habits. "We tend to forget that fruit and vegetables can be stored outside the refrigerator – they just need the right environment: someplace airy and bright for tomatoes, or dry and dark for potatoes, for instance," says Chanel. "So we could easily use smaller fridges and replace some of the space with racks suitable for different foods. It's what our grandparents did!"

The Low-Tech Lab opened in September 2021 and already offers semester projects for interested EPFL students. "One project involved setting up thermoelectric generators, which produce a current when there's a temperature difference between two masses," says Chanel. "These generators can produce power during everyday activities like heating up a saucepan."

The Low-Tech Lab is also home to rebuiLT. Maxence Grangeot, an EPFL PhD student and the project's technical coordinator, explains: "Right now we're drawing up an inventory and suggesting ways for reusing the parts of a building that was constructed in the 1970s and that's now scheduled for demolition." These recovered parts will be repurposed for building a pavilion in Ecublens. "We plan to erect the pavilion's basic structure and then invite the residents of Ecublens to help us design the rest of it using a low-tech approach," says Chanel.

The rebuiLT team is being guided by Prof. Corentin Fivet, the head of EPFL's Structural Exploration Laboratory, where Grangeot is completing his PhD. "We're investigating new ways of making load-bearing structures because these are the most expensive in terms of resources," he says. "We're particularly interested in reusing construction materials – hence the synergies with rebuiLT." Project team members also come from EFPL's Fribourg campus and the PopUp workshop on that campus, designed for large-scale projects.

The pavilion design should be finalized by winter 2022, and the structure itself will be built through credited semester projects in association with Ecublens community organizations. The project team is hoping to start the (re)construction phase in March 2023 at several worksites where people can lend a hand on a voluntary basis.

Project-based learning at ENAC

Author: Marina Nicollier, Samuel Cotture
Photo: Marie Geiser

MAKE projects like rebuiLT, with their interdisciplinary structure and focus on sustainable innovation, run in synergy with other project-based learning initiatives at ENAC. MAKE projects, along with the SKIL prototyping workshop and the Design Together program, offer ENAC students an opportunity to expand their skillsets and earn credits by working on interdisciplinary project teams.

For instance, during the 2022 Design Together ENAC Week titled Constructive Second Hand, a group of Bachelor's students from different fields worked together at the Smart Living Lab's PopUp workshop in Fribourg. Their goal was to explore innovative approaches based on the circular economy by creating useable prototypes from discarded building materials. Master's students who complete their semester projects through the Design Together program can work on a topic that is related to an interdisciplinary MAKE project; in so doing, they can receive ECTS credits for their project while adding scientific value and receiving laboratory support. Ten students involved in rebuiLT used the SKIL prototyping workshop to complete four semester projects. The SKIL lab managers provided educational support as well as a safe space to work, tools and technical advice for the student projects. This type of collaborative, interdisciplinary, and hands-on learning experience is an important element of the education we provide at ENAC. Students pool their field-specific knowledge to find solutions to common challenges and learn to communicate more effectively with peers from other fields. By applying the skills they acquire in concrete projects, students will be better prepared to expand their range of competencies and then implement their skills later on in their careers to solve complex problems.

Design Together unites students out in the field

Author: Marina Nicollier
Photos: ENAC communication

Design Together is one of our interdisciplinary education initiatives at ENAC. Through Design Together, Bachelor's and Master's students from our three sections take part in a variety of classes and project work.

Students are becoming increasingly aware that meeting the challenges posed by climate change, rapid urbanization, population growth, and the dizzying speed of digitalization will require working with and understanding experts from a variety of other fields. Design Together aims to introduce students to this kind of collaborative work, giving them insight into how their expertise can be leveraged to develop innovative solutions hand in hand with peers from other disciplines.

Over 275 second-year Bachelor's students participated in the 2022 Design Together ENAC Week, giving them intense, hands-on experience completing projects in interdisciplinary groups outside of the usual classroom environment. The classes given during the Week were taught by cross-disciplinary teams and spanned a broad range of topics, drawing on the combined expertise of civil engineers, architects and environmental engineers. Students participating in Carving Natural Stones – one of the 12 ENAC Week topics offered in 2022 – spent the week designing and building a hand-carved stone structure on EPFL's Lausanne campus. The topic was taught by experts from ENAC's departments of civil engineering and environmental engineering. These experts guided students as they learned about the complex structural, thermal and environmental properties of natural stone. For ENAC students in the third year of their Bachelor's program, Design Together offers a number of semester-long, cross-disciplinary classes. For example, Living on Mars – a class taught by experts in civil engineering, architecture and sustainable ecology – calls on student groups to design a habitat for living on Mars. The student groups must develop strategies for dealing with the challenges of living outside the Earth's atmosphere: how to manage resources effectively, implement life support systems, produce building materials and cope with the psychological ramifications of living with others in confined spaces.

Student Kreativity and Innovation Laboratory (SKIL)

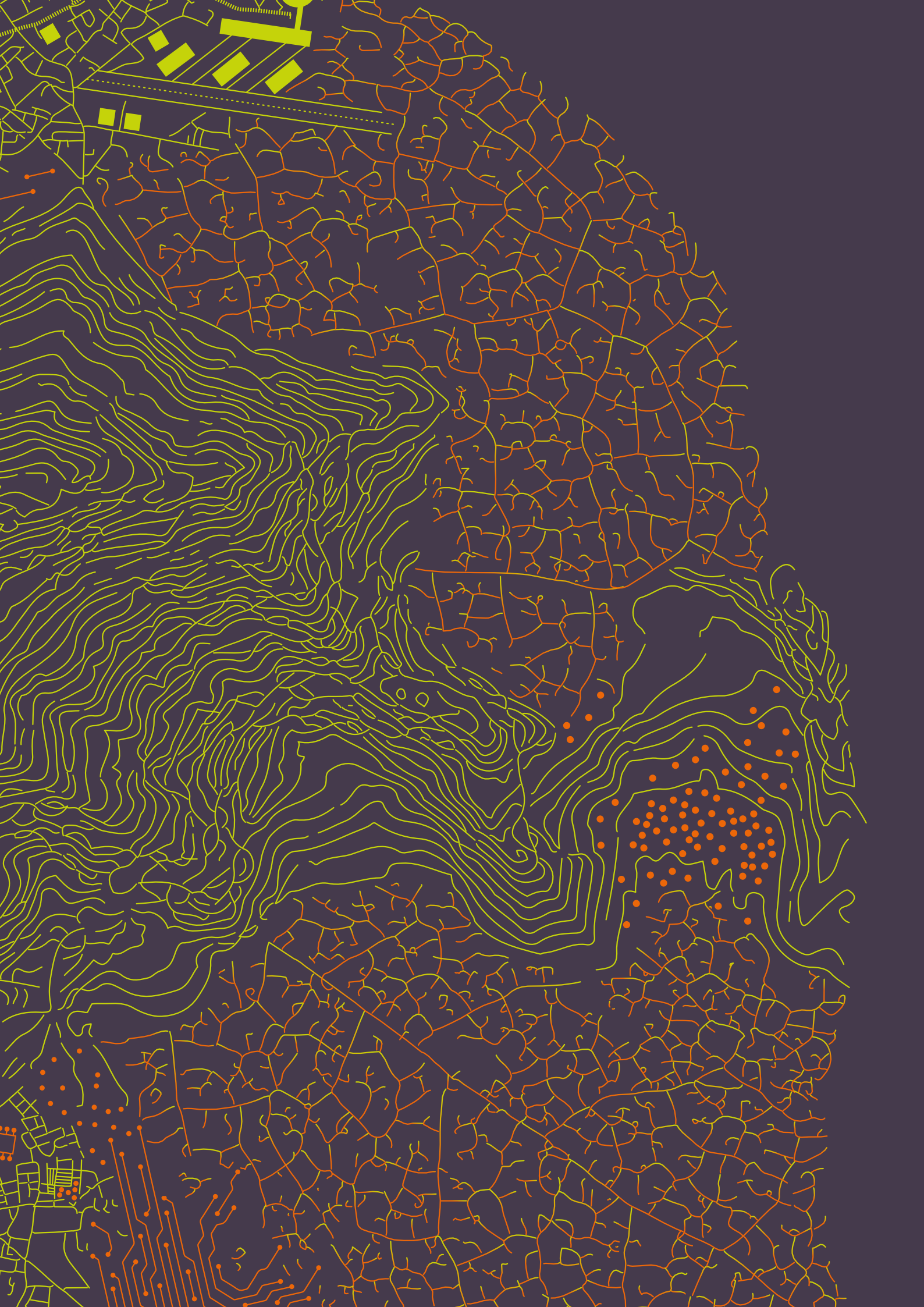
Author: Samuel Cotture
Photos: SKIL

Over 1,000 EPFL students used SKIL's facilities in 2022 to build prototypes and carry out innovation-oriented projects. 40 ENAC students received credits from SKIL through the associated class and various semester projects.

In 2022, we opened the Student Prototyping and Outreach Tank (SPOT) as a new makerspace to run alongside SKIL. In creating SPOT, we drew on the experience with SKIL in order to offer students complementary facilities such as a mechanics workshop, electronics area and immersive room. This new makerspace underscores our commitment to project-based learning and, coupled with SKIL's facilities and support, gives life to the pioneering vision of our school.

SPOT has considerably expanded the rapid prototyping capabilities at SKIL, especially in the areas of woodworking and composites, for example. It's also backed several student initiatives to promote low-tech approaches and the re-use of materials on our campuses. These issues are clearly important to students, as reflected in the successful rebuiLT and Sailowtech MAKE projects – initiated by students but supported by ENAC.

Another highlight of 2022 relates to plastic recycling at EPFL. In a class offered through SKIL, students developed a table made of recycled plastic; SKIL also worked with the Plast It Back student initiative to recycle EPFL's plastic waste and raise awareness of the problem of plastic pollution.



Diversity

ENAC's Diversity Office (DO@ENAC) was established in 2021 to replace the ENAC Gender Equality Group. Over the past two years, DO@ENAC has been helping ENAC grow as a welcoming community that celebrates diversity and enables each community member to realize their full potential regardless of gender identity, race, sexual orientation, able-bodiedness or any other personal characteristic.

DO@ENAC has 36 members from all our departments and institutes and all segments of our community: Bachelor's, Master's and PhD students, scientists, engineers, other faculty members and staff. It operates through three working groups: Recruitment and Retention, Onboarding and ENAC Culture, and Communication and Information.

In 2022, DO@ENAC contributed to ENAC's 20th anniversary celebrations, presenting and discussing its various activities with our community members. In addition, the Office put up portraits of women professors from each ENAC department and institute in the entry halls of ENAC's main building in order to illustrate their growing presence at our school. We look forward to filling up all the available space on our walls!

Diversity Office working groups: 2022 achievements

Authors: Rizlan Bernier-Latmani, Sara Bonetti, Olivier Burdet, Stefana Parascho and Andrew Sonta

Recruitment and Retention

This working group tackled two major issues related to hiring practices in 2022. It sent a survey to all unit heads to assess the current state of non-faculty hiring and potential areas for improvement. The survey obtained a nearly 50% response rate; a report is now being finalized and will be sent to unit heads with practical guidelines. The working group also looked at faculty hiring procedures, with the goal of providing guidance to faculty search committees and their chairmen. Working group members put together a presentation that details EPFL's hiring process along with common pitfalls (such as implicit biases) and how to avoid them. The presentation is given at the briefing meeting for each faculty search.

In 2023, the working group plans to outline strategies for improving recruitment and retention within our diverse ENAC community. It will start with student recruitment and develop a secondary-school outreach program that encourages underrepresented minorities to enroll in STEM subjects. The working group is also exploring career development opportunities at EPFL for support staff such as administrative assistants, and is looking into ways to promote family-compatible working schedules. As our faculty becomes more diverse, the group will run various activities to support new professors in their career development and the tenure process.

Onboarding and Culture

This working group held two parallel workshops (in English and French) in 2022, in association with AGEPoly. These workshops were intended for class representatives from across EPFL and designed to build awareness of harassment and discrimination. They gave participants tools and methods for addressing such situations effectively. The workshops proved highly popular and participants suggested making them available to the entire student body. In response, EPFL's Vice Presidency for Responsible Transformation worked with AGEPoly to adapt the workshops and open them to the broader EPFL community.

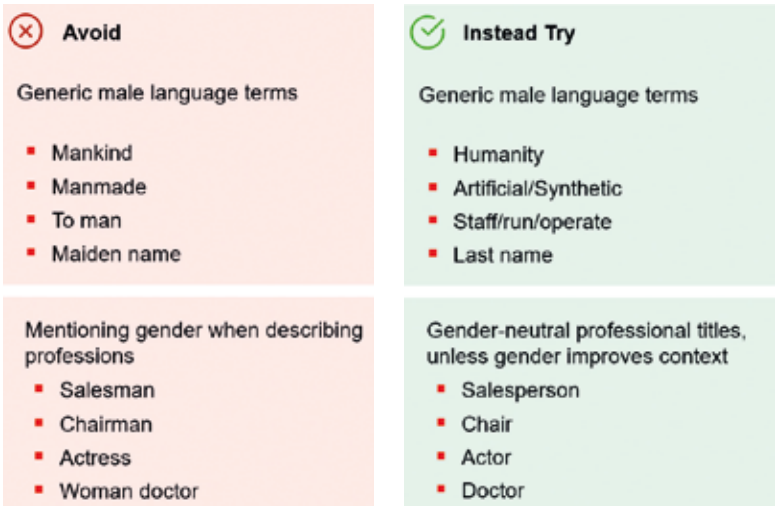
In 2023, this working group will continue to roll out the workshops within ENAC. It also plans to introduce other initiatives to better understand and address disability-related diversity at ENAC and EPFL.

