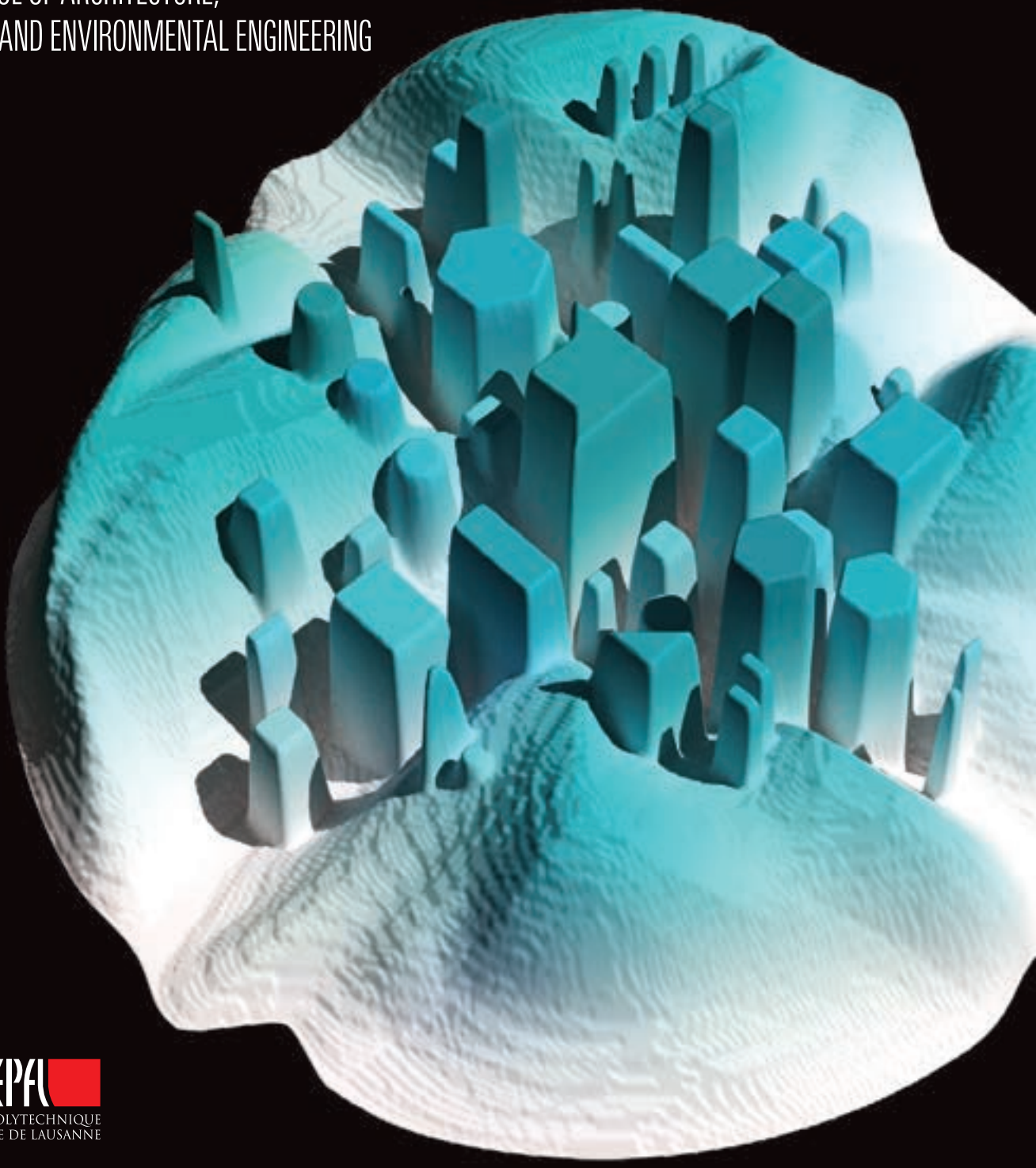
FINDING SOLUTIONS FOR

A SUSTAINABLE FUTURE

ENAC

SCHOOL OF ARCHITECTURE,
CIVIL AND ENVIRONMENTAL ENGINEERING



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

DESIGN & BUILD TOGETHER

FOREWORD

We are delighted to present the 2012 edition of our annual report. This report highlights another year of positive growth, outstanding graduating classes, important scientific progress, and the continued development of strong links with the other research institutes in the ETH Domain, Federal and Cantonal offices, and the Professional Associations. We trust you will enjoy reading some highlights from our research in sustainable development, energy, urban systems, and the built environment.

To learn more about the School and how you might become more involved, we invite you to attend the ENAC "Assemblée générale" in October 2013 and in May 2014 the ENAC "Research Day".

ENAC continues to grow spectacularly, more than doubling the number of Bachelor, Master, and PhD students over the past decade, with continued development of cutting edge research and further enhancement of vital connections with academic and industrial partners in Switzerland and around the world. Whether it is through increasing the availability of sustainable energy from wind or water, making our infrastructure more effective, reimagining abandoned sites in our cities, or by developing engineering and architectural solutions to minimize our impact on the earth, ENAC remains dedicated to its goal of finding solutions for a sustainable future.

We are particularly pleased to announce the Chair "Gaz naturel" Petrosvibri directed by Professor Lyesse Laloui and the Margaretha Kamprad Chair of Aquatic Sciences and Limnology headed by Professor Alfred Wüest, who joins us with an EAWAG joint appointment. We are grateful to continue to strengthen our ties with EAWAG through this fifth joint faculty appointment. The new Director of WSL, Professor Konrad Steffen, has also joined ENAC reinforcing connections with WSL that began with the joint appointments of Professors Alexandre Buttler and Michael Lehning.

We would like to warmly congratulate Professor Andrea Rinaldo for his richly deserved nomination as member of the US Academy of Sciences and Professor Anton Schleiss for winning the prestigious 2012 Agepoly teaching award. We know that you will enjoy reading and discovering more about ENAC and are especially grateful to Ms Claire Hofmann and Mr Jan Overney who did another fantastic job making this report possible.

On a personal note, I have enjoyed immensely my time as Dean of ENAC and have been rewarded every day by the genuine joy, energy and enthusiasm of all our students, staff and faculty and the strong connections built with our Alumni, many short and long-term visitors to the School and the professional groups we collaborate. ENAC is a special School with the highest of academic expectations and I am sure you join me in warmly welcoming the new Dean, Professor Marilyne Andersen, who takes on this new responsibility in September 2013.

Best personal regards,

Marc Parlange, ENAC Dean

CONTENT

FROM WASTELAND TO OPPORTUNITY

LONG IGNORED, URBAN FALLOWS HAVE BECOME A VALUABLE RESOURCE FOR URBAN DEVELOPERS.

Laboratory of Architecture and Sustainable Technologies (LAST)

http://last.epfl.ch

Emmanuel Rey, Director

There is no single best way to build sustainable neighborhoods

With the number of urbanites, city dwellers, on the rise, cities are under pressure to accommodate more and more residents and satisfy their needs and demands – ideally without spilling over the already built perimeter. For urban sprawl, the spreading of urban activities onto previously uninhabited land, goes against the precepts of sustainable development. Loosely connected built areas squander space and spoil the landscape. Studies have shown that they lead to higher energy consumption per capita, increased reliance on cars, and much higher infrastructure costs than dense settlements. And urban sprawl has been associated with increasing social disparity.

Over the past decade architects and urban developers seeking to sustainably develop their cities have given urban wastelands – large plots of land left abandoned following the shutting down of factories, railway lines, military sites, hospitals, or other infrastructures – a second life, as contemporary residential, commercial, institutional and public areas. The facts that they tend to be located within urban areas, that they are already tied into the transportation and public utilities networks, and that they are lying idle make them ideal candidates for this type of transformation.

In Switzerland, urban wastelands cover a surface larger than the city of Geneva, and have the potential to absorb the population growth expected for the coming decade. But transforming them sustainably is challenging. According to Professor Emmanuel Rey, from the Laboratory of Architecture and Sustainable Technologies (LAST), it isn't enough to increase density to a certain value, recycle an optimal fraction of wastewater and locally produce solar energy. "It is essential that we optimize the economic and environmental performance of cities. But to achieve true sustainability, this must be done keeping in mind the social and emotional dimensions as well," he says.

What makes a neighborhood truly sustainable? Rey says that it must satisfy a wide range of criteria: optimal coordination between urbanization and mobility, high quality sustainable buildings, accessible and attractive public spaces, local services, and a level of social and functional mixing. The result should be a neighborhood that provides a high quality of living to its residents in the heart of the city.