Communication and Information

A key achievement of this working group in 2022 was producing a series of films that describe the experience of individuals facing discrimination. Two films were shown in 2022 – *Hidden Figures* and *Moonlight* – and were followed by an expert-moderated discussion. The events were well-attended and sparked a lively discussion on the

Respect and Inclusiveness Workshop (from left to right): Obstacles to respect and inclusiveness identified by the participants / class delegates participating to the workshop / introduction by Rizlan Bernier-Latmani, head of the ENAC Diversity Office.

Announcement posters for the movie showing of Moonlight (May 2022) and Hidden Figures (June 2022).



ENAC Diversity Office web pages on inclusive language – example in English.

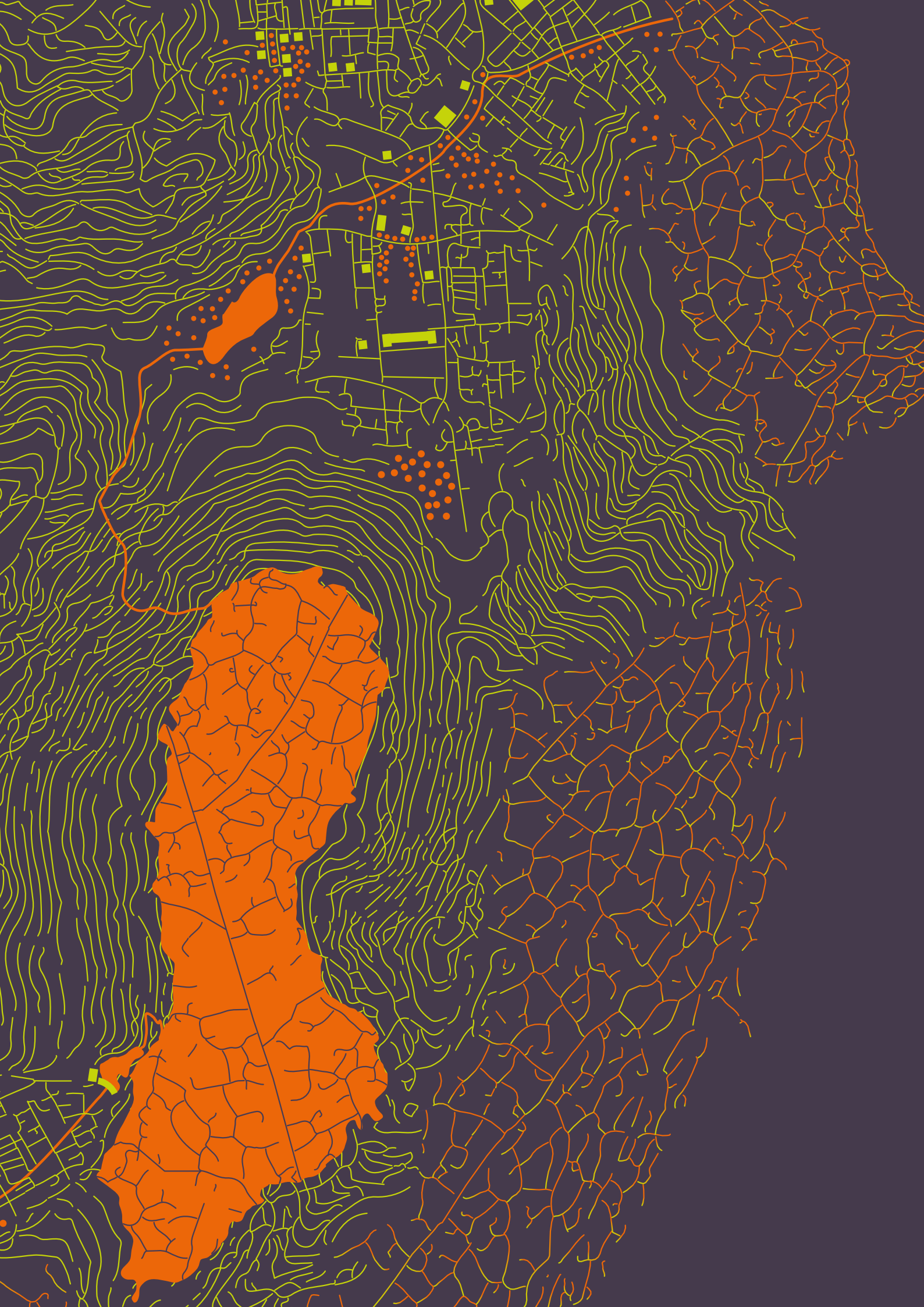
diversity-related topics they addressed. The working group also developed a series of web pages on inclusive communications in both French and English, giving guidelines on grammatical gender, pronouns, disability, sexual orientation and socioeconomic status in professional content like emails, job advertisements and surveys. Finally, the working group compiled statistics on gender diversity at ENAC and is drafting a report for the community on its findings.

Looking ahead, the working group plans to keep informing our community of the resources and processes available for fighting harassment and discrimination. It will produce more films and maintain an active presence on social media to foster dialogue on equity, diversity and inclusion at ENAC and at EPFL more broadly.

Expanded efforts

A key focus of DO@ENAC in 2023 will be developing and coordinating information sessions and training to enhance our community's understanding of and capacity to deal with diversity- and inclusion-related issues such as harassment and bias in the workplace. The information sessions and training will cover EPFL's grievance procedure for harassment and bullying and the School's inclusive communications practices.

DO@ENAC website



Research Data & Open Science

In 2022, we made considerable progress on our third strategic goal: leveraging our research data and promoting open-science practices. Open science has become a pivotal issue at universities, and our ENAC-IT4Research technical support team continues to provide value-added IT data-management services to ENAC researchers.

Encouraging data-driven approaches and open science is a key aspect of our strategy. It entails leveraging the trend towards big data and the growing awareness of the importance of open science.

Our scientists and engineers collect unique data sets in their labs and out in the field – data that are essential for tackling the major challenges ENAC strives to address. Furthermore, the advent of big data calls for sophisticated data-driven approaches in order to exploit the data's full potential and share them openly and effectively. However, such approaches require technological skills and efforts that are beyond the main focus of many researchers. That's why ENAC-IT4Research offered an array of services designed for researchers in 2022.

By sharing knowledge in an impactful way that's consistent with FAIR* principles, we can amplify our impact on key global issues like climate change, digitalization and sustainable urban development – while factoring in economic, technological and societal needs and constraints.

In the area of open science, PhD students – including several from ENAC – ran a summer school program to build awareness of the issue. We also hired an Open Science Catalyst to drive the implementation of our ambitious open science strategy. Efforts so far include promoting open research highlights (like datasets and software) on our website and taking part in ETH Domain calls for open research data (ENAC researchers obtained five grants under these calls in 2022: two ETH Domain Explore grants, two ETH Domain Contribute grants and one ETH Zurich ASEAN grant).

Also in 2022, we shored up our initiatives to showcase our open-science research findings, incorporate open-science awareness and skills into our Master's and PhD programs, provide services to support open research data and software, and encourage technology transfer based on open-science research.

* The FAIR principles of open science state that research should be findable, accessible, interoperable and reproducible.

Our open science strategy

Author: Silvia Aguilera Murciano

Open science is a driving force for us at ENAC, as it clearly has the potential to speed innovation, cut down on duplicate efforts, and boost the public's confidence in science by encouraging collaboration and the free dissemination of research findings.

We took proactive steps in 2022 to advance our open-science strategy by hiring an Open Science Catalyst in August. This enabled us to further showcase our open-science projects, promote funding opportunities and collaborate with other people at EPFL involved in open science, such as the EPFL open-science team (with whom we ran joint events like the IIC Seminar Series) and the EPFL Library (where we contributed to the discussion that resulted in the Zenodo EPFL community curation guidelines).

Goal 1. Showcase all ENAC open-science research findings

We further showcased our research findings in 2022, updating and adding to our open scripts and software, enhancing our open-science educational resource pages, and publishing around a dozen new open research highlights. Our open-science website recorded over 3,400 page views in 2022. We also started publishing Twitter threads on our research highlights to boost the visibility of our community's open research efforts.

Goal 2. Adopt open-access policies

We took additional steps in 2022 to adopt open-access policies and assist researchers with open-access publishing. We once again worked with the EPFL Library to gain a better understanding of researcher's needs and expectations when it comes to open-access publishing – especially in terms of navigating the fast-changing open-access ecosystem and its myriad of publishers, funding agencies and public-sector organizations.

Goal 3. Incorporate open science into our Bachelor's, Master's and PhD programs

We submitted three open-science ideas to the ETH Summer School program. One of them, "Science and Policy: How to Bridge the Gap?", was selected for the summer of 2023. This summer school will be open to all ETH PhD students and will include lectures on open-science oriented topics like current challenges, scientific communications and funding opportunities for young researchers.

In addition, we held a second edition of the Research Skills for Engineers Master's class in the first semester of 2022. A total of 19 students enrolled in this class, which covered open-science principles, tools and best practices.

Goal 4. Provide services to support open research data and open software

We continued to support our researchers in 2022 through our ENAC-IT4Research technical support service. This team of software engineers, data engineers and data scientists helped researchers make the most of their data and create efficient, reproducible data pipelines.

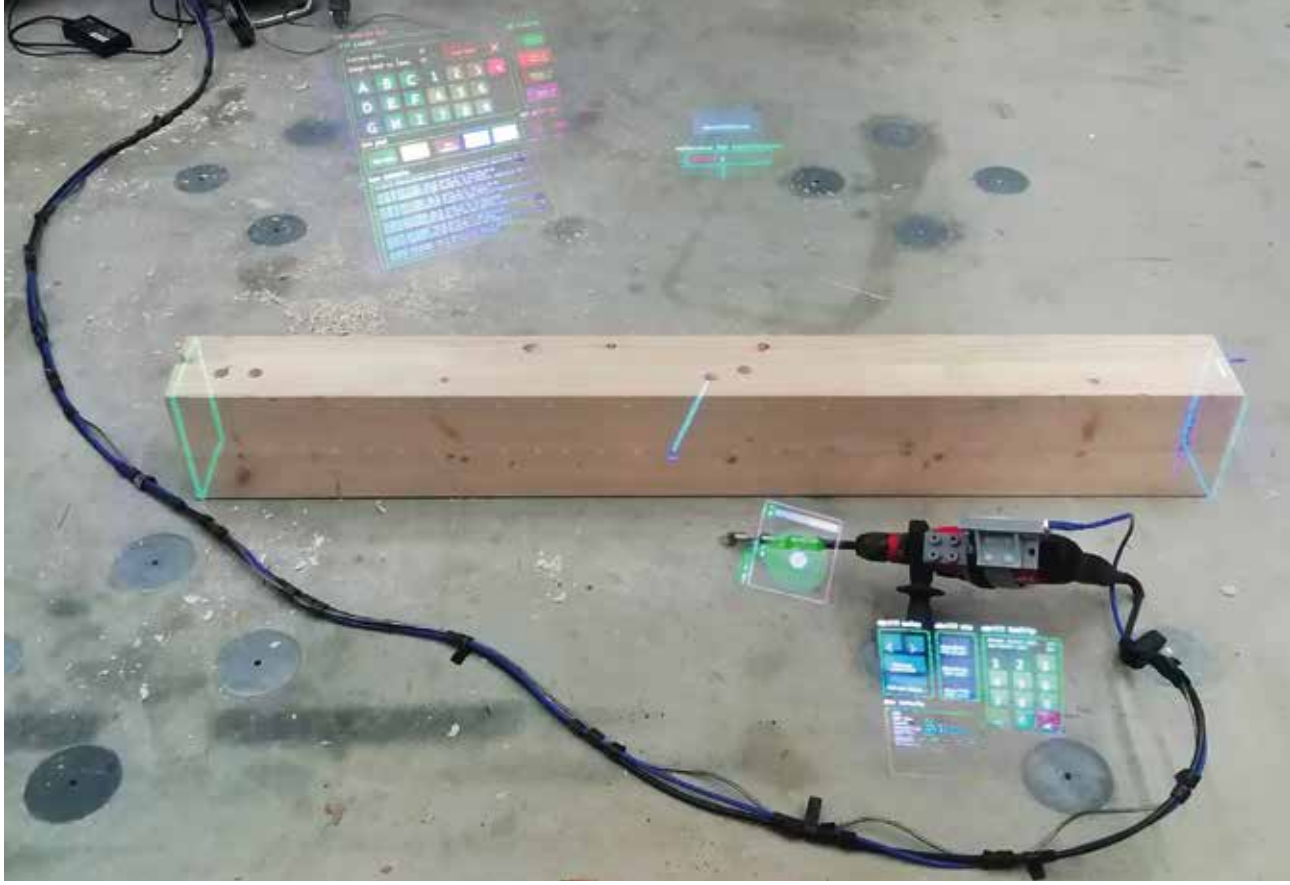
ENAC-IT4Research has assisted 30% of the labs at ENAC. In 2022, the team provided 15 advanced services and worked with 17 ENAC labs and EPFL groups. In addition, our Data Help Desk put researchers in touch with resources for data management, data science and disseminating research findings.

Goal 5. Support technology transfer based on open-science research findings

In 2022, we again worked on expanding and communicating on our technology transfer initiatives. For example, we reached out to the general public through our efforts with the FUSTIC association and held an open-science outreach event for the Romande Energie power utility that showcased our energy-related open-science research.

Virtual co-pilot facilitates the task of cutting wood

Author: Sandrine Perroud
Photos: Andrea Settimi



Andrea Settimi wants to make woodworkers' lives easier. Settimi, a second-year PhD student at EPFL's Laboratory for Timber Constructions (IBOIS), is developing an augmented reality (AR) program that can help with simple cutting tasks.

The IBOIS research group carried out a pilot test of the software in 2022 and released it in open-source format. In addition to Settimi, the research group includes Prof. Yves Weinand – the head of IBOIS and Settimi's thesis supervisor – and Julien Gamerro, Settimi's thesis co-supervisor.