As the vast expanses of urban wastelands suggest, the transformation from a fallow to functioning eco-neighborhood is rarely spontaneous. According to Rey, three key elements are essential for success. First, it takes a trigger to start the process: a new vision for the site, an objective imposed by the urban planning authorities, or a private initiative. Then, the site has to morph into its new role in the minds of those involved – architects, engineers, project developers, pushing them to go beyond "building as usual" and envision bold solutions to the problems they run into. And once under construction, it has to be subject to a regular monitoring process, to ensure that it is being developed sustainably. "Once regenerated, the result can serve as a trigger for transformations on neighboring areas, as you can see right on our doorsteps in Malley, on the outskirts of Lausanne, where a new train station has triggered a wave of urban development on disused sites" says Rey.

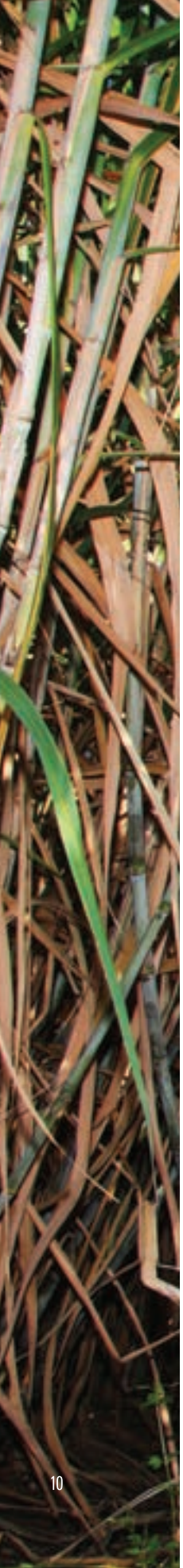
"By regenerating derelict sites cities can grow without increasing urban sprawl."

Emmanuel Rey

But monitoring the sustainability of a neighborhood is a tricky business. Not everything can be captured in numbers, and qualitative criteria can lack objectivity. Rey developed a system of operational indicators that helps combine the best of both worlds, which he applied to the sustainable regeneration of the site on which the Ecoparc neighborhood in Neuchâtel now stands. Besides assisting urban developers and architects in the decision making process, the tool also offers a shared vocabulary, making it much easier to communicate on these issues. "In the near future," he says, "we plan on continuing the development of this system and on testing it beyond Swiss borders to evaluate its performance in different climates and regulatory environments."

One thing is clear. There is no single best way to build sustainable neighborhoods. The set of challenges varies with location and time, as does the optimal solution, and what worked in the past may be completely inadequate for the future. A case in point: according to projections made by the Swiss Federal Office of Statistics, by 2030, only roughly a quarter of all households will be home to more than two people. Existing houses and apartments were built for families with a mother, a father, two children and a dog. If the various actors involved in urban and architectural projects don't anticipate these kinds of structural changes, they will design houses that will not correspond to the societal needs in the future.

FOOD AND FUEL?



CAN WE GROW ENOUGH CROPS TO FEED THE PLANET AND FUEL OUR CARS?

Bioenergy and energy planning research group (BPE)

http://bpe.epfl.ch

Edgard Gnansounou, Director

In 1798, Reverend Thomas Robert Malthus wrote that, if left unchecked, population growth would outpace agricultural production and catastrophic famines that would rock humanity would ensue. Fortunately, the mechanization of agriculture proved him wrong and in recent decades, agricultural surpluses have been the norm in many countries, not the exception. But when food-prices skyrocketed in 2008, sparking protests around the world, the alarm bells went off again, and policies promoting biofuels took the heat. Understandably so, as biofuel production stands in direct competition with food production.

Despite the bad rap they have had in the press in recent years, biofuel's promise of being a low-carbon-footprint fuel source that works with today's technology makes its development an active field of investigation. The race is on to find sustainable ways of producing biofuels, especially since the EU has pledged to cover ten per cent of transportation fuels using renewable sources by 2020.

Professor Edgard Gnansounou, at the Bioenergy and Energy Planning Research Group, has made it his goal to show that the competition between food and fuel doesn't have to be a zero sum game. "We are looking into ways of producing biofuels that are fully compatible with the principles of sustainable development," he says. "I believe that it is possible."

Biofuels have been under development since the advent of the diesel engine, but their heyday came in the 1970s in Brazil. Drawing on Brazil's bountiful supply of sugar cane, extracting the sugar sirup, and fermenting it with bacteria, billions of liters of bio-ethanol are produced every year to propel the country's cars. Today, in the name of greenhouse gas reduction, corn, oil palms, jatropha, and a variety of other plants are cultivated around the world with the sole purpose of producing biofuels – bio-diesel or bio-ethanol – to reduce the carbon footprint of vehicle transport.

"While first generation biofuels stand in direct competition with the food production, we are studying technical, social, and environmental impact and feasibility of a second generation of biofuels," explains Gnansounou. These so-called second generation biofuels are produced using stems, husks, and other types of plant residues that we can barely chew.

"One of our projects centers on palm oil plantations in Brazil, where the palm oil trees are used in reforestation programs. The fruits they provide are used in first generation biofuel production. The empty fruit bunches provide the biomass needed to produce second generation biofuels," he says. By combining both approaches, biofuel yield could be increased without having to augment plantation size.

For the time being, second generation biofuel production is still in a pilot phase. The sugars that it relies on are harder to get to, typically trapped in ligno-cellulose, the hard material that makes wood wood. And while it works in the lab, some hurdles still have to be cleared before the process can be commercialized.

One of the main challenges is economic viability. A potential solution: the bio-refinery. Much like a petroleum refinery, a bio-refinery maximizes the value that can be extracted from the raw material, in this case, biomass. Biofuels could be made more affordable by selling expensive by-products to the pharmaceutical or cosmetic industries.

A second solution takes advantage of economies of scale, as increasing the size of production facilities decreases the cost of biofuel production. But with that come problems related to logistics. Only by combining plant residues from several plantations does it become possible to benefit from these economies of scale. But transporting the residues requires fossil fuels consumption and negatively impacts the biofuel's carbon footprint.

"In July 2012, we had the kick-off meeting of Swiss-Brazilian project that aims at addressing these and many other practical questions that stand in the way of sustainable biofuel production," says Gnansounou, who, thanks to this project, will soon have a handful of students working away on these issues.

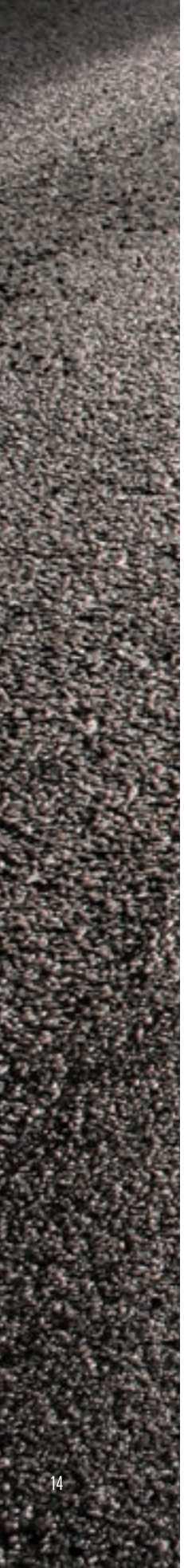
Contrary to Malthus, Gnansounou is confident that the planet has the resources to grow crops for both food and fuel, since he sees the bottleneck not in agricultural potential, but rather in governance. But unraveling those issues is a whole other story.

"We have to find a way to guarantee that biofuels are produced sustainably."

Edgard Gnansounou

The competition between food and fuel does not have to be a zero-sum game

PAVED TO LAST



WITH THE RIGHT BLEND OF ASPHALT, OUR ROADS CAN BE ADAPTED TO TOMORROW'S CLIMATE.

Traffic Facilities Laboratory (LAVOC)

http://lavoc.epfl.ch

André-Gilles Dumont, Director

Modern asphalts can help increase longevity and reduce noise, energy and CO_2 emissions

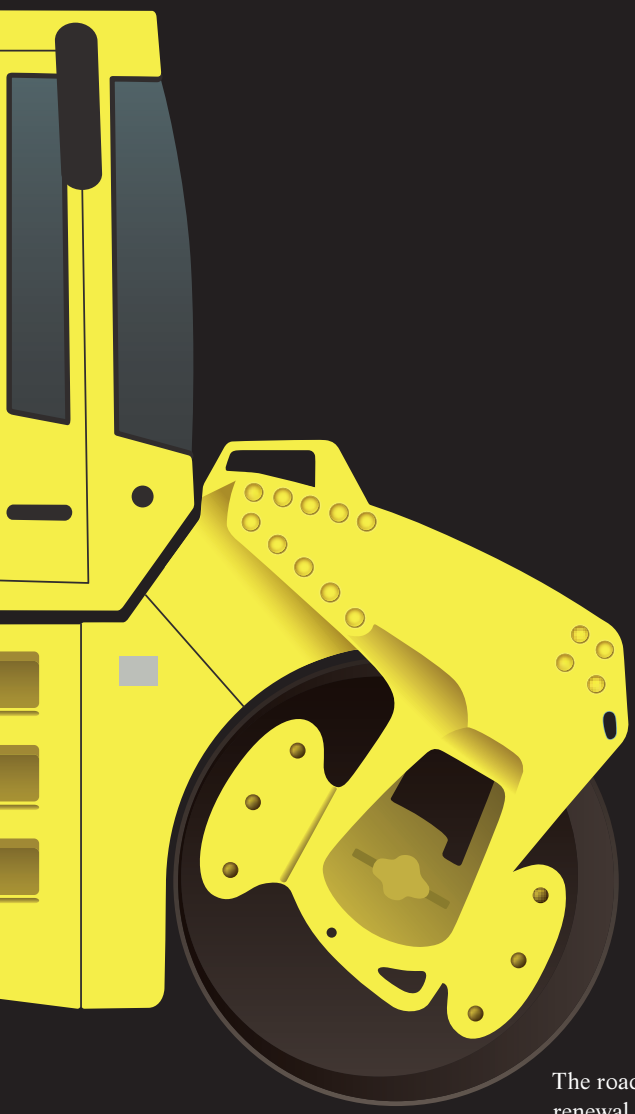
"Today's roads were designed to meet the demands of the past climate."

André-Gilles Dumont

When we think of climate change, we first tend to think of polar bears wandering helplessly on fast melting icebergs, cities buried under a thick curtain of smog, or wheat fields filled with withering crops. Behind these apocalyptic scenarios hide other more realistic and often insidious threats to our lifestyle that affect not only our natural environment, but our built environment as well. They can be found in infrastructure we rely on every day of our lives, but have grown so accustomed to that we take it completely for granted, such as road pavements. And that, despite the fact that "on any given day, more people walk on asphalt than brush their teeth," as Professor André-Gilles Dumont, Professor at the Traffic Facilities Laboratory, likes to say.

Dumont's group works mainly on a wide range of problems related to today's primary means of mobility: motor vehicle transport. Over the past decades, the infrastructure comprising the road network has hardly changed, but the number of cars and trucks that use it has gone through the roof. Coming to terms with this increase in load requires not only more robust construction materials, but also better traffic management schemes. On top of that, these advances have to be sustainable, from an environmental, social, and economic perspective. "Through our work, we try to build a knowledge base to assist those in charge of coordinating the rehabilitation of traffic infrastructure."

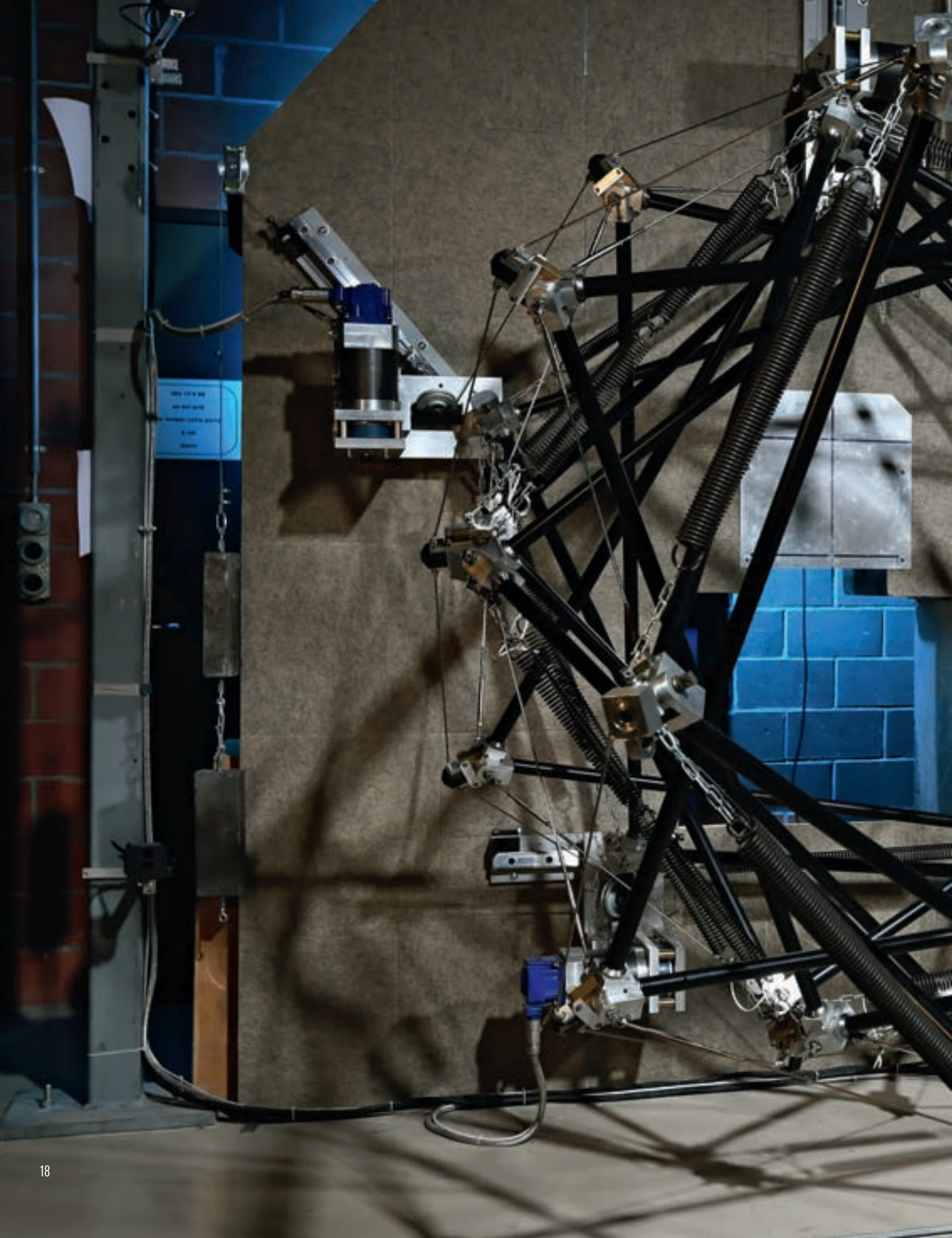
"We received a mandate from the Swiss Federal Roads Office to find out whether climate change would impact our roads, and if so, how best to prepare them in the face of these impending challenges," says Dumont. Roads are designed to provide a safe surface to carry traffic, whatever the weather. They freeze and thaw during the winter, expand and contract, and harden and soften with changing temperatures. All the while, cars, trucks and busses mercilessly drive up and down them. These effects add up and can lead to the formation of cracks and rutting. Roads are designed to endure this treatment for about two decades, but if the environmental conditions that they are exposed to change, their longevity can take a hit.



For his PhD project, Patrick Rychen, a former student in Dumont's lab, developed a framework to evaluate the impact of climate change on the Swiss road network, basing himself on predictions of future weather patterns from 18 global climate models. In Switzerland, he says, climate change is likely to have the strongest impact on roads in the warmest parts of the country – the Lake Geneva area and southern Switzerland. In the colder areas, especially at higher altitudes, some roads may actually benefit from climate change due to the reduction of freeze thaw cycles they will experience.

The road network is in a perpetual state of renewal. There are over 70'000 km of roads in Switzerland, and ensuring that they are in good condition is already a formidable feat of logistics and planning. "If all of a sudden we were to notice that increased rut formation made the average lifespan roads drop from 20 to 17 years, our budgets would explode!" says Dumont. Rychen's research shows that, by anticipating the changes in temperature expected for the next decades, this situation can be avoided. While in the cooler regions adapting the composition of the pavement would suffice, the warmer regions need a more thorough upgrade. High performance asphalts may provide the most optimal solution.

Other research projects analyze innovative asphalt mixtures, which are composed of different type of additive – water, wax, or some more complex chemical or polymer cocktail, bestowing the final road pavement with properties that are fine-tuned to address the required specifications. They are but one of a series of developments that are making our roads more sustainable. Hot mix asphalts are being replaced by a newer warm mix variant that can be rolled out with much lower greenhouse gas emissions. And asphalt recycling is increasingly becoming the norm. The impact is significant, says Dumont. "If you consider the extent of the road network, and the amount of asphalt that is consumed every year, these innovations, which may appear incremental at first glance, can go a long way."