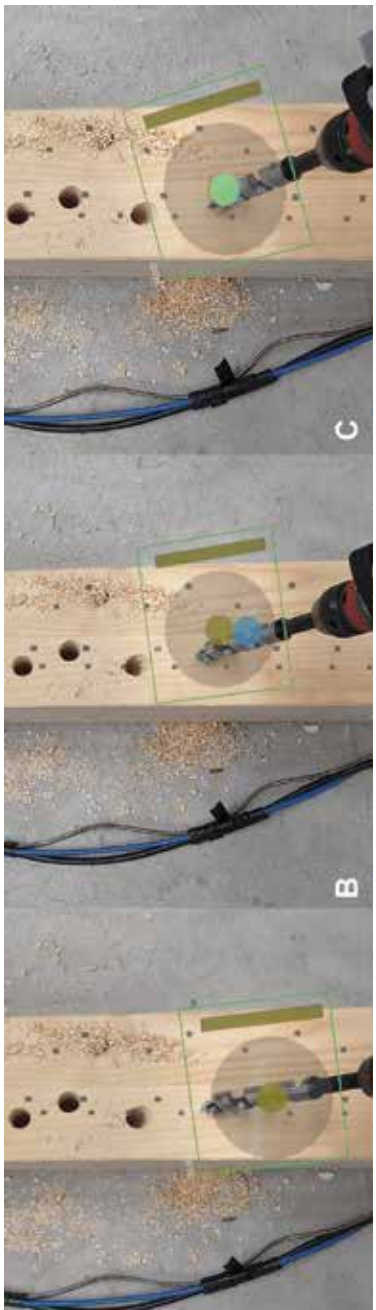
The software relies on technology similar to that employed in self-driving cars: a camera and connected sensors. The sensors are placed on the piece of wood, and the camera is installed on a regular drill or saw. Then, looking through an AR headset, users can see the piece of wood overlaid with a 3D diagram (as shown in the photo). The software guides users on where to cut or drill and on the best type of drill bit to use or how to saw the wood to obtain the desired form.

"Our software is intended to prevent small businesses from having to invest in costly equipment," says Settimi. "It gives them an affordable, easy-to-use alternative that still delivers precise, high-quality results."

Settimi's thesis is still ongoing, and many more developments are in the works. For instance, Settimi is designing an application that will let even novice hobbyists carve out sophisticated designs using basic hardware – or even a smartphone equipped with the technology.

Once the software program is finished, it can be used in workshops just as well as at construction sites. "With our program, we want to enable full automation while still keeping humans at the center of the process," says Settimi. "We also hope our research can help extend the life of standard woodworking tools."

Watch the videos



Scientists standardize hydrometeorological data for enhanced collaboration

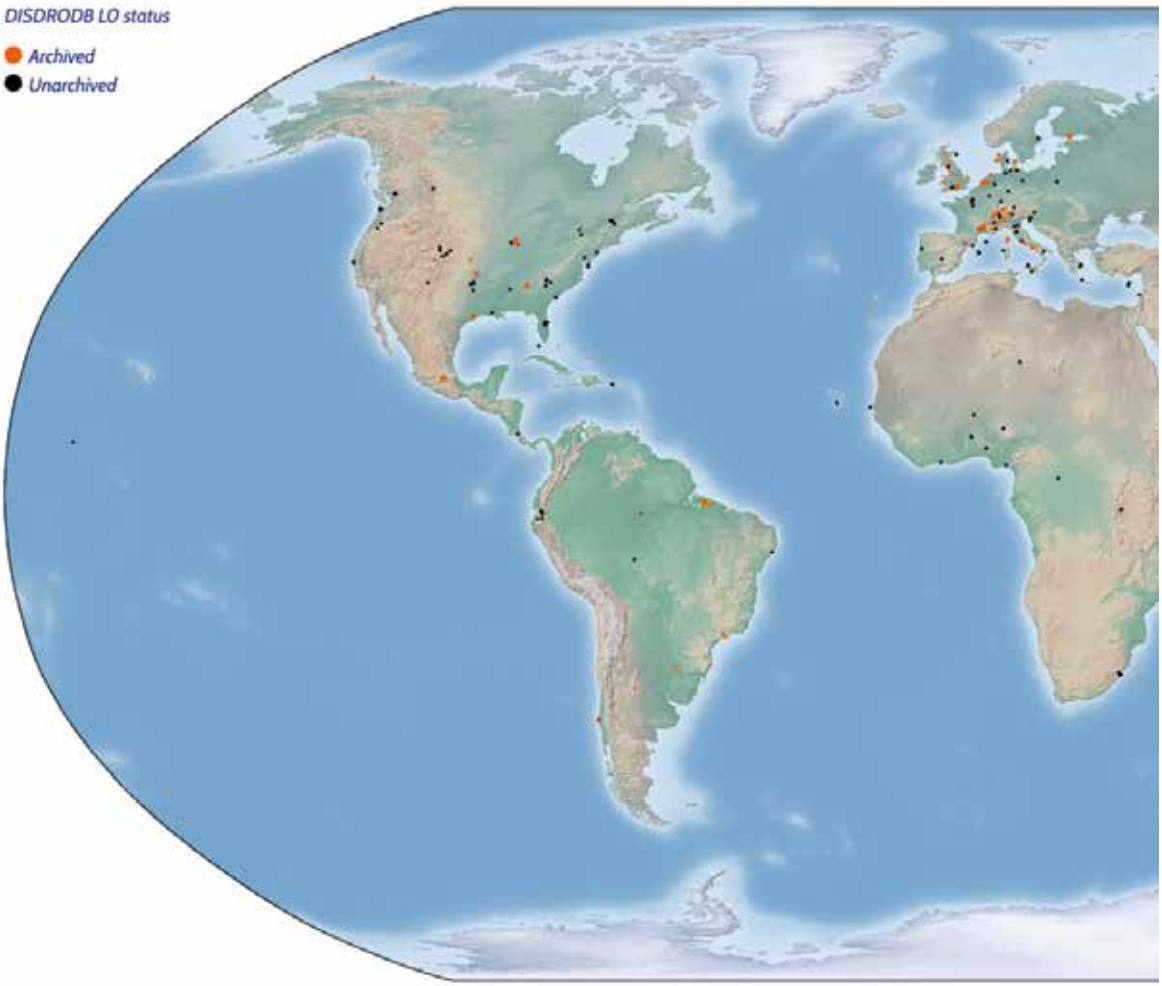
Author: Sandrine Perroud

ENAC's Environmental Remote Sensing Laboratory (LTE) has been working since 2007 to collect thousands of precipitation observations in areas ranging from the Alps to Antarctica.

"One of our priorities was to develop robust software to homogenize and standardize our archives," says Gionata Ghiggi, a PhD student at LTE. "We obtained a grant from the ETH Domain" – under the Open Research Data Program – "and used the funds to initiate this work, as part of an international group including colleagues from the Netherlands and Australia."

The resulting application pools data from over 300 disdrometer stations around the world. Each partner organization can retain the ownership of the raw data, while the software takes care of collecting the data and homogenizing them to a common standard. "A big challenge for us was to standardize the different parameters, such as the names of the physical properties measured by the different instruments, and the metadata, like the conditions under which the data were collected," says Ghiggi. In 2022, LTE worked with ENAC-IT4Research to adopt best practices for open-source software collaboration. These practices included tracking the problems encountered and enabling the traceability of code changes. The developers also introduced automated quality control processes for editing or adding new code, thus ensuring the software's long-term maintainability and promoting the creation of an international community of users.

By sharing precipitation data and collaborating more efficiently, the scientists will be able to better characterize regional variations in precipitation properties. This will also lead to more informed decisions about where to set up weather stations, in order to eliminate redundancies and to cover regions – like Africa – where data are still lacking.



Other examples of open scripts and software made available by our labs include:

Open Data for Old and New Stone Masonry buildings

Experimental data of cyclical experiments on rubble stone Masonry walls can be key for the seismic assessment of historical structures.

Earthquake Engineering and Structural Dynamics (IIC-EESD)

Solving Contact Mechanics Problems with Tamaas

Tamaas solves contact mechanics problems with periodic rough surfaces, plasticity, adhesion and friction using the boundary element method.

Computational Solid Mechanics Laboratory (IIC-LSMS)

Bringing Open Source to Building Information Modeling (BIM)

BIM enables construction professionals to project a building through a digital model that includes 3D geometry and metadata. With the Industry Foundation Classes standard, a vendor-agnostic, open language solution can be provided to allow easy collaboration and sharing of BIM models.

Laboratory of Numeric Cultures for Architectural Projects (IA-CNPA)

Cleaning Arctic Aerosol Datasets From Pollution

The Pollution Detection Algorithm was developed to identify local pollution emission from vessel stacks in aerosol and trace gas datasets in remote locations.

Extreme Environments Research Laboratory (IIE-EERL)

Modeling Snow Avalanches With AVAC 3.0

Avalanche-dynamics computational models are useful for predicting extreme avalanches and their threat to urbanized areas or civil-engineering structures like ski lifts, railway or reservoirs.

Environmental Hydraulics Laboratory (IIC-LHE)

Phoenix3D: Reducing Environmental Impact Of New Structures

Phoenix3D is designed for architects and structural engineers who are designing structures that are made from reused elements, as this can significantly reduce their environmental impact.

Structural Xploration Lab (IA-SXL)

Breaking Interoperability Barriers In Architecture, Engineering and Construction Software

The TopSolid-Speckle Connector is an Open Source plugin for the CAD-CAM software TopSolid that prevents proprietary enclosure of data and allows better collaborative workflows between different disciplines working on architectural projects.

Laboratory of Numeric Cultures for Architectural Projects (IA-CNPA)

Democratizing Views: Open Visual Capital Data

Opening data from digital twins on building views can open the door to other research like urban health, well-being or inequities across regions.

Laboratory of Environmental and Urban Economics (IA-LEURE)

Urban Landscapes and Health Outcomes in Côte d'Ivoire

Open data sources can assess basic indicators related to demography essential to urban and human development.

Urban and regional planning community (IA-CEAT)

ENAC-IT4Research data services

ENAC-IT4Research helps scientists and engineers bridge technical gaps and bolster their research impact by providing expert assistance in data science and software development.

ENAC-IT4R's data scientists, software engineers and programmers assist with any data or software questions, throughout the data lifecycle, from data acquisition and harmonization to data dissemination. Now in its second year, ENAC-IT4R collaborates with researchers among the three institutes and EPFL campuses and performed 15 tailored projects. This was only possible after three people with skills the team was lacking – a senior full-stack developer, a front-end developer (specialized in data visualization) and a data engineer (specialized in spatial data manipulation) – were hired. The Data Help Desk can be reached by email : enacit4research@epfl.ch.

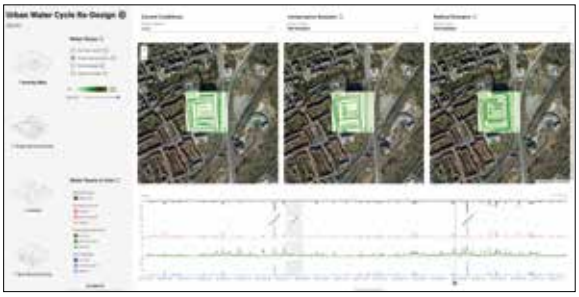
Here are some examples of ENAC-IT4Research's advanced services tailored to labs' specific needs:

Hybrid Timber-stone Structures fabrication

Laboratories:
MANSLAB, IBOIS and EESD

Description:
The main objective of this project is to draw inspiration from traditional construction method to propose ecological and sustainable stone-timber structures that meet the requirements of modern buildings. Today's advanced digital tools are leveraged to develop an automated design-production framework to generate new designs, reduce labor intensity, and optimize cost-effectiveness.

Technology:
Cables.GL, GitHub Pages



Visualizing Urban Water Cycle

Laboratories:
ECHO and Lab-U

Description:
This work is part of the Water-Age-Neutral Habitats: Re-designing the urban water cycle for a renewable city-territory research project, conducted at EPFL. This interdisciplinary project is funded by the ENAC Cluster Grants 2020 – Sustainable Territories, with modeling done in collaboration with Chris Soulsby and his team at IGB Berlin. This website is created through the ENAC Cluster Grant Data Valorisation program.

Technology:
VueJS, Leaflet, eCharts

Affective mapping in Geneva

Laboratories:
ALICE and LASIG

Description:
This project will address climate change from the perspective of landscape infrastructure as a nature-based solution capable of linking urban connectivity, active mobility and psychophysical health and well-being.

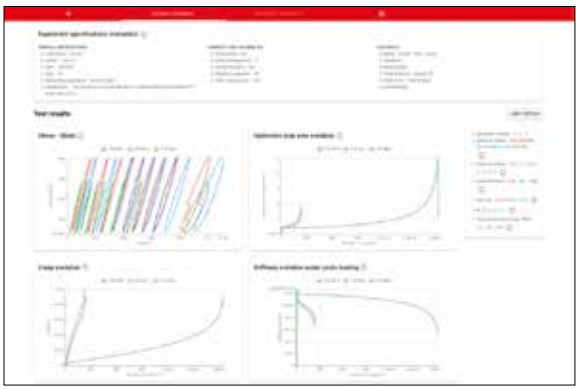
Technology:
VueJS, Maplibre, QGIS

No GPS, no problem ! ML Competition

Laboratory:
TOPO

Description:
Today drones and other aerial autonomous systems for navigation and control depend heavily on the robustness of GNSS reception for their position estimation. The objective of this competition is to ask users around the world to contribute to TOPO's research by building and training a model that can be used to estimate the position of the drone only with ground pictures.

Technology:
Python



Composite materials fatigue database and life prediction – open research platform

Laboratories:
CCLAB

Description:
The CCFatigue platform offers a standardized and interoperable database for sharing, accessing and analyzing material testing datasets. It is composed of:

- a database, with composite material fatigue and fracture test data, and
- a suite of calculation modules allowing users to experiment with their own data.