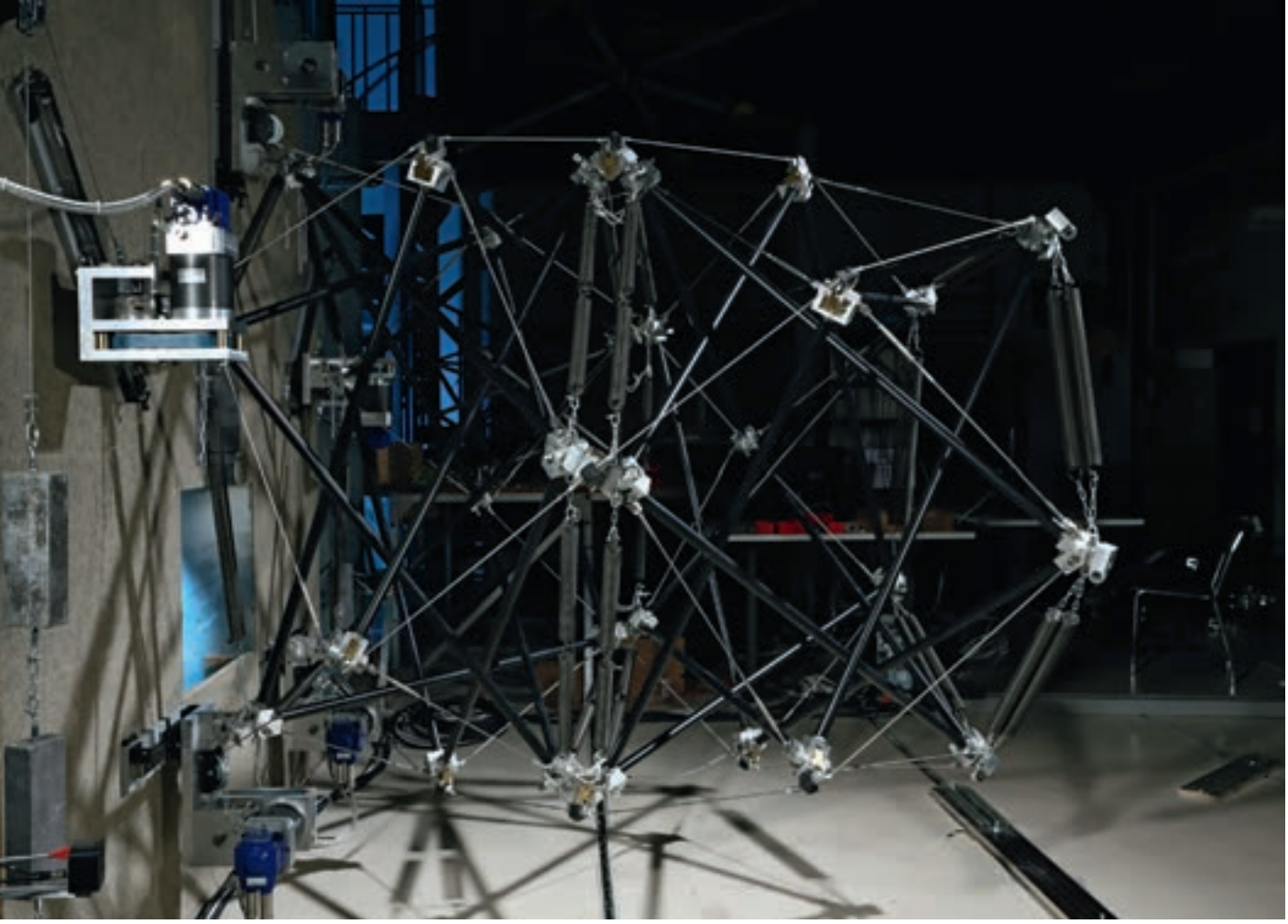
BOUNCING BACK

BY EXPLOITING SENSORS AND TODAY'S COMPUTATIONAL TOOLS, PROFESSOR IAN SMITH IS FINDING WAYS TO IMITATE NATURE'S DESIGN PRINCIPLES TO MAKE CIVIL STRUCTURES MORE RESILIENT.

Applied Computing and Mechanics Laboratory

http://imac.epfl.ch

Ian Smith, Director



Biological organisms have resilience hard-wired into their DNA. If a cow tips over, it knows how to get back up. If it breaks a leg, the bone will heal if provided enough time to rest. And if it catches a flu, it's immune system will most likely cure the disease. Contrast that to man-made structures, where small fractures, the structural equivalent of a flu, can go unnoticed until they lead to visible, irreversible damage. Costly interventions may fix the structure, but often demolition and reconstruction are the only solution.

Most man-made objects lack the biological equivalent of a nervous system to signal flaws or fractures before it is too late. But as Ian Smith from the Applied Computing and Mechanics Laboratory explains, technology has now reached the critical level needed for a paradigm shift. "These times are marked by a convergence of enabling technologies: cheap, portable, and lightweight sensors that can measure just about anything, and inexpensive computer hardware that is able to store and interpret the mass of measured data." As a consequence, Smith believes, in the future, cities, buildings, and structures will be more and more sensed. "The technology is ready. We "just" have to find the best way to put it into practice and then make sense of the data," he says. Although it sounds easy, there are hard scientific challenges behind doing this right.

"Biomimetics could be useful for all kinds of projects that are set in uncertain and challenging environments, such as nuclear power plants, underwater operations, or space missions."

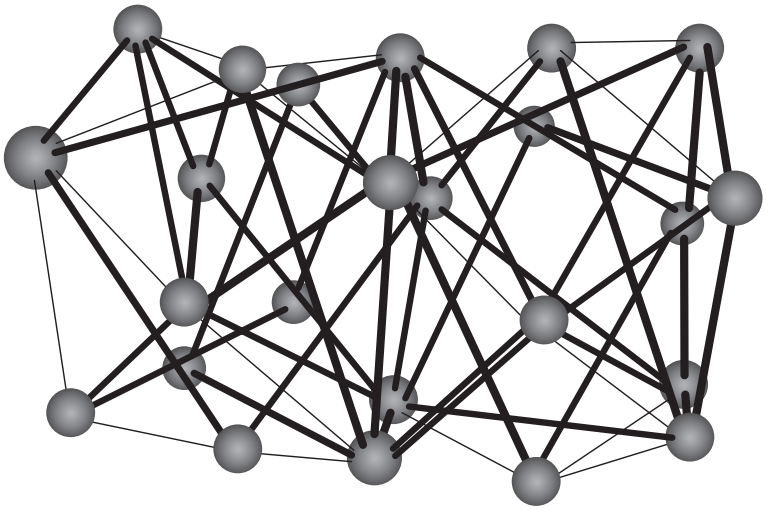
Ian Smith

But why bother? Wouldn't it be enough to improve construction techniques and develop more advanced computer models? No, says Smith, for two reasons. First, bridges and other civil structures are remarkably complex. Assumptions and simplifications made to model them mean that the models will never accurately represent reality. Second, without any way of knowing what is going on inside the structure, once completed, its performance cannot be evaluated. As a result, bridges, for instance, are often demolished and replaced once the time they were designed to last comes to an end or when they start to show signs of deterioration, even though they may well have another century or more in them.

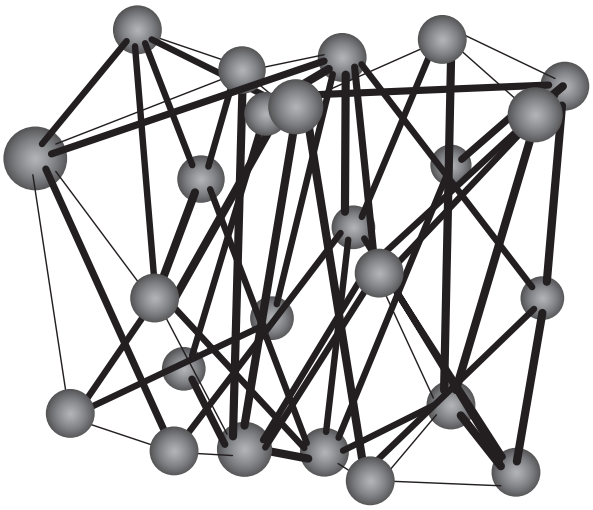
Sensors let engineers evaluate the performance of structures – bridges, tunnels, roads and pipes – by delivering a continuous stream of data on their vital statistics. If, against the expectations of the cautious engineer who originally designed the structure, it can still be deemed safe after its planned expiration date, its lifetime can be prolonged. And if the sensors indicate premature deterioration, these flaws can be addressed. Either way, the structure is made safer and more durable.

Now, researchers in Smith's team are going one step further, designing structures to respond automatically to the sensed data, much like the cow mentioned earlier. "We try to achieve resilience through a behavioral biomimetic approach, which involves learning, self-diagnosis and adaptation." In an ongoing research project, one of Smith's students is developing a deployable bridge structure, designed with these three goals in mind. The structure is composed of metal rods and wires. By adjusting the tension on the wires, the structure can change shape and adapt to different environments. "This type of biomimetics could be useful for all kinds of projects that are set in uncertain and challenging environments, such as nuclear power plants, underwater operations, or space missions," he says.