Technology:
VueJS, Python + RestAPI, eCharts

UNHCR Sustainability Web Tools

Laboratories:
EssentialTech, FAR and BPE

Description:
EssentialTech, FAR and BPE, in the context of ongoing work with UNHCR Geneva Technical Hub, aim to develop web application building on various data sources (mostly Excel sheets and web sources) and user inputs, to improve sustainability practices, through GHG emmissions estimates, shelter sustainability scores and improved energy planning in refugee camps. The overaching project is composed of three different tools, each with distinct specifications and functionalities – but developed jointly to foster synergies and integration wherever possible.

Technology:
Couchdb, Vue.js, ECharts.

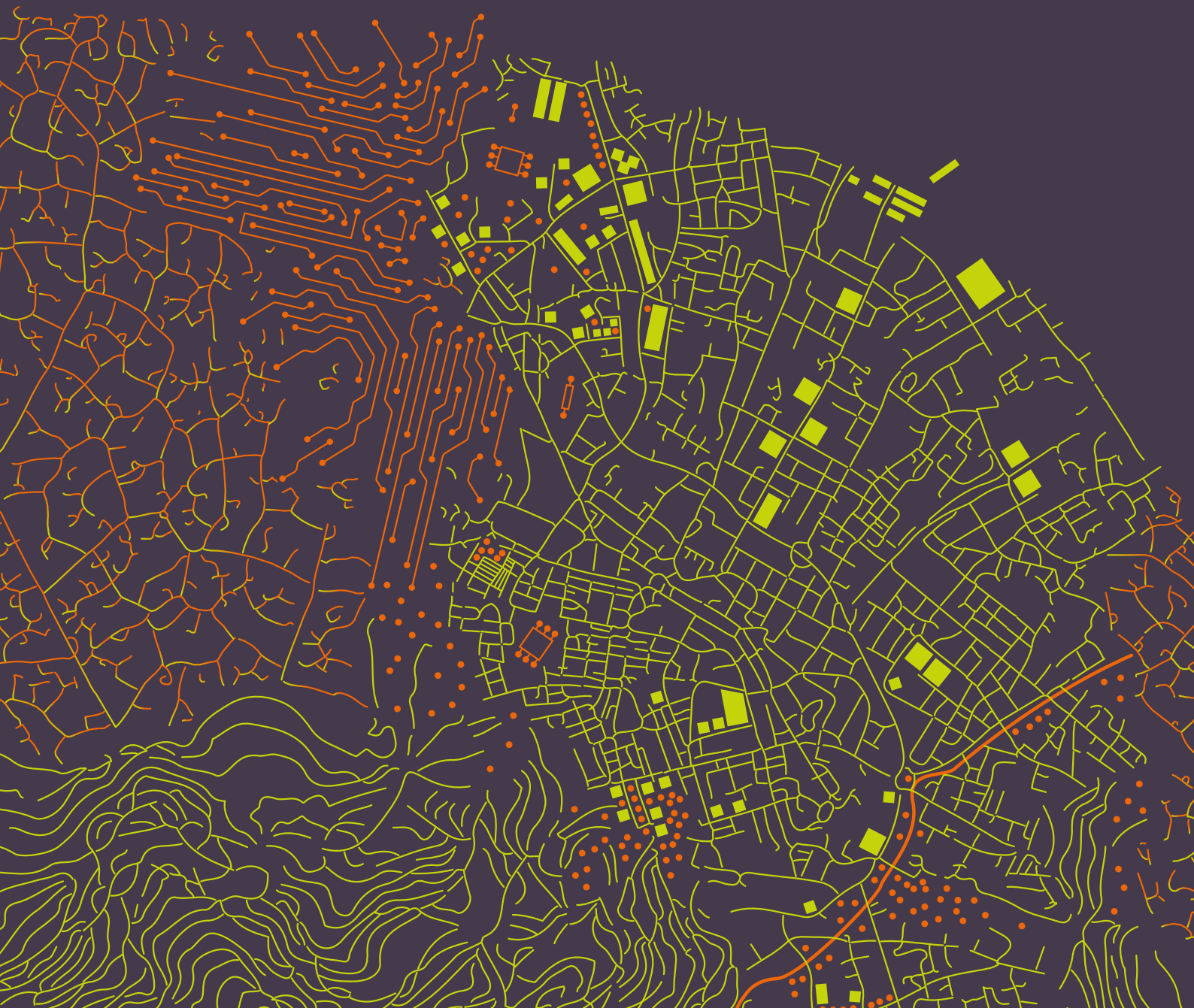
Standardize hydrometeorological data

Laboratory:
LTE

Description:
DistroDB application pools data from over 300 disdrometer stations around the world (see page 48). In addition to some code refactoring, ENAC-IT4R implemented testing and release processes to this codebase, in order to scale it to an effective collaborative code repository meeting software development standards and best practices

Technology:
Python

ENAC-IT4Research website



Innovation & Partnership

Our pioneering research at ENAC stands to make a significant contribution to the development of innovative systems that drive a sustainable society.

Cities serve as focal points for major societal and environmental issues, but they also have enormous potential as breeding grounds for innovation. Over 50% of the global population lives in cities, which account for 75% of worldwide energy use and more than 75% of CO_2 emissions. That means cities are major contributors to some of our most pressing global problems such as air, water and soil pollution, biodiversity loss, and climate change, and play a role in the far-reaching effects of these problems on human health.

In 2022 we shored up a number of our R&D partnerships and continued our ENAC Innovation Seed Grant program. These grants are awarded through three application rounds per year, providing essential support to scientists and engineers as they follow the path from basic research to prototype development, technology transfer and market launch. The grants also act as catalysts for entrepreneurship in our community, allowing individuals to pursue their promising business ideas.

Our efforts included providing assistance and mentorship to previous grant recipients, helping them turn their inventions into marketable goods and services. The assistance we provided ranged from identifying funding opportunities and exploring possible use cases to coordinating outreach initiatives and driving market adoption.

Our Future Sustainable Territories, Infrastructure, and Cities (FUSTIC) association – which aims to encourage joint R&D between ENAC and partner organizations – experienced considerable membership growth in 2022, to over 150 people. It held its first annual general meeting in September, where pivotal decisions were made in a collaborative spirit.

These achievements in 2022 reflect our commitment to forming healthy R&D networks and creating an ecosystem that promotes idea sharing, sustainable innovation and collaboration among various stakeholders. We're pleased with the year just ended and look forward to continuing our work to forge close ties and advance sustainable ideas.

Making installed train windows permeable to mobile-phone signals

Author: Cécilia Carron
Photo: Alain Herzog

ENAC spin-off nu glass has successfully tested a portable system that makes the window panes on railcars permeable to mobile communications. This can bring significant environmental and cost benefits to railway companies and mobile-phone operators, since they'll no longer have to install signal boosters to provide wireless connectivity for passengers.

Train riders expect to have a good internet connection while on board, yet the insulated window panes currently used on trains interfere with wireless signals. For now, railway companies get around this problem by equipping each railcar with a signal booster, or repeater. But repeaters are expensive boxes that consume a lot of power, are environmentally unfriendly and must be replaced every time there's a new advance in wireless technology. To avoid the need for repeaters, nu glass has developed a laser treatment that can be applied directly to installed window panes. The company tested their system on a Swiss railway company (CFF) railcar at the Olten rail yard and found it can deliver substantial cost savings for railway companies and for the mobile-operator consortia that provide connectivity for passengers.

One-third of the power used by railcars goes to their heating and cooling systems, which means that effective insulation is essential. Around ten years ago, railway companies began adding an ultra-thin metal coating to windows that can double railcars' energy efficiency – but it also prevents wireless signals from getting through. Railway companies and mobile operators therefore decided to install repeaters in each railcar so that passengers can use their connected devices while on board. Installing and maintaining these boxes is a costly process, however, and the boxes need to be replaced regularly to keep up with the latest Wi-Fi technology. "For instance, railway companies

will now need to replace all their repeaters to make the switch from 4G to 5G," says Luc Burnier, founder and CEO of nu glass. What's more, each repeater can require up to 700 watts of power.

LESO-PB researchers, with the support of rail-industry companies, developed a laser treatment process a few years ago that engraves microscopic lines in the metal coating so that mobile-phone frequencies can pass through without affecting the coating's thermal insulation properties. A number of window pane manufacturers already use this system for the glass they produce. But most railcars today are not ready to be replaced yet – each one has a useful life of around 30 years. The researchers therefore came up with a portable version of their system that can be used directly on existing railcars. This is the innovation now being marketed through nu glass.

An optical device that works effectively on curved panes

The nu glass system consists of a laser housed within a portable casing that operators attach to a train window. The laser can engrave a single window in around 15 minutes and an entire railcar in just a few hours. The challenge in developing the system was getting the laser to move with enough precision. The LESO-PB engineers thus integrated an optical measurement device into the system that continually places the laser in the right position. "The optical device is what lets our system work effectively on curved windows, such as those on panoramic trains," says Burnier.

Nu glass was awarded an EPFL InnoGrant last year and made the final adjustments to its invention. The results from its recent pilot test were highly encouraging. "The next step will be to use it on a railcar in a train that travels around Switzerland so we can get feedback from passengers," says Burnier. "Our goal is to eventually deploy our system across the country and elsewhere in Europe."

Watch the video

AI enables more effective humanitarian action

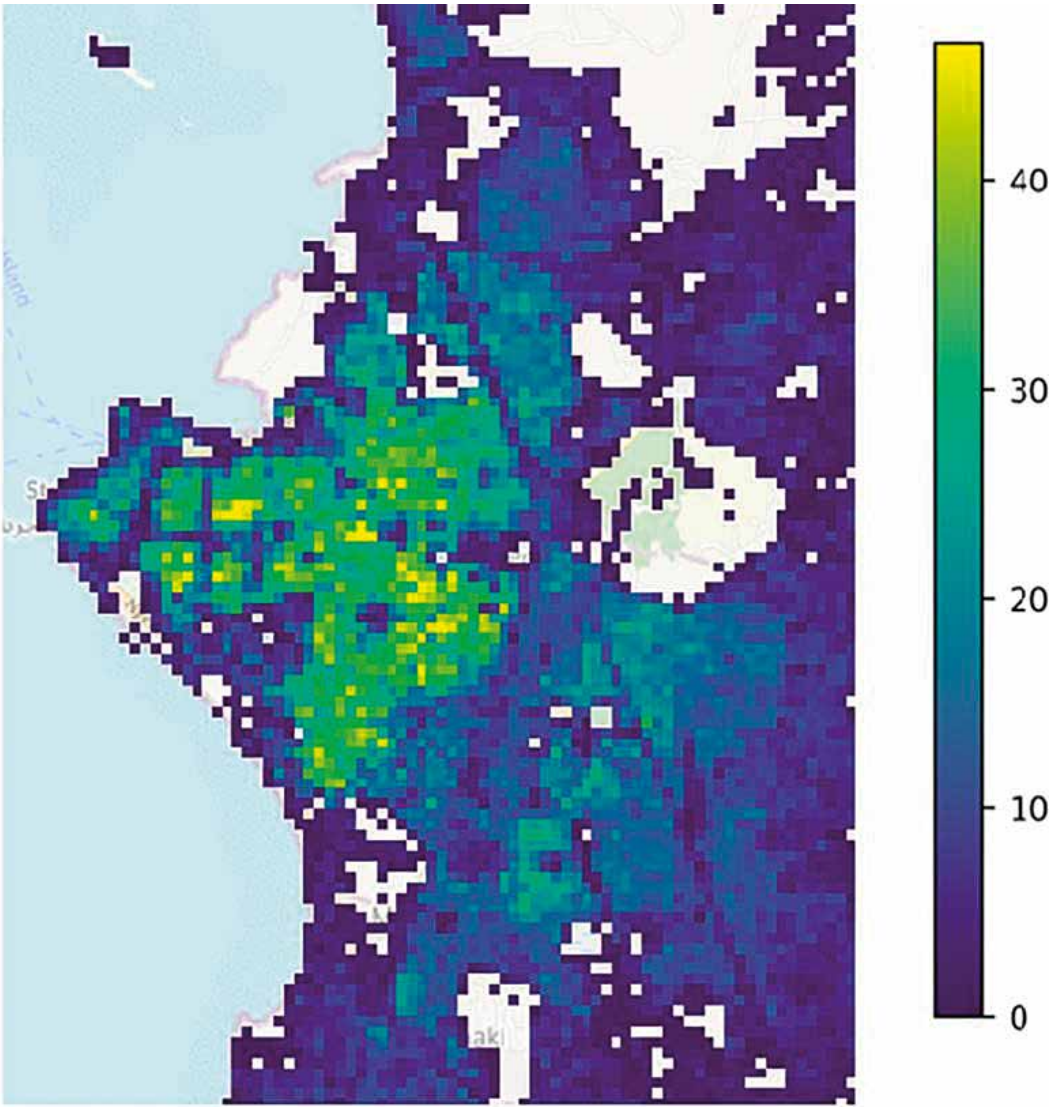
Author: Cécilia Carron

Researchers from ENAC and ETH Zurich, working together with the International Committee of the Red Cross (ICRC) and Bin Khalifa University (Qatar), have developed a program that can generate population density estimates with unparalleled precision, and needs only a rough estimate at the regional level to learn.

In most countries where the ICRC operates – whether in response to crisis or conflict or to support reconstruction – no updated census data are available. And where census counts are taken, they often become outdated quickly as a result of rapid population growth and demographic shifts. But when humanitarian workers need to restore a water supply, distribute food or assess the feasibility of a prevention program, they can work much more efficiently if they know how many people are in a given area. That's why EPFL and ETH Zurich engineers teamed up with the ICRC to develop an artificial-intelligence-based program called Pomelo. The software compiles large sets of public data from remote sensing systems – such as data on building counts, average building sizes, proximity to roads, road maps and night lighting – and aggregates them based on weightings learned by a neural network. Pomelo has been tested successfully in several African countries and generates exceptionally granular results over surface areas as small as a hectare. The researchers' findings appear in *Scientific Reports*.

Precision down to the nearest hectare

Although several population mapping methods already exist, none of them can produce estimates with the accuracy needed for humanitarian operations, urban planning and environmental monitoring. These methods generally work either by extrapolating data from detailed but local surveys so as to cover larger areas, or by taking openly available geodata (such as drone and satellite images) that are obtained over large areas and disaggregating them according to various criteria in order to achieve a much finer resolution. The ICRC currently uses software that relies on building footprints. "But our software doesn't account for other factors like how buildings are used," says Thao Ton-That Whelan, a project manager at the ICRC. "That matters because the kind of aid needed in a given area depends on whether it's an industrial, administrative or residential district, for example." Prof. Devis Tuia, who heads ENAC's Environmental Computational Science and Earth Observation Laboratory, adds: "There are a few other artificial-intelligence-based programs out there, but they all need a precise census count to start learning, which they then refine with other data. But all our system needs is an estimate of the population at the coarse regional level."



Visual comparison of Zanzibar City, Tanzania. High Resolution Population Density Maps on the left and with POMELO (right)

Pomelo was developed under the Engineering Humanitarian Action initiative – a partnership among EPFL, ETH Zurich and the ICRC to leverage new technology and engineering know-how in order to improve the lives of people in need. The goal with Pomelo was to create an AI program that can produce accurate population maps for discrete plots of land measuring one hectare, or 100 meters long by 100 meters wide. Their program can deliver such precision thanks to the wealth of public data sets it draws from.

Tested in Tanzania, Zambia and Mozambique

For instance, based on the open data for a given building, Pomelo can draw logical population estimates based on how the building is used. "Buildings tend to be taller in urban areas than suburban ones, for example, and more people tend to live in areas where there's more night lighting," says Tuia. "All this information helps produce more accurate estimates of population density. At first, we considered using data from social media, but then we realized these apps aren't used widely enough in crisis zones, especially in rural areas."

The engineers tested their program with data from several African countries including Tanzania, Zambia and Mozambique – countries where the ICRC also operates. They used Pomelo to generate a series of digital maps showing population density estimates by hectare and compared the results with estimates from other programs. Pomelo proved to be more accurate than its peers – not just at the hectare level, but also at larger and coarser scales, including at low population densities (1,000–2,000 residents).

"Working with these two universities has enabled us to use advanced technology that we wouldn't necessarily have had the time or the capacity to develop at the ICRC," says Ton-That Whelan, who believes Pomelo will be very useful for planning purposes. "It has its limits, of course, like in situations where groups are moving rapidly. And the program can't tell us if buildings are empty – but we have teams on the ground that can provide us with that kind of information." The researchers are planning to release an easy-to-use version of the software for non-experts in the first half of 2023.

Four ENAC linked start-ups created in 2022

nu glass has developed technology to improve wireless connectivity indoors. Its system makes glass permeable to mobile phone frequencies, eliminating the need for routers and repeaters.

LESO-PB - IIC

www.nu.glass

Bameo offers tailor-made support for developing products made from bamboo. Drawing on its expertise with this material, Bameo provides design assistance, technical support and production support.

SGC

www.bameo.eu

MobiLysis supplies a turnkey solution for monitoring transportation patterns on a large scale in order to pinpoint the sources of traffic congestion and suggest more effective and more sustainable traffic management methods.

LUTS - IIC

www.mobilysis.ch

Resilio provides environmental impact assessment software, training and consulting services to help companies become digitally sustainable.

SSIE

resilio-solutions.com

2022 ENAC Innovation Seed Grants winners

Our Innovation Seed Grants are a unique opportunity for ENAC scientists and engineers to obtain funding (up to CHF 20,000) so that they can explore innovative ideas early on in the development process. These grants are intended to support innovation and technology transfer at our school and encourage researchers to think across boundaries and design holistic, sustainable, inventive solutions to critical societal problems. The grants are open to ENAC PhD students, postdocs and other researchers who are in the initial phase of developing an application, product or service with a real societal impact.

CRATER

Production of water using micro-organisms.

- PI: Anna Carratalà (LCE / IIE)
- Start date: 1 April 2022
- Duration: 6 months

DEMA-NDT

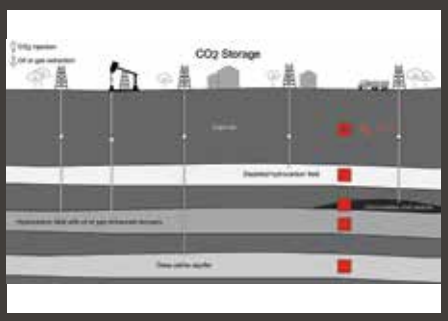
Digital twins of existing masonry structures using non-destructive tests.

- PI: Savvas Saloustros (EESD / IIC)
- Start date: 1 September 2022
- Duration: 6 months

HOBO

Human oriented buildings' operation.

- PI: Evangelos Belias (HOBEL / IIC)
- Start date: 1 October 2022
- Duration: 6 months



InSituStreTech

Advanced In-Situ Geo-Stress Estimation Technology.

- PI: Angelica Tuttolomondo (LMS / IIC)
- Start date: 1 April 2022
- Duration: 6 months

REFUGE

Water Shed System.

- PI: Malcolm Onifadé (ALICE / IA)
- Start date: 1 May 2022
- Duration: 6 months

RE:SLAB

A reusable slab-column system for sustainable housing.

- PI: Edisson Xavier Estrella Arcos (SXL / IA)
- Start date: 1 August 2022
- Duration: 5 months

FUSTIC association: collective intelligence is the key to successful innovation

Author: Frédéric Dreyer

FUSTIC is a process-oriented association that works with related organizations to support the development of digital technology and innovative best practices, products and services that will solve key economic, industrial, urban-development, and climate-related challenges for a sustainable future.

FUSTIC aims to unlock the full potential of digital solutions, inspire a culture of innovation and transformation and bring viable solutions to our ecosystem and global markets. Science and innovation should serve the needs of society, and inspiring innovation and excellence is at the heart of everything FUSTIC does. This includes horizon scanning for emerging technologies and trends, leveraging cross-sector technology and consulting experts for their insight and advice.

Actions must be taken as quickly as possible to limit the impact of human activities on climate change. Our focus is on cities and territories, and we must devote significant energy to them if we are to meet the goals of the UN's 2030 Agenda for Sustainable Development. FUSTIC offers a unifying ecosystem, and since our first general meeting in early September 2022 more than 150 members have joined us.

The FUSTIC association was officially launched on 2 September 2022 at our first general meeting, held at the SwissTech Convention Center. Our work takes various forms:

Bringing together the value chain of change actors

FUSTIC's aim is to form a value chain of change agents from the public and private sectors, academia, NGOs, associations, regulatory bodies and the general public.

More than 140 members have joined FUSTIC since the association was formed. This diverse network consists of private-sector entities (55%), academic entities (30%) and public-sector entities, NGOs and citizens (15%). FUSTIC members bring with them expertise in a range of fields, such as construction, urbanization, architecture, energy and water networks, mobility & transportation, the circular economy, biodiversity, agriculture, waste management, health and digitalization.

Fostering global engagement and partnerships

FUSTIC is involved in international initiatives such as the 2000-Watt Smart Cities program and the Solar Impulse Foundation's 1000 Solutions for Cities program, both of which share our commitment to creating sustainable urban environments. These partnerships demonstrate our dedication to collaborating on a global scale and leveraging innovative solutions to address sustainability challenges.

Engaging our community

Our website, www.fustic.org,

contains a list of members together with testimonials that provide insight into FUSTIC's purpose and activities. This comprehensive list showcases the collective knowledge and expertise that drive our initiatives.

Collaborative solution-oriented projects

By ensuring that all stakeholders in the value chain have a seat at the table, FUSTIC reinforces its actions and leverages collective solution-oriented projects. From startups and universities to SMEs, corporates, NGOs and public institutions, FUSTIC's members are committed to shaping tomorrow's cities and territories by drawing on their combined strengths and perspectives.

Showcasing our initiatives

In 2022, FUSTIC was actively involved in various awareness-raising initiatives, including conferences, working groups and steering committees. For example, we participated in the Green Village program at CERN; worked with the Swiss-French Chamber of Commerce sustainability committee; teamed up with RENT (Real Estate New Technologies Switzerland); and partnered with Swissnex and research centers such as CLIMACT, EcoCloud and Habitat Research Center (HRC). These collaborations highlight our commitment to promoting sustainable practices and fostering innovation.

Building bridges

In one notable example of FUSTIC's work, we helped design the Blue City project and bring together various partners. This transdisciplinary consortium, led by Prof. Jeffrey Huang (from EPFL's Media and Design Lab), aims to create a responsive Urban Digital Twin for sustainable and digitally transformed cities. This project has the potential to revolutionize the industry and establish Switzerland as a leader in innovative city planning and retrofitting. FUSTIC was involved in building the consortium and connecting partners from academia and the public and private sectors. Our involvement in this initiative clearly reflects our commitment to facilitating collaboration and driving sustainable initiatives.

Looking ahead

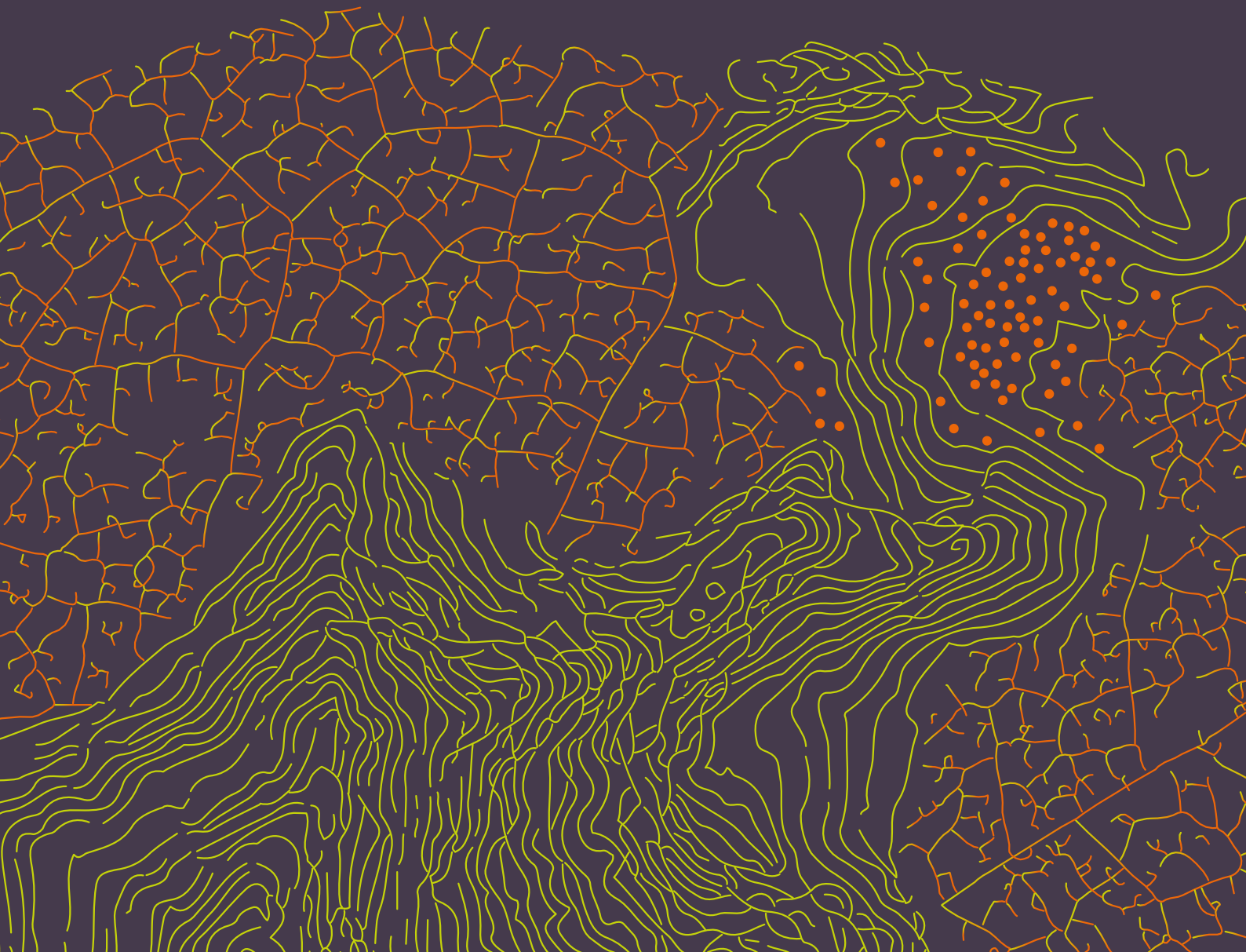
FUSTIC is dedicated to exploring further collaborations and launching co-creation projects that boost sustainability in various sectors, including construction. An example of our efforts is the La Plaine platform in Vufflens-la-Ville, where researchers learned how mineral materials from deconstruction and aggregates are acquired, processed and transported. The aim of this collaboration is to reduce the environmental impact of mineral extraction and meet the growing demand for construction materials.

The initiatives, achievements and partnerships described above provide a brief glimpse of how we pursue our overarching mission of driving innovation, fostering collaboration and creating a sustainable future for cities and territories.

Join the change and be the change!