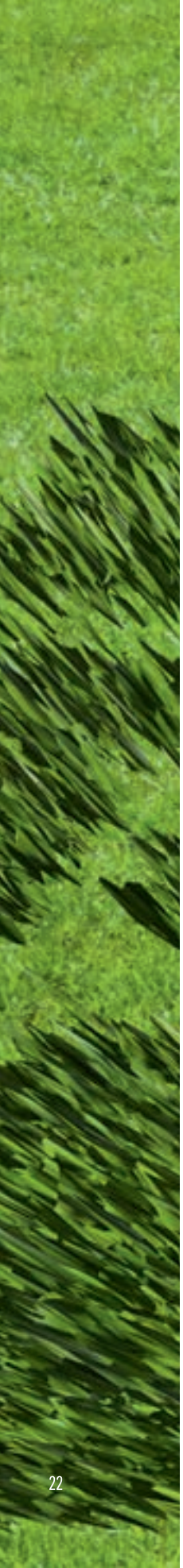
According to Smith, it isn't just about embedding sensors into a structure. Most crucially, it is about figuring out the best way to interpret the data. "Engineers are used to coming up with a single model to study a complex system, for example a bridge, which they then fine-tune based on measured data. I argue that we have to move away from this idea. Instead, we should focus on comparing what can be a huge number of models to our sensor measurements. By eliminating, or falsifying, all of the models that do not reproduce what our sensors are measuring, we are left with a population of models that work reasonably well." Predictions should be based on such a population of models, increasing the chances of accurately studying the system. But, Smith says, it is hard to promote this idea to a scientific community with deep-seated one-model habits. As they say, to people that have been dealing with brown shoes for their entire career, everything looks like a brown shoe...



In the future, cities, buildings, and structures will be more and more sensed



TRANS-PLANTING PLANTS



SOIL AND VEGETATION TRANSPLANTS GIVE INSIGHT INTO THE ELUSIVE IMPACT OF CLIMATE CHANGE ON MOUNTAIN PASTURE ECOSYSTEMS AND BIODIVERSITY.

Environmental Remote Sensing Laboratory (LTE)

http://ecos.epfl.ch

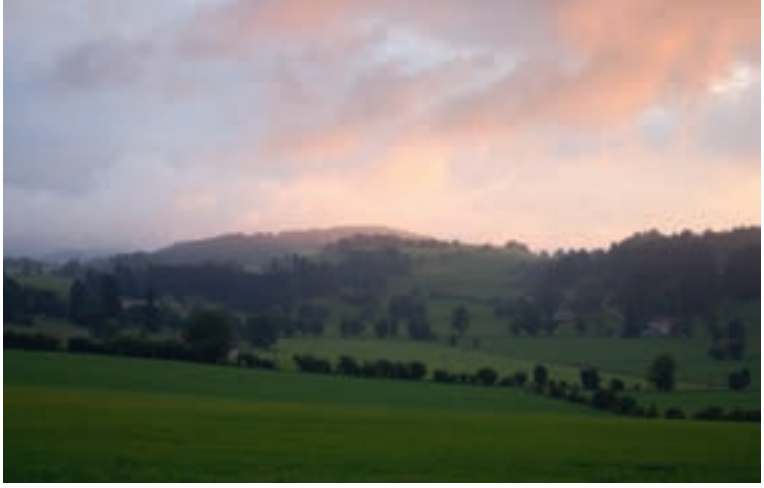
Alexandre Buttler, Director

Mixed pastures, a hallmark of the Jura landscape, are in steady decline

The Swiss Jura landscape, a mosaic of forests, pastures and human settlements is the result of centuries of co-evolution of nature and human activities. Plants continually conquer every niche available to them, while humans graze their herds on pastures, log the forests for wood, rely on the ground for drinking water, and use the rolling hills, lakes and plains for recreational activities. But a changing climate could unsettle the subtle balance that underlies this biologically and functionally rich region, says Alexandre Buttler. He would like to find out what can be done to minimize the impact of climate change on the habitat and resources that mountain ecosystems provide.

These questions have been addressed in over a dozen peer-reviewed articles, featured in three special issues of national and international journals. The articles are the final outcome of Mountland, an ambitious four-year project of the Competence Center Environment and Sustainability (CCES) that brought together researchers, policy makers and farmers from around Switzerland.

Alexandre Buttler is the director of the Ecological Systems Laboratory (ECOS) at ENAC, one of nine teams involved in the Mountland project. As an ecologist, he doesn't mind getting his and his students' hands dirty in the field. While others rely exclusively on computer simulations to assess the impact of climate change on plant biodiversity, Buttler and his team of researchers don't shy away from picking up a shovel.



In a unique field campaign, the ECOS team transplanted blocks of vegetation covered soil from three habitats – densely and moderately wooded, and open pastures – at a high altitude to two lower lying sites. By analyzing the transplants over three years, they were able to observe how the vegetation actually evolves when the average temperatures surrounding them go up by two and four degrees and annual precipitation drops. In the experiment, plants growing on open pastures fared worst, losing up to 40% of biomass, while those growing under moderate or dense tree cover were able to retain or even increase their productivity thanks to the buffering effect of the tree cover.

Mixed pastures with a moderate tree cover are therefore best adapted to sustain biodiversity and forage production in the Jura Mountains under warmer and dryer climate conditions. But the current evolution is going the other way. A historical analysis shows that socio-economic factors such as agricultural subsidies and the price of milk have made small productive pastures more attractive to farmers. As a result, trees are given free reign to encroach onto less productive ones, leading, over the years, to a segregation between open pastures and dense forests, with mixed pastures in a steady decline.

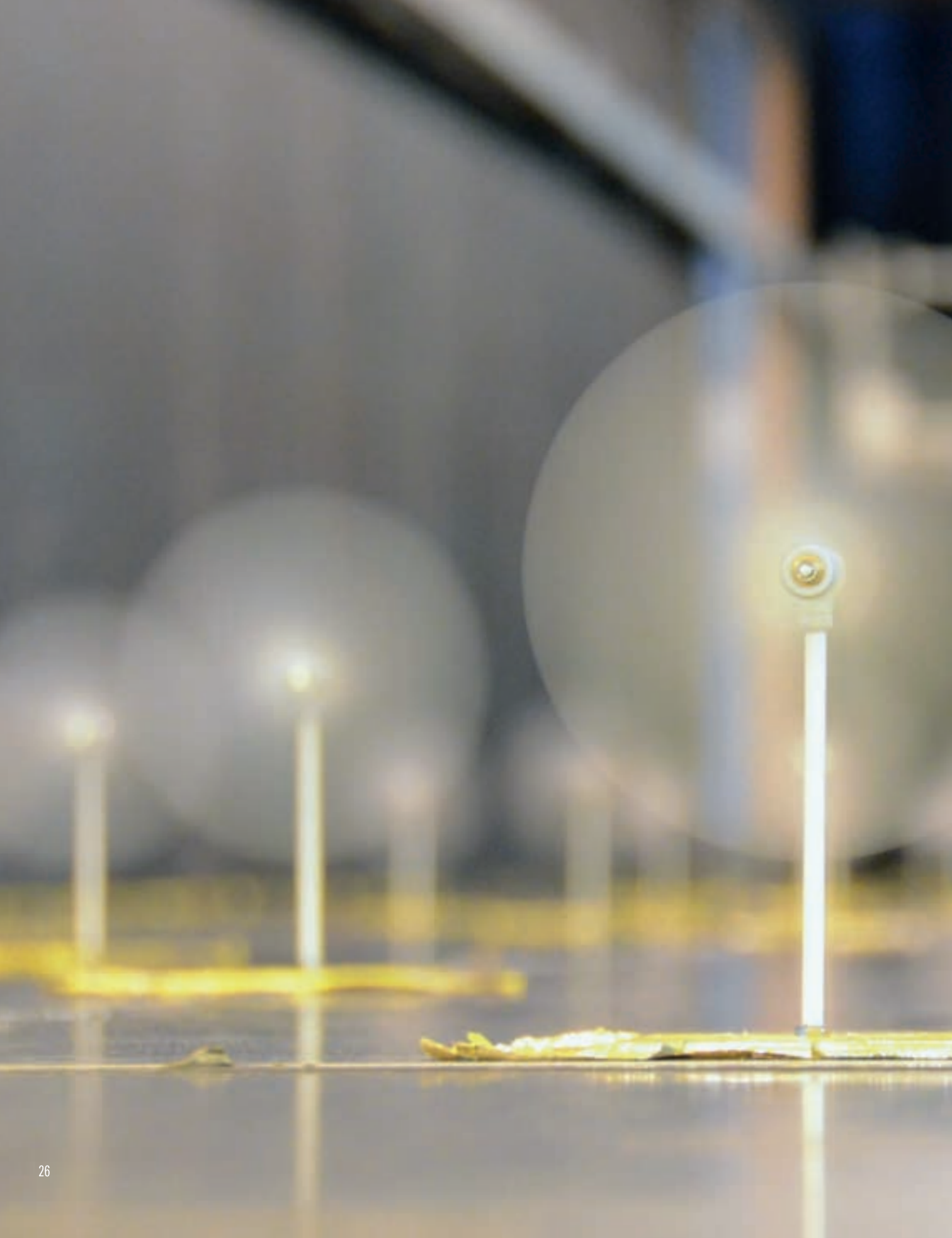
Simulations show that these trends are likely to continue. Using a combined vegetation and socio-economic simulation model, researchers working with Alexandre Buttler attempted to peer into the future and make predictions on how these mountain ecosystems might evolve in the face of climate change. They found that, overall, their functional and biological diversity is expected to decrease in the 21st century. Increasingly open pastures are likely to be exploited beyond their capacity, unsustainably, threatening the balance in this half natural, half artificial mountain ecosystem.