FUSTIC
FUTURE SUSTAINABLE TERRITORIES, INFRASTRUCTURES AND CITIES

www.fustic.org



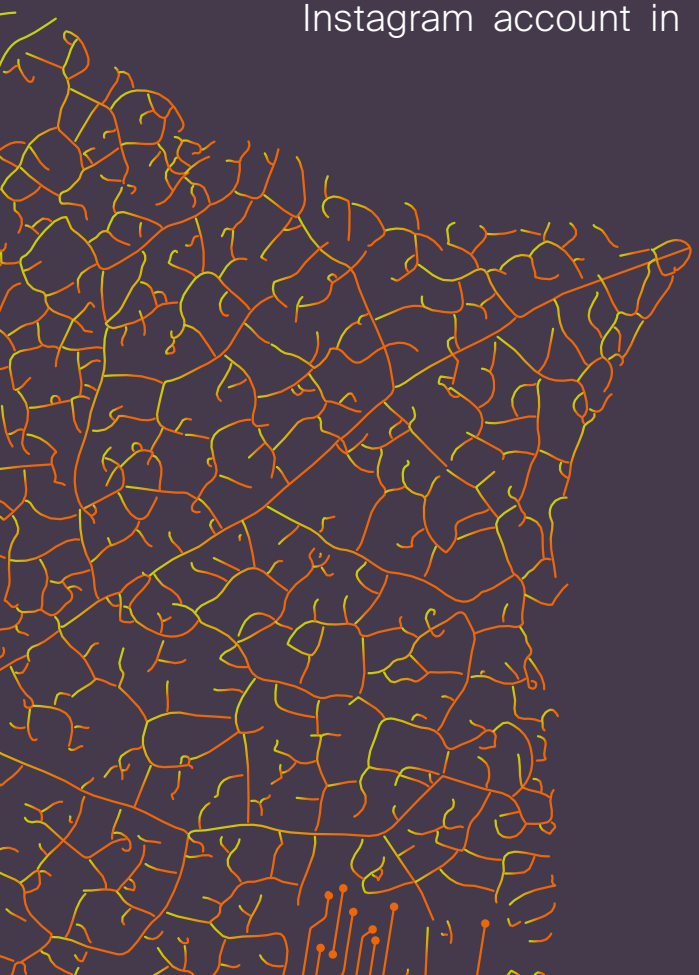
Communications

Our communications strategy aims to boost our school's visibility by illustrating how we're positioned to address three sustainability-related challenges: climate change, digitalization and urbanization. These issues are key topics of public debate, meaning it's essential for ENAC and EPFL as a whole to proactively communicate on their research, expertise, innovation and technology transfer.

In 2022, our communications team focused on highlighting our excellence in teaching in order to attract students who will become the architects and engineers of tomorrow.

A key element of our approach is effective content production and distribution. We continuously update the channels through which we communicate with the public and adapt to citizens' rapidly-changing habits in terms of how they get and share information. For instance, we set up an Instagram account in 2022 and filmed a series of science videos (see next page).

Much of our communications is done through regularly published articles and press releases, which are relayed widely in the media. Journalists also often interview our experts to get their insight on important issues. This gives our school broad visibility on a regional and national level. We would like to take this opportunity to thank the scientists involved in our communications for their hard work and commitment.



Positioning ENAC, and new approaches to attract future students

Author: Armand Goy

Our communications team shares the research breakthroughs and new developments coming out of ENAC labs, through regular contact with the general public and potential partners. It also highlights the excellent education we offer in order to attract bright new students.

We created a special section of the ENAC website to showcase our news articles and other announcements. This section also contains a press review that aggregates our researchers' many appearances in the media.

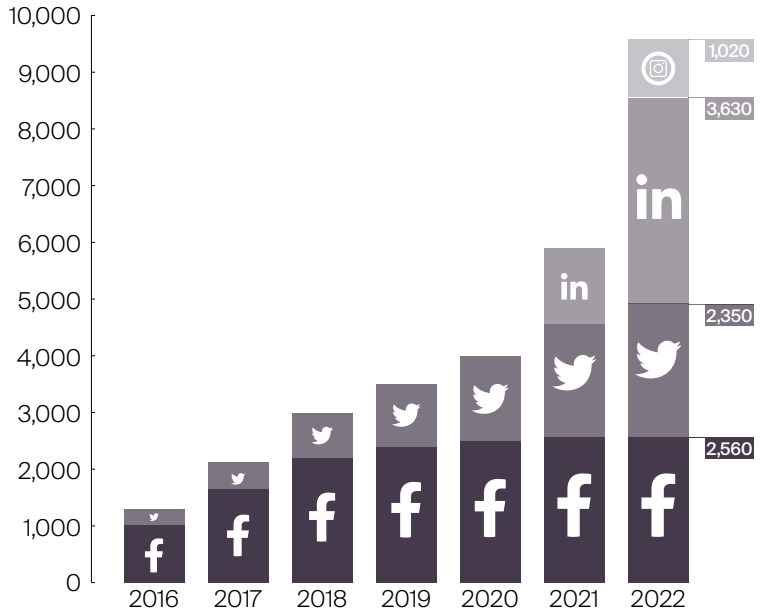
In 2022, our communications team worked with the three ENAC sections to develop communications materials aimed specifically at prospective students. We opened an Instagram account to enhance our visibility among young audiences. This move also prompted us to develop new communications formats; for example, we filmed videos of Master's projects in each of our three disciplines as well as videos of students who are involved in university associations. One big project in 2022 was creating a new format for science videos – the first of its kind at EPFL (see next page).

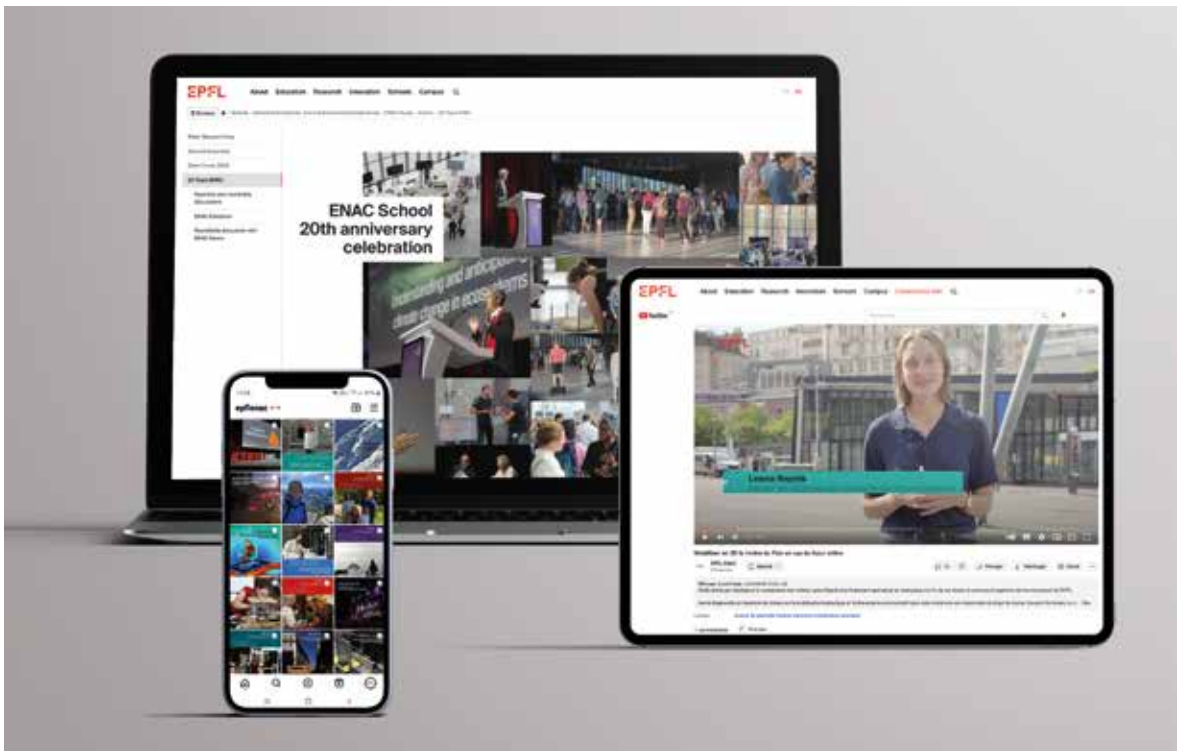
Overall, we've seen sharp growth in our followers on social media. By end-2022, we had a total of over 9,500 followers – up 60% from the prior year.

Last but not least, a major communications event in 2022 was the celebration of our school's 20th anniversary. Our entire communications team worked hard to put on the event, which underscored ENAC's positioning and provided excellent visibility. 720 people attended the anniversary celebration and our social media posts and Tweets got over 25,000 impressions (see page 7).

Follow us @epflENAC

ENAC followers on social media





Science video series: *De la glace à l'eau*

Do you know how snow is formed?

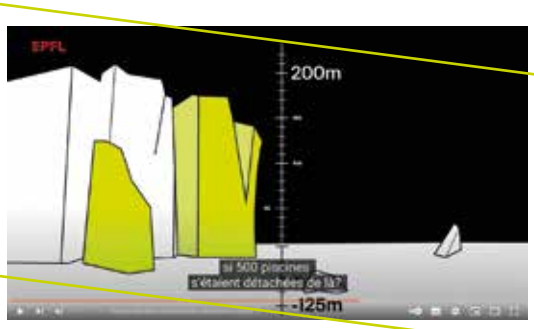
How can we determine the shape of a snowflake?

How are avalanches formed?

What's the point of studying the mechanics of natural phenomena?

In *De la glace à l'eau* ("From Ice to Water"), ENAC professors describe their research on snow, avalanches, the North and South Poles and the Alps. This video series is intended for potential EPFL students and shows how scientists use digital technology to model natural phenomena and better understand the challenges and impacts of climate change. These are just some of the many topics explored at EPFL's new ALPOLE research center, opened in 2022

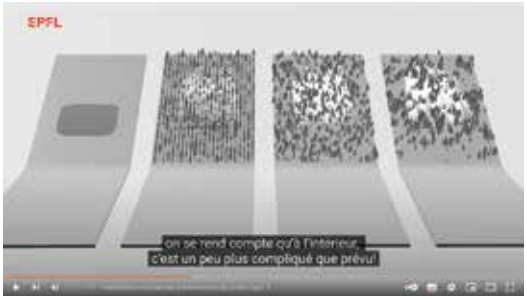
Why does polar weather matter?



What happens when glaciers sink?

Who cares about polar weather?

Why is it important to digitally model past events?



What happens during polar expeditions?

How can snow be turned into renewable energy?

Watch the video

ENAC in 2022

ENAC Board

situation at 31.12.2022

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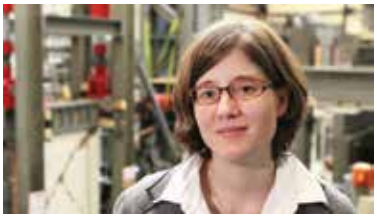

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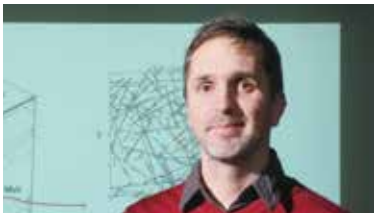

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Organization

ENAC's Labs

active in 2022

Lab acronym	Lab name	Head	Institute	Location	Change in 2022
ACHT	Architecture, Criticism, History and Theory	van Gerrewey Christophe	IA	Lausanne	
ALICE	Design Studio on the Conception of Space	Dietz Dieter	IA	Lausanne	
BUILD-O	Building 2050	Aguacil Sergi	IA	Fribourg	
CCLAB	Composite Construction Laboratory	Keller Thomas	IIC	Lausanne	
CEAT	Urban and Regional Planning Community	Chenal Jérôme	IIE	Lausanne	
CHANGE	Laboratory of Catchment Hydrology and Geomorphology	Bonetti Sara	IIE	Sion	opened
CNPA	Laboratory of Digital Culture for Architectural Projects	Cache Bernard	IA	Lausanne	
CONSTRUCT	Concrete Behaviour and Structural Design Laboratory	Ruggiero David	IIC	Lausanne	opened
CRCL	Laboratory for Creative Computation	Parascho Stefana	IA	Lausanne	opened
CRYOS	Laboratory of Cryospheric Sciences	Lehning Michael	IIE	Sion	
DISAL	Distributed Intelligent Systems and Algorithms Laboratory	Martinoli Alcherio	IIE	Lausanne	
EAST-CO	Laboratory of Elementary Architecture and Studies of Types	Fröhlich Martin and Fröhlich Anja	IA	Lausanne	
ECEO	Environmental Computational Science and Earth Observation Laboratory	Tuia Devis	IIE	Sion	
ECHO	Laboratory of Ecohydrology	Rinaldo Andrea	IIE	Lausanne	
ECOL	Ecological Engineering Laboratory	Barry D. Andrew	IIE	Lausanne	
EERL	Extreme Environments Research Laboratory - Ingvar Kamprad Chair	Schmale Julia	IIE	Sion	
EESD	Earthquake Engineering and Structural Dynamics Laboratory	Beyer Katrin	IIC	Lausanne	
EML	Environmental Microbiology Laboratory	Bernier-Latmani Rizlan	IIE	Lausanne	
ETHOS	Civil Engineering and Technology for Human Oriented Sustainability Lab	Sonta Andrew	IIC	Fribourg	opened
FAR	Laboratory of Construction and Architecture	Tombesi Paolo	IA	Lausanne	
GEL	Geo-energy Laboratory - Gaznat Chair on Geo-energy	Lecampion Brice	IIC	Lausanne	
GR-ACM	Les Archives de la construction moderne	Aprea Salvatore	IA	Lausanne	
GR-CEL	Central Environmental Laboratory	Breider Florian	IIE	Lausanne	
GR-GN/BPE	Bioenergy and Energy Planning Research Group	Gnansounou Edgar	IIC	Lausanne	closed
GR-LUD	Ludwig Group	Ludwig Christian	IIE	Lausanne	
GR-URBDEMO	Urban Demography	Lerch Mathias	IA	Lausanne	
HERUS	Laboratory on Human-Environment Relations in Urban Systems	Binder Claudia R.	IIE	Lausanne	
HITAM	History and Theories of Architecture, Technology and Media	Thiermann Alfredo	IA	Lausanne	opened
HOBEL	Human-Oriented Built Environment Lab	Licina Dusan	IIC	Fribourg	
IBETON	Structural Concrete Laboratory	Muttoni Aurelio	IIC	Lausanne	
IBOIS	Chair of Timber Construction	Weinand Yves	IIC	Lausanne	
ICE	Laboratory of Integrated Comfort Engineering	Khovalyg Dolaana	IIC	Fribourg	
IMOS	Intelligent Maintenance and Operations Systems	Fink Olga	IIC	Lausanne	opened
LAB-U	Laboratory of Urbanism	Viganò Paola	IA	Lausanne	
LAPI	Laboratory of Atmospheric Processes and their Impacts	Nenes Athanasios	IIE	Lausanne	
LAPIS	Arts of Sciences Laboratory - Archives of imaginary	Braghieri Nicola	IA	Lausanne	
LASIG	Geographic Information Systems Laboratory	Golay François	IIE	Lausanne	
LAST	Laboratory of Architecture and Sustainable Technologies	Rey Emmanuel	IA	Lausanne	
LASUR	Urban Sociology Laboratory	Kaufmann Vincent	IA	Lausanne	
LBE	Laboratory for Environmental Biotechnology	Holliger Christof	IIE	Lausanne	
LCE	Environmental Chemistry Laboratory	Kohn Tamar	IIE	Lausanne	
LDM	Media and Design Laboratory (ENAC/IC)	Huang Jeffrey	IA	Lausanne	
LEMR	Laboratory of Experimental Rock Mechanics	Violay Marie	IIC	Lausanne	