"By transplanting vegetation to different altitudes we can use nature to simulate a changing climate."

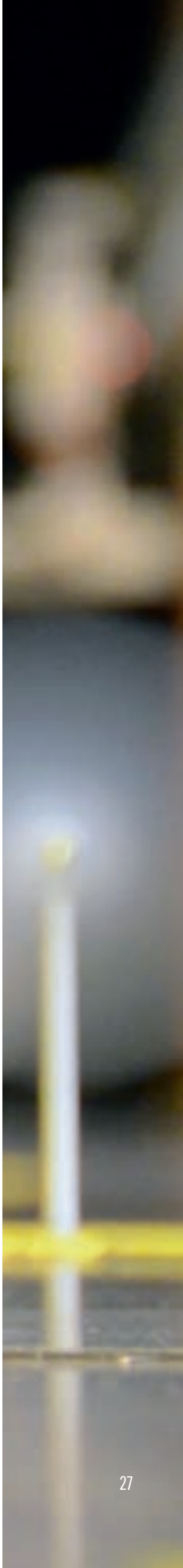
Alexandre Buttler

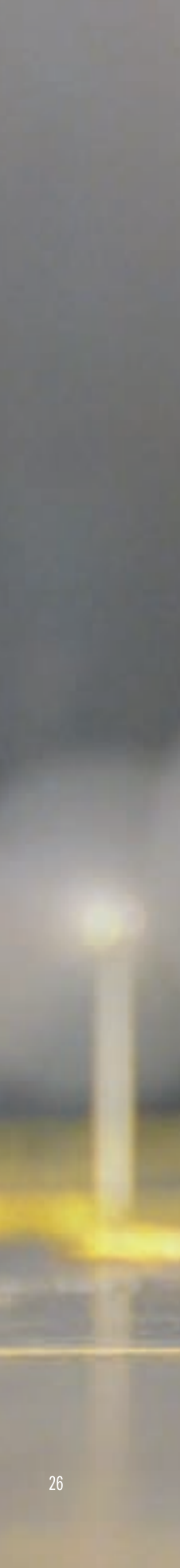
Addressing these issues, says Alexandre Buttler, will require innovative and adaptive management approaches, capable of responding to changing environmental and socio-economic conditions. Rather than imposing a single solution onto a diverse area, local conditions will have to be considered.

The Mountland project could be considered a dress rehearsal for the challenges that lie in store for the Jura and other mountain regions in the near future. And according to Buttler, the outcome of the project should be grounds for optimism. It showed that scientists, politicians, agricultural experts and farmers, can work together efficiently to develop new means of addressing these complex challenges. A perfect example of the kind of cross-cutting academic, political, ecological and economic initiative that will make these landscapes more resilient in a changing world.



UNRAVELED TURBULENCE



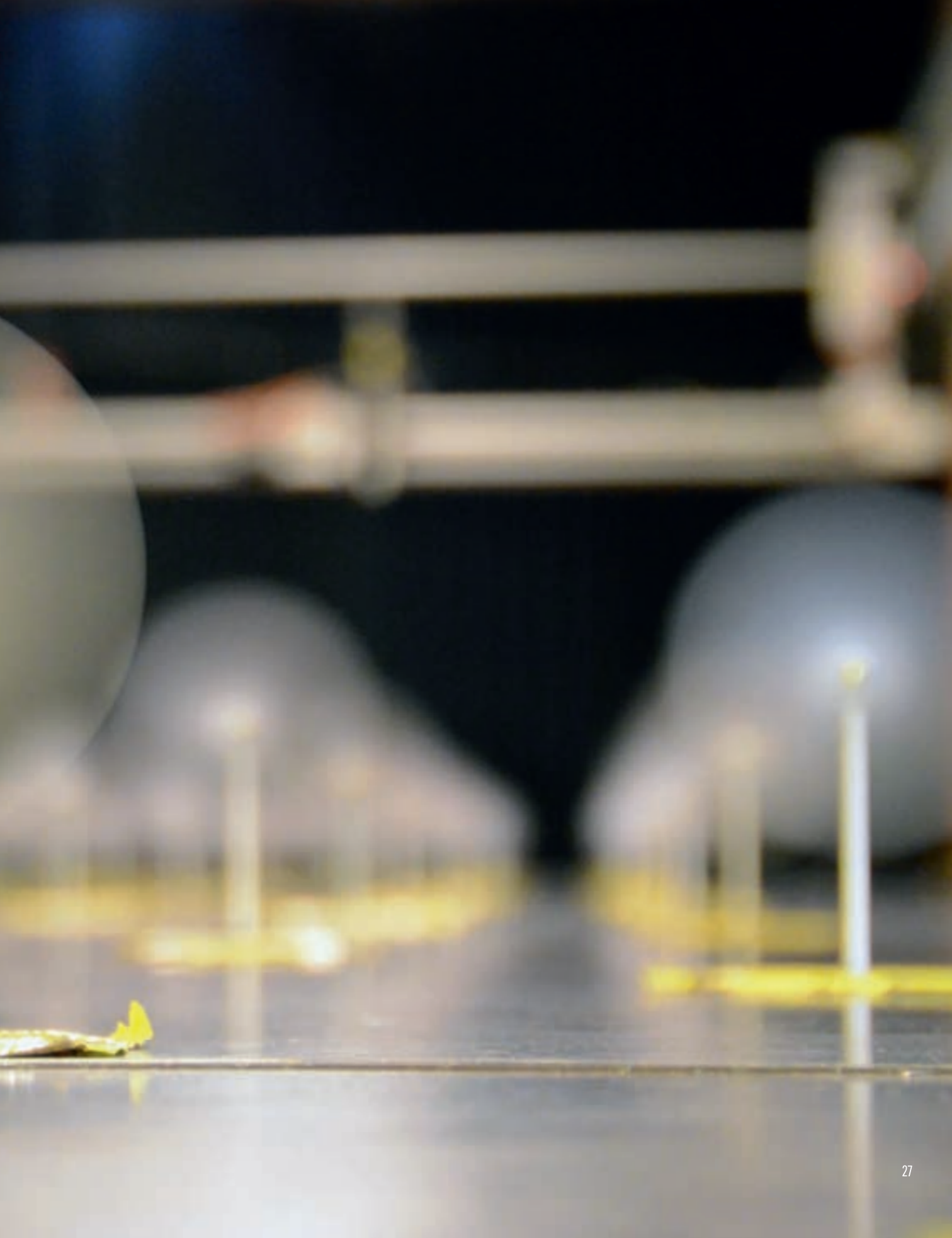


RESEARCHERS WORKING WITH FERNANDO PORTÉ-AGEL ARE USING LASERS TO MAKE INVISIBLE TURBULENCE VISIBLE.

Wind Engineering and Renewable Energy Laboratory (WIRE)

http://wire.epfl.ch

Fernando Porté-Agel, Director



Clear air turbulence has long been a nuisance and a hazard to planes and passengers. It is invisible, unpredictable, and tends to strike when it is least welcome, for example during the inflight chicken salad lunch. But turbulence also occurs closer to ground, and being able to see it, or simply getting a better grasp of it, would be an important step forward for aviation and other industries.

Wind power generation is one such industry. Although wind may flow smoothly into a wind turbine, the rotating blades that slice through the moving air stir it up into a chaotic collage of whorls – or turbulence. Since it takes time for this turbulence to die down, a second turbine further downwind will be driven by wind that hasn't yet had time to settle fully. This process can perpetuate itself through an entire wind farm and can lead to the often observed loss of productivity for downwind turbines; losses of up to 40 per cent in the worst known cases.

The trouble with turbulence is that it is difficult to measure. In wind farms, researchers usually rely on sensors mounted on poles or towers. But you just can't set up enough sensors at enough locations within and surrounding a wind farm to get an accurate picture of where the main whorls tend to be, how far they extend, and how long they persist.

Using beams of bundled light – lasers – researchers at ENAC have found a way to solve this conundrum. By shooting a laser beam into the air and measuring the light that is reflected back by humidity or tiny particles that are naturally present in the atmosphere, a lidar – the laser equivalent of a radar – can provide a detailed profile of the air it traverses – almost in real time.

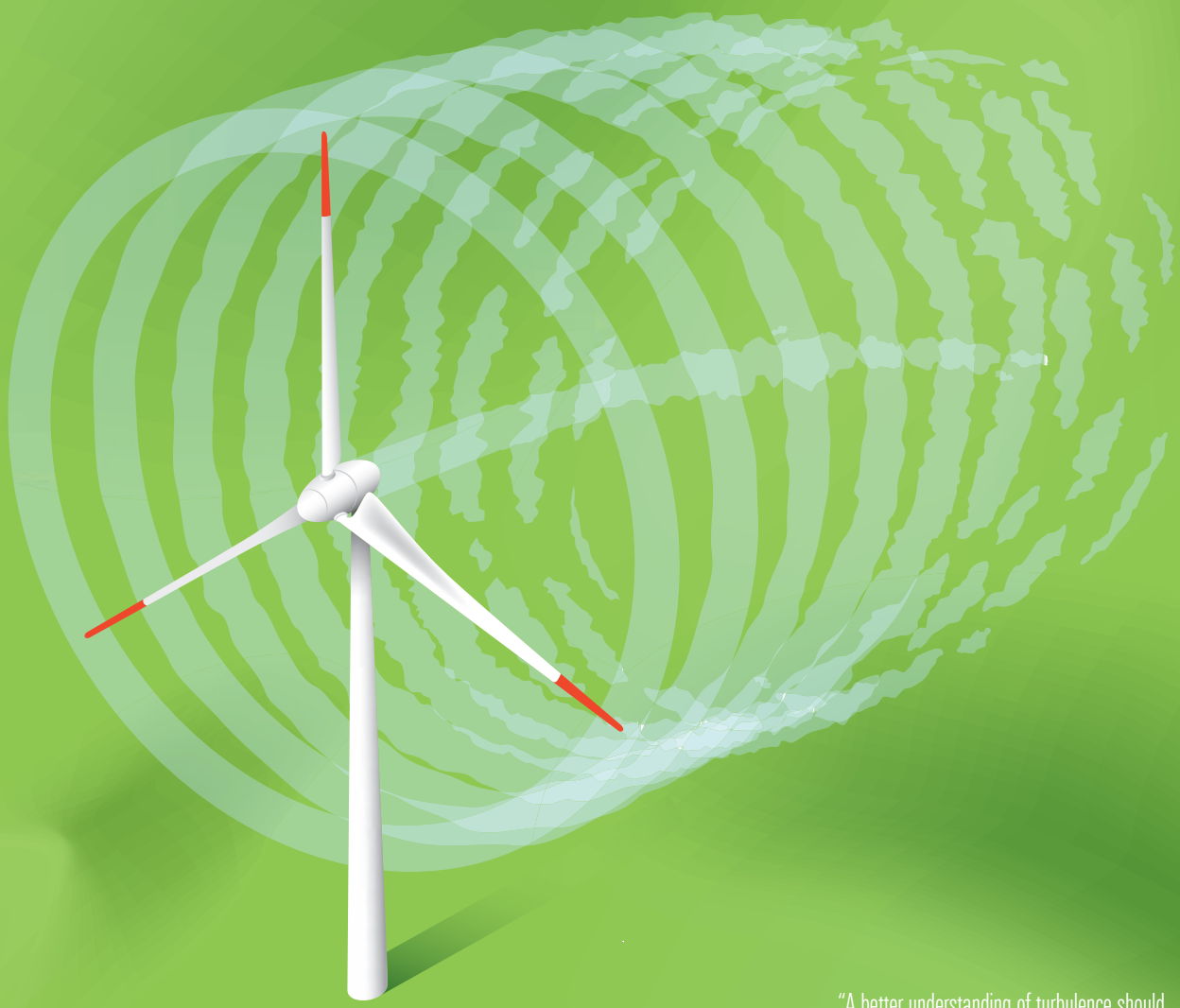
"Last year, for the first time, we used multiple lidars to measure the actual turbulent wake behind a wind turbine," says Fernando Porté-Agel, from the Wind Energy and Renewable Energy Laboratory. These field measurements, performed on a wind turbine near Martigny, in the canton Valais, can be used to confirm predictions made using computer simulations of wind blowing through wind farms. And they also provide data that are otherwise difficult, or even impossible, to obtain.

Turbulent phenomena are complex, and it often takes more than one single experimental method to identify and understand them. "In our wind tunnel experiments, we found that the turbulence created by a wind turbine settled faster when the atmosphere was most turbulent, for example on a hot day, when the warm ground heats the air just above it, and sets it in motion," says Porté-Agel. "Our computer simulations under the same conditions show the same behavior. And now, we would like to study the turbulence behind the wind turbines in Valais, Switzerland under these conditions to see if we can confirm this phenomenon outdoors and understand why it occurs."

In the long run, a better understanding of these phenomena should lead to improved design of wind farms, taking into account not only the arrangement of the individual turbines within them, but also the surrounding topography, climate, and dominant winds, ultimately leading to more efficient exploitation of these expensive infrastructure projects, says Porté-Agel.

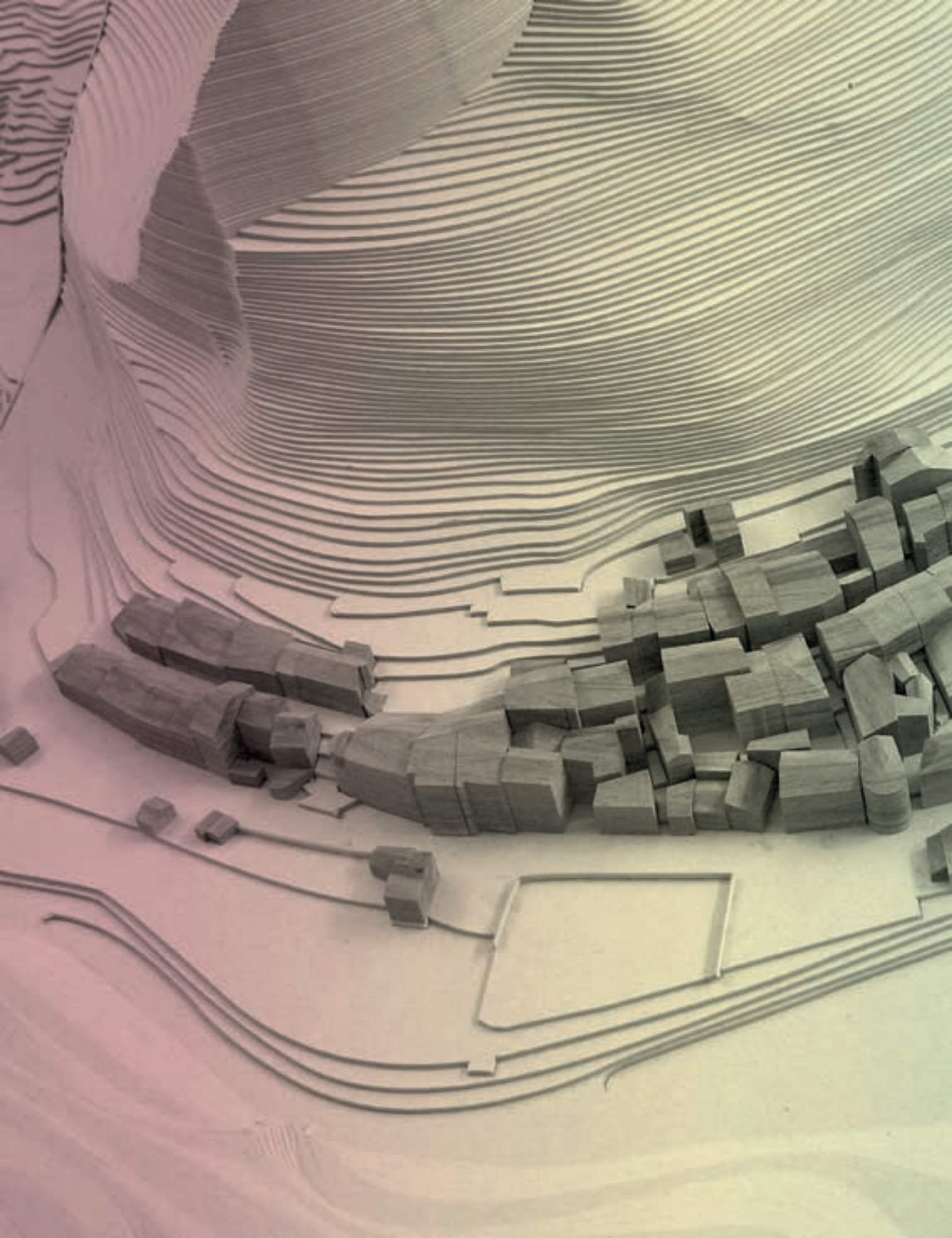
Their ability to visualize turbulence has already found applications in other fields. Solar Impulse, the lightweight solar airplane on a mission to fly around the globe without a drop of fuel, is so light that it gets bounced around by turbulence like a bird in a storm. At high altitudes the risk can be managed, but closer to ground, especially during take off and landing, a bounce in the wrong direction could be dangerous. Addressing this risk, members of Porté-Agel's group collaborated with Solar Impulse to develop a portable lidar-based solution to scan the air around the airfield for dangerous whorls. Once a green light is given, the pilot can be assured that the plane will safely glide down to the runway for touchdown.