LESO-PB	Solar Energy and Building Physics Laboratory	Scartezzini Jean-Louis	IIC	Lausanne	closed
LEURE	Laboratory of Environmental and Urban Economics	Thalmann Philippe	IA	Lausanne	
LGB	Laboratory for Biological Geochemistry	Meibom Anders	IIE	Lausanne	
LHE	Environmental Hydraulics Laboratory	Ancey Christophe	IIC	Lausanne	
LIF	Laboratory of Imagination and Fabrication	Taillieu Jo	IA	Lausanne	
LIPID	Laboratory of Integrated Performance in Design	Andersen Marilyne	IA	Lausanne	
LMS	Soil Mechanics Laboratory - Chair gaz naturel Petrosvibri	Laloui Lyesse	IIC	Lausanne	
LSMS	Computational Solid Mechanics Laboratory	Molinari Jean-François	IIC	Lausanne	
LTE	Environmental Remote Sensing Laboratory	Berne Alexis	IIE	Lausanne	
LTH3	Theory and History of Architecture Laboratory 3	Gargiani Roberto	IA	Lausanne	closed
LTQE	Laboratory for Water Quality and Treatment	Von Gunten Urs	IIE	Lausanne	
LUTS	Urban Transport Systems Laboratory	Geroliminis Nikolaos	IIC	Lausanne	
MACE	Microbiome Adaptation to the Changing Environment	Altshuler Ianina	IIE	Sion	opened
MANSLAB	Laboratory for Spatial Manufacturing	Bakker & Blanc	IA	Lausanne	
MCS	Structural Maintenance and Safety Laboratory	Brühwiler Eugen	IIC	Lausanne	
PERL	Plant Ecology Research Laboratory	Grossiord Charlotte	IIE	Lausanne	
PL-LCH	Hydraulic Constructions Platform	Perona Paolo	IIC	Lausanne	
RESSLAB	Resilient Steel Structures Laboratory	Lignos Dimitrios	IIC	Lausanne	
RIOT	Research and Development for Innovation on Architecture, Urban Design and Territory	Malterre-Barthes Charlotte	IA	Lausanne	opened
RIVER	River Ecosystems Laboratory	Battin Tom	IIE	Sion	
RPGL	Rock Physics and Geofluids Laboratory	Kushnir Alexandra	IIC	Lausanne	opened
SENSE	Smart Environmental Sensing in Extreme Environments	Chappellaz Jérôme	IIE	Sion	opened
SLAB	Snow Avalanche Simulation Laboratory	Gaume Johan	IIE	Lausanne	closed
SOIL	Soil Biogeochemistry Laboratory	Aeppli Meret	IIE	Sion	opened
SXL	Structural Exploration Lab	Fivet Corentin	IA	Fribourg	
TEXAS	Theory and Experience Architecture Studio	Lapierre Eric	IA	Lausanne	
THEMA	Theory of Environment, Material, and Architecture	Nichols Sarah	IA	Lausanne	opened
TOPO	Geodetic Engineering Laboratory	Merminod Bertrand	IIE	Lausanne	
TOX	Laboratory of Environmental Toxicology	Kristin Schirmer	IIE	Lausanne	
TPOD	Theory and Project of Domestic Space	Aureli Pier Vittorio	IA	Lausanne	opened
TRANSP-OR	Transportation and Mobility Laboratory	Bierlaire Michel	IIC	Lausanne	
TSAM	Laboratory of Techniques and Preservation of Modern Architecture	Graf Franz	IA	Lausanne	
UPHCE	Prof. Hering Group in Environmental Chemistry	Hering Janet	IIE	Lausanne	closed
UPJESSEL	Prof. Jessel Group	Jessel Beate	IIE	Lausanne	
URBES	Laboratory of Urban and Environmental Systems	Manoli Gabriele	IA	Lausanne	opened
VITA	Visual Intelligence for Transportation	Alahi Alexandre	IIC	Lausanne	
WIRE	Wind Engineering and Renewable Energy Laboratory	Porte Agel Fernando	IIE	Lausanne	
WR-LAB	Watershed Research Lab	von Freyberg Jana	IIE	Lausanne	opened

2022 teaching and research awards

Institute of Architecture and the City (IA)

Aguacil Moreno, Sergi; Morier, Yvan; Couty, Philippe; Bacher, Jean-Philippe (BUILD-O)
Outstanding Contribution.
Central Europe towards Sustainable Building (CESB22).

Stracchi, Paolo; Cardellicchio, Luciano; Tombesi, Paolo (FAR)
Best Paper Award.
Frontiers of Architectural Research.

Viganò, Paola (LAB-U)
Schelling Prize for Architectural Theory.
Schelling Architecture Foundation.

Fivet, Corentin; Bastien Masse, Maléna; Küpfer, Célia Marine; Devènes, Julie Rachel; Brütting, Jan (SXL)
Trophées Bâtiments Circulaires.
Construction21.

Fivet, Corentin; Küpfer, Célia Marine (SXL)
Swiss pavilion at the Venice Biennale - 2nd place.
Pro Helvetia.

Lucan, Jacques (Professor emeritus)
Prix spécial du Jury du Livre d'architecture 2022.
Académie d'Architecture (France).

Muresan, Alex-Manuel (SXL)
Rent Innovation Prize 2022.

Widmer, Nicole (SXL)
Young Engineers - award International.
Association for Bridge and Structural Engineering (IABSE).

Civil Engineering Institute (IIC)

Wang, Qianqing (EESD)
Mobility Award.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Licina, Dusan (HOBEL)
Yaglou Award.
International Society of Indoor Air Quality and Climate (ISIAQ).

Pejatovic, Marko (IBETON)
Best Paper Awardees.
Fédération internationale du béton (fib-CH).

Corres Sojo, Enrique (IBETON)
Best Paper Awardees.
Fédération internationale du béton (fib-CH).

Muttoni, Aurelio (IBETON)
Freyssinet Medal.
Fédération internationale du béton (fib-CH).

Rogeau, Nicolas (IBOIS)
Young CAADRIA Award.
Computer-Aided Architectural Design Research in Asia (CAADRIA).

Weinand, Yves; Gamerro, Julien; Vestartas, Petras; Settimi, Andrea (IBOIS)
POST-CARBON Best Paper Award.
Computer-Aided Architectural Design Research in Asia (CAADRIA).

Khovalyg, Dolaana (ICE)
Best Paper Award.
Journal Building and Environment.

Walch, Alina (LESO-PB)
Outstanding PhD Thesis Award.
EPFL Doctoral Programme in Energy (EDEY), EPFL.

Laloui, Lyesse (LMS)
Honoris Causa.
Herriot-Watt University.

Laloui, Lyesse (LMS)
Honoris Causa.
Technical University of Cluj-Napoca.

Laloui, Lyesse (LMS)
Vienna Terzaghi Lecture.
Austrian Geotechnical Conference.

Peltier, Margaux (LMS)
Grand Prize.
>>venture>> Foundation.

Peltier, Margaux (LMS)
Prix Entreprendre Lausanne.
Region (PERL).

Roch, Thibault Didier (LSMS)
Jury Distinction.
SNSF Scientific Image Competition.

Pham-Ba, Son (LSMS)
Doctoral Program Distinction Prize.
Doctoral Program in Mechanics (EDME), EPFL.

Lignos, Dimitrios; Skiadopoulos, Andronikos; Elkady, Ahmed Mohamed Ahmed (RESSLASB)
Raymond C. Reese Research Prize.
American Society of Civil Engineers (ASCE).

Skiadopoulos, Andronikos (RESSLAB)
Outstanding Ph.D Thesis Distinction.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Rezvany, Negar (TRANSP-OR)
PhD mobility award.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Pougala, Janody (TRANSP-OR)
PhD mobility award.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Alahi, Alexandre (VITA)
Meta award for one of the most influential research labs in Europe AI 100 Most Influential Scholar Honorable Mention in Computer Vision.
AMiner.

Bertoni, Lorenzo (VITA)
PhD thesis Distinction.
Doctoral Program in Electrical Engineering (EDEE), EPFL.

Environmental Engineering Institute (IIE)

Milojevic, Tatjana (CRYOS)
Best Poster Award.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Ercolani, Chiara (DISAL)
Best Poster Award.
EPFL'S Environmental Engineering Institute (IIE).

Kellenberger, Benjamin Alexander (ECEO)
Award in Environmental Engineering and Sustainability.
Zeno Karl Schindler Foundation.

Tuia, Devis (ECEO)
President's Honorary Citation.
International Society for Photogrammetry and Remote Sensing (ISPRS).

De Jong, Aurélie Anne (ECEO)
Swisstopo EDU award.
Swiss mapping agency SWISSTOPO.

Rinaldo, Andrea (ECHO)
Faculty Fellow.
Hagler Institute of Advanced Studies at Texas A&M.

Lemaitre, Joseph Chadi (ECHO)
Best PhD Thesis.
Doctoral Program in Civil and Environmental Engineering (EDCE), EPFL.

Barry, David Andrew (ECOL)
Elected Member European.
Academy of Sciences.

Pagani, Anna (HERUS)
Thesis Distinction.
Doctoral Program in Civil and Environmental Engineering (EDAR), EPFL.

Binder, Claudia R. (HERUS)
Elected Ordinary Member.
Academia Europea.

Roy, Arindam (LAPI)
Public Engagement Grant.
European Geophysical Union (EGU).

Baccarini, Andrea (LAPI)
Prix de Quervain.
Swiss Academy of Sciences.

Schaub, Aline Laetitia (LCE)
Best Oral Presentation.
Swiss Chemical Society.

von Gunten, Urs (LTQE)
Award for Creative Advances in Environmental Science and Technology.
American Chemical Society.

Grossiord, Charlotte (PERL)
Mercator Fellow.
German Centre for Integrative Biodiversity Research (iDiv), German Research Foundation (DFG).

Gaume, Johan (SLAB)
Early Career Scientist Award.
International Union of Geodesy and Geophysics (IUGG).

Porté-Agel, Fernando (WIRE)
Polysphère Award.
EPFL's School of Architecture, Civil and Environmental Engineering (ENAC).

2022 Students awards

Architecture Section (SAR)

Valentine Aellen
Prix de la Fondation Arditi

Anne-Sophie de Pesters
Prix de la Fondation Arditi

Céline Carrière
Prix Mita Krafft Gloria Prix des meilleurs énoncés théoriques

Alexandre Gameiro
Prix de la Ville d'Ecublens

Michael Göhring
Prix SIA Vaud

Iweins D'Eeckhoutte
Prix Mita Krafft Gloria

Charlotte Jianoux
Prix BG – «Construction et développement durable»

Michel Kyra
Prix des meilleurs énoncés théoriques

Olivier Lalancette
Diplôme «Finaliste du Prix Arditi»

Emma Larcelet
Prix Mita Krafft Gloria

Jérémie Lysek
Diplôme «Finaliste du Prix Arditi»

Benoît Meylan
Prix des meilleurs énoncés théoriques

Jeremy Morris
Prix de la Fédération Suisse des Architectes (FAS) Romandie

Joanne Nussbaum
Prix SIA Vaud (Mention)

Maylis Pillet
Prix SIA Vaud

Cléa Quillet
Prix des meilleurs énoncés théoriques

Nicolas Sacha
Prix des meilleurs énoncés théoriques

Ronan Schubnel
Diplôme «Finaliste du Prix Arditi»
Prix Mita Krafft Gloria

Pierluigi Surano
Prix de la Ville d'Ecublens

Marie Walliser
Prix SIA Vaud

Simon Wüst
Prix Orlando Lauti
Prix Mita Krafft Gloria

Beate Zavadska
Prix des meilleurs énoncés théoriques

Civil Engineering Section (SGC)

Diogo De Almeida Sousa
Prix Pegurri

Elena Canomeras
Prix de l'Institut d'Ingénierie Civil, EPFL

Nathan Kempter
Prix Sarada M. et Raju A. Vinnakota
Prix de l'Union patronale des ingénieurs et des architectes vaudois (UPIAV)
Prix de la Société suisse du génie parasismique et de la dynamique des structures (SGEB)

Romain Leiglon
Prix IM Maggia Engineering SA

Jolan Loisel
Prix SIA Vaud (Meilleur projet de master)

Thibaud Maillard
Prix de la Société suisse du génie parasismique et de la dynamique des structures (SGEB)

Nicolas Richter
Prix Citec

Michael Stirniman
Prix de l'Institut d'Ingénierie Civil

Environmental Science and Engineering Section (SSIE)

Alexis Barrou
Prix Durabilis

Sylvain Clément
Prix Géosuisse (Société suisse de géomatique et de gestion du territoire)

Jean-André Davy-Guidicelli
Prix Durabilis

Corinna Frank
Prix de la Société Académique du Valais

Loé Maire
Prix Durabilis

Clara Streule
Prix CSD Ingénieurs Conseils SA
Prix SIA

Pierre Veron
Prix Géosuisse (Société suisse de géomatique et de gestion du territoire)

Sébastien Will
Prix CSD Ingénieurs Conseils SA
Prix Association des Ingénieurs Géomètres de Suisse Occidentale (IGSO)

Appointments

Dr. Alfredo Thiermann, previously a lecturer at Harvard University, was appointed tenure track assistant professor of architectural history and theory at ENAC in Lausanne on 1 June 2022.