Using lasers, invisible turbulence can be made visible



"A better understanding of turbulence should lead to improved design of wind farms, ultimately leading to more efficient exploitation of these expensive infrastructure projects."

Fernando Porté-Agel




IN REVIEW

RESEARCH HIGHLIGHTS

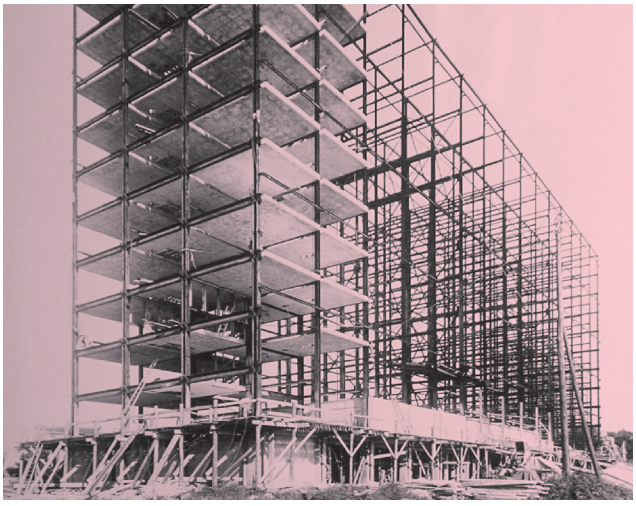
In our laboratories, some 70 lead researchers and their groups are advancing knowledge in today's most challenging areas of architecture, civil engineering and environmental engineering. Highlighted here is a sampling of some of the research conducted in 2012. To learn more about the latest studies by ENAC scientists, visit **http://enac.epfl.ch/research**

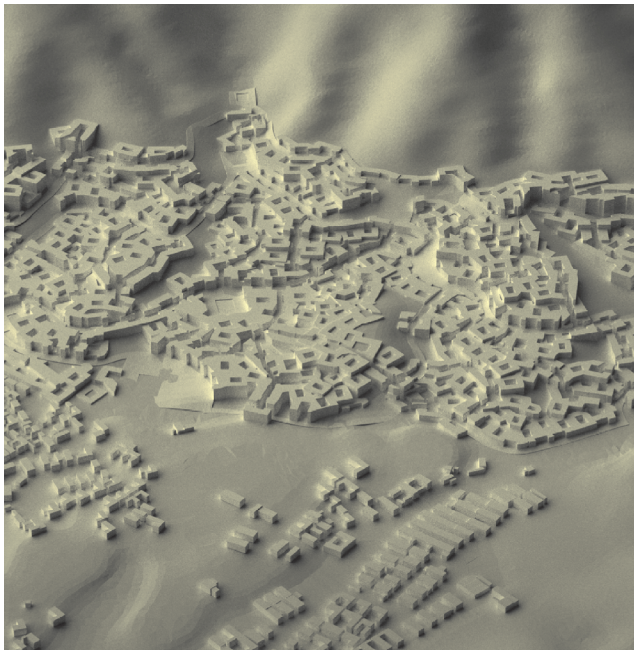
A CRITICAL ENCYCLOPEDIA OF RESTORATION AND RE-USE OF TWENTIETH CENTURY ARCHITECTURE

Twentieth century architecture abounds. Built *en masse* and often on a tight budget, today many of these buildings are in need of restoration. Professor Franz Graf is co-directing the compilation of a critical encyclopedia of restoration and re-use of twentieth-century architecture, which is becoming a reference work within the international scientific and academic communities, as well as for architects confronted with the task of bringing these buildings up to today's standards while preserving the cultural heritage they represent. The Critical Encyclopedia further seeks to present contemporary architecture from an unconventional perspective: that of its material history. The work, which once completed will be available in four languages, is divided into three key areas: (i) industrially prefabricated construction materials, (ii) building-façade materials, and (iii) comfort, each time focusing on challenges and opportunities related to the restoration, preservation, and transformation of buildings. The first volume, focusing on industrially prefabricated construction materials, was published in 2012.

F. Graf, Y. Delemontey. Architecture industrialisée et préfabriquée: connaissance et sauvegarde. Presses polytechniques et univsersitaires romandes, 2012.

Prof. Franz Graf
Laboratory of Techniques and Preservation of Modern Architecture (TSAM)
http://tsam.epfl.ch





USING ALGORITHMS TO DESIGN SUSTAINABLE CITIES IN SILICO

In a new architectural design studio, Jeffrey Huang from the Media and Design Laboratory gave ENAC Master's students an opportunity to use computational tools to design sustainable cities for the world's growing urban population. As a case study, the students were asked to generate urban blueprints for Chinese cities, which are expected to absorb 300 million new immigrants over the next 20 years. The computational algorithms they used take into account a wide range of factors – topography, animal and vegetal communities, and cultural systems – and propose sustainable urban designs compatible with these constraints and other imposed criteria, such as residential density and land use. The project was carried out in close collaboration with Peking University and the Harvard Graduate School of Design and funded by a research grant from the Swiss Cooperation Program in Architecture (SCPA) on "Superstudio" and a research grant from the Swiss National Science Foundation (SNF) on "Artificial Morphogenesis."

N. Zuelzke, T. Patt, J. Huang. Computation as an Ideological Practice, in Goulthorpe, M., and Murphy, A. (eds.), Digital Aptitudes + Other Openings: Proceedings from the ACSA 100th Annual Meeting, 2012.

Prof. Jeffrey Huang
Media and Design Laboratory (LDM)
http://ldm.epfl.ch

TAMING THE COMPLEXITY OF LARGE ARCHITECTURAL PROJECTS

Beyond a certain critical size, the complexity of architectural projects undergoes a radical transition as problems related to the architectural program, rules and regulations, construction, and finances grow disproportionally. A new doctoral program in Complex Design, involving the Universities of Fribourg and Neuchatel as well as EPFL, was inaugurated in 2012 under the direction of ENAC Professor Inès Lamunière. It takes a three-pronged approach to studying large and complex architectural projects, focusing on them from a legal, a socio-economic and an architectural perspective. By analyzing large-scale operations at different levels, this doctoral program aims to provide strategies to help deal with the complexity of such projects. Last October, the first Summer School, entitled Penser à grande échelle – PAGE (Thinking at a Large Scale), brought together academics, researchers, and stakeholders in the context of the development of the Prailles Acacias Vernets district in Geneva.

http://complexdesign.epfl.ch

Prof. Inès Lamunière
Laboratory of Architecture and Urban Mobility (LAMU)
http://lamu.epfl.ch

INTERNET – TRANSFORMING SPACE TO TRANSFORM SOCIETY

Four decades after it was first conceived, internet has become ubiquitous. No technology before it has been as successful at satisfying people's needs and desires. At the same time, internet has redefined space to such a degree that society is caught in an upheaval, with dynamics that we are only beginning to unravel. In a book published in 2012, Boris Beaude predicts that internet is likely to trigger a revolution in societal organization, in the same way as the introduction of writing, the printing press, the telegraph, or television fundamentally transformed society. But how that revolution plays out, what role internet will play as it permeates society, depends primarily on the role that society attributes to it. Through a critical analysis of the societal ramifications of this new multi-modal medium, Beaude aims to enlighten his readership, so that they can play an active part in defining how internet's transformation of space will transform the world we live in.

http://beaude.net/icecs/

Prof. Jacques Lévy
Chôros Laboratory (LAC)
http://choros.epfl.ch

RESEARCH HIGHLIGHTS

IS REVERSIBLE MOBILITY HERE TO STAY?

Studying patterns of individual mobility in today's society, Vincent Kaufmann and Stéphanie Vincent-Geslin identified an until now overlooked form of mobility, which they coined "reversible mobility." Reversible mobility is defined by frequent round trips, often over large distances, which are both energy expensive and time consuming, but which use today's rapid means of personal and virtual mobility to undo the negative effects typically associated to a non-sedentary lifestyle. Although reversible mobility is often a forced solution to make social and professional demands meet, it has also become a hallmark of many leisure activities. In a book co-written by Kaufmann and Vincent-Geslin, the authors present the results of a two year study on long-distance reversible mobility, conducted in the context of a European Union Research Program. Basing themselves on a several sociological surveys, the researchers attempt to clearly define and characterize reversible mobility and understand who engages in it and why.

S. Vincent-Geslin, V. Kaufmann. Mobilité sans racine. Plus loin, plus vite... plus mobiles ?, éditions Descartes & Cie, collection Cultures Mobiles