Thiermann's research sits at the crossroads of architecture and different media, encompassing sound installations, film scenography, private houses, public buildings, large-scale infrastructures and more. Another of Thiermann's research interests is the transition from the industrial to the digital age. Thanks to his cross-sectoral vision of architecture, Thiermann is making a key contribution to our school's strategic clusters in the areas of digital infrastructure, and cities and sustainable territories.

Prof. Pier Vittorio Aureli, previously a professor at Yale University and visiting professor at EPFL, and co-director of an architecture firm in Brussels, was appointed associate professor of architectural and environmental theory at ENAC in Lausanne on 1 September 2022.

Aureli's research explores the principles of architectural theory in the light of the current social and political context, and examines the role of theory and its influence on architectural and environment-related design methods. Aureli is currently regarded as one of the world's most influential practitioners in the area of architectural and environmental theory. His appointment gives ENAC and EPFL as a whole a unique opportunity to become undisputable leaders in this vital research field.

Dr. Ianina Altshuler, previously a postdoctoral fellow at the Norwegian University of Life Sciences, was appointed tenure track assistant professor of environmental engineering at ENAC in Sion on 1 August 2022.

Altshuler's research looks at the environmental adaptation strategies of microorganisms in the cryosphere in alpine and polar regions, with a focus on the effects of global warming and widening temperature fluctuations. Her research at ENAC aims to improve our understanding of ecological adaptation strategies in hostile environments. Her appointment has enhanced our school's scientific influence and the quality of the education we provide.

Dr. Sara Bonetti, previously an assistant professor at the University of Wageningen, Netherlands, was appointed tenure track assistant professor of environmental engineering at ENAC in Sion on 1 September 2022.

Bonetti is studying processes in soil surfaces, ecosystems and water on a variety of spatial and temporal scales. Her work examines hydrological and geomorphological mechanisms to gain a quantitative understanding of soil erosion and the development of land surfaces. Her appointment has strengthened our school's ties with other research institutes, including WSL, thus boosting our influence in this important field of research.

Appointments

Dr. Gabriele Manoli, previously a lecturer at University College London, was appointed tenure track assistant professor of architecture at ENAC in Lausanne on 1 September 2022.

Manoli's research investigates water supplies, energy exchange mechanisms and the carbon cycle in urban and suburban systems. His interdisciplinary approach draws on environmental technology and infrastructure and urban planning. At ENAC, he's looking primarily at the global trend towards urban densification and the effects of urban climate alterations (such as through greening measures). His appointment has anchored the role of ENAC, and of EPFL more broadly, in this research field of vital importance to society.

Prof. Jérôme Chappellaz, previously the research director at the National Centre for Scientific Research (CNRS), France, was appointed full professor of environmental engineering at ENAC in Sion on 1 November 2022.

Chappellaz's field of research is polar science and the biogeochemical cycles of greenhouse gases. His work has resulted in significant breakthroughs and a patent, along with numerous distinctions such as a 2011 ERC Advanced Grant and a 2016 ERC Proof of Concept Grant. Chappellaz's appointment at ENAC has given us, and EPFL, a unique opportunity to become a key player in a field that's of major relevance to society.

Dr. David Ruggiero, previously a design engineer at Read Jones Christoffersen Ltd. in Toronto, Canada, was appointed tenure track assistant professor of structural design and engineering at ENAC in Lausanne on 1 September 2022.

Ruggiero's research aims to obtain a better understanding of the behavior of reinforced concrete structures and structural elements made from cementitious materials. His achievements include developing a new theoretical model, known as the General Crack Component Model, which can be applied to a broad range of cementitious materials. He now intends to concentrate his efforts on sustainable materials and extending the life of infrastructure, while also contributing to multidisciplinary projects at EPFL.

Dr Wenyu Gu, previously a postdoctoral scholar at Stanford University, was appointed tenure track assistant professor of environmental engineering at ENAC in Lausanne on 1 January 2023.

Gu is a microbiologist whose research combines bioscience, biotechnology, bioinformatics and mathematical modeling. She has a particular interest in the use of microbes for energy production, environmental remediation and improving human health. At ENAC she's applying her specialist knowledge to water supply infrastructure and wastewater treatment systems. Gu has won a number of awards and is helping bolster our school's impact in an important research area.

Appointments

Prof. Martin Ackermann, the new director of Eawag, was appointed full professor of microbial system ecology at ENAC on 1 January 2023.

Ackermann's research focuses on the biology and ecology of bacteria in the environment. He worked as a professor at ETH Zurich and spent ten years as head of a 50-strong research department at Eawag, where he spearheaded solution-oriented research in the field of aquatic microbiology. From April 2020 to July 2020 he served as Vice Chair of Switzerland's National COVID-19 Science Task Force, and as its Chair from August 2020 to August 2021.

Prof. Brice Lecampion was appointed head of ENAC's Civil Engineering Section (SGC) in the ENAC School on 1 September 2022.

Lecampion joined ENAC as tenure track assistant professor and head of the Geo-Energy Lab – Gaznat Chair on Geo-Energy in 2015. He was promoted to associate professor in 2021. On 1 September 2022, he took over as head of the Civil Engineering Section for a two-year term, succeeding Prof. Lyesse Laloui, who had led SGC since 2012.

Promotions

Prof. Rizlan Bernier-Latmani was promoted to full professor of environmental microbiology at ENAC on 1 April 2022.

Bernier-Latmani's research explores the biological degradation of toxic metals and radionuclides by microorganisms. In her field experiments, she uses concepts and techniques from a variety of disciplines including microbiology, molecular biology, analytical chemistry (e.g., X-ray spectroscopy) and geochemistry. She was awarded an ERC Consolidator Grant in 2017. Bernier-Latmani is a role model for women in science; encouraging the advancement of women is one of the causes she's committed to at EPFL.

Elena Cogato Lanza, previously a senior scientist, was promoted to adjunct professor at ENAC on 1 August 2022.

Cogato Lanza is a leading researcher in the history and theory of urban planning. Her inter- and trans-disciplinary work in the fields of architecture, urban planning and ecology is making a significant contribution to improving our understanding of sustainable urbanization and sustainable territories.

Prof. Marie Violay was promoted to associate professor of rock mechanics at ENAC on 1 June 2022.

Violay studies the mechanical and physical properties of underground rock materials for applications in geothermal energy production, carbon sequestration, nuclear waste disposal and more. She has received several distinctions including a 2017 ERC Starting Grant. Her appointment has advanced our work in the strategic area of energy and sustainability and strengthened our efforts in the fight against climate change. Violay will play an important role in helping Switzerland retain its leading position in the fields of rock mechanics and rock physics.

Departures

Prof. Roberto Gargiani, full professor of history of architecture and construction at ENAC, retired on 28 February 2022.

Gargiani joined EPFL as a visiting professor in 1999 and was appointed full professor in 2004. His extensive research focuses primarily on the use of concrete. Gargiani was the head of ENAC's History and Theory of Architecture Laboratory (LTH3) and gave many talks and seminars that played a key role in the education provided at ENAC, helping to enhance our school's reputation. Gargiani has been honored by a number of awards. He was an asset to EPFL for more than two decades, inspiring thousands of students. We thank him warmly for his exceptional contribution to our school.

Prof. Jean-Louis Scartezzini, full professor of building physics at ENAC, retired on 30 November 2022.

Scartezzini studied at EPFL before holding various posts at both EPFL and universities outside Switzerland. He returned to EPFL as an associate professor in 1994. His research looks mainly at energy efficiency and the use of renewable energies in the built environment, with the goal of helping to reduce buildings' energy use. Scartezzini has won many awards, has an impressive list of publications and has been elected to numerous committees thanks to his broad expertise and international standing. We thank him warmly for his exceptional contribution to our school.

Prof. Edgard Gnansounou, adjunct professor at ENAC, retired on 31 July 2022.

Gnansounou graduated from EPFL with a civil engineering degree in 1983 and a PhD in 1991, completing his thesis on energy planning. He was hired by EPFL as a lecturer in 2006 and then appointed adjunct professor in 2011. Gnansounou began working in EPFL's Energy Systems Laboratory (today the BPE) in 1983 and was put in charge of the lab in 2003. BPE studies systems for incorporating renewable energy on a large scale into today's mostly fossil-fuel-based power grids. Alongside his role as the head of BPE, Gnansounou led a number of cross-disciplinary projects in Europe, Latin America, Asia and Africa. We thank him warmly for his exceptional contribution to our school.

Prof. Janet Hering, full professor of environmental biogeochemistry at ETH Zurich and full professor of environmental chemistry at ENAC, retired on 31 December 2022.

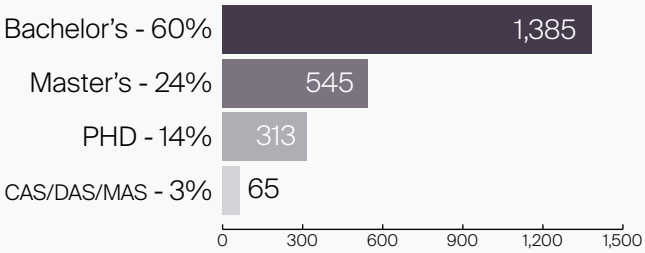
Hering joined ETH Zurich in 2007 as a full professor and director of Eawag; in 2010 she was appointed full professor at EPFL. Hering's research interests include techniques for making contaminated water drinkable, the biochemical behavior of trace metals, and the exchange of knowledge between researchers, policymakers and practitioners. A multi-award-winning researcher, Hering was and still is a member of several international scientific bodies. We thank her warmly for her exceptional contribution to our school.

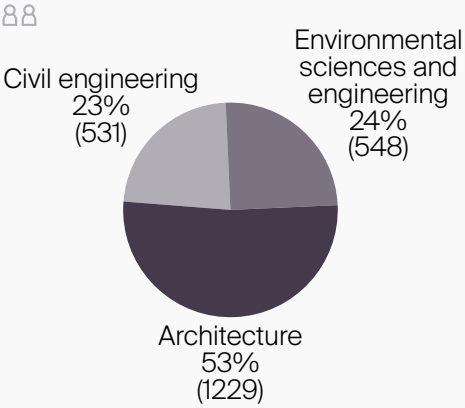
2022 key figures

Education

2,308
Students*

45% Women
55% Men





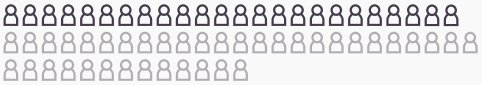
602
Degrees

*incl. visiting students

Research

627
Researchers

39% Women
61% Men



76
Research units

912 publications by ENAC labs

Main national and international research grants

SNSF: 23
Innosuisse: 6
Swiss Federal Offices: 15
EU programs: 13

Source: EPFL GrantsDB & grants/lab. Grants signed in 2022

Innovation

4 startups created by ENAC researchers or students

29 research and technology-transfer agreements

Staff

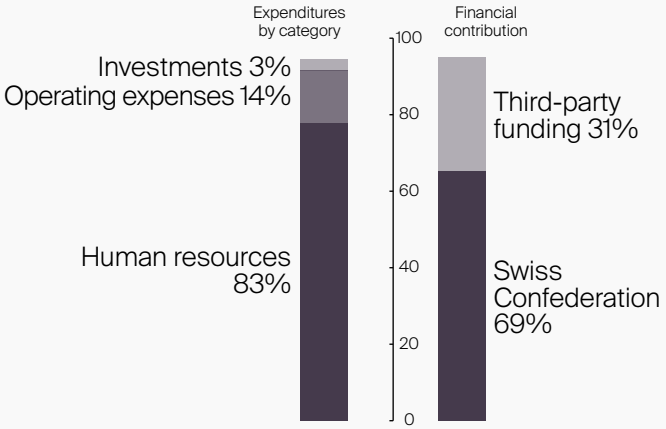
829 (687 FTEs) employees

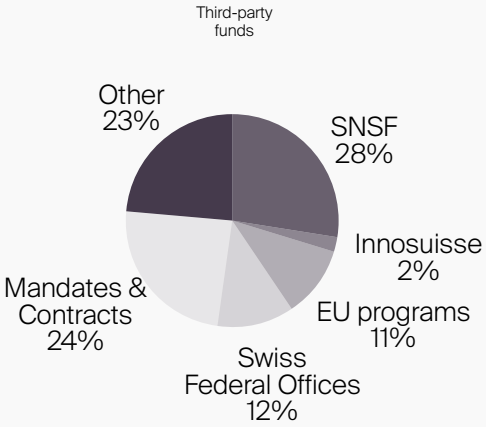
41% Women
59% Men

68 nationalities

Budget

95 MCHF total budget





Data sources: EPFL, December 2022

Impressum

Contributors

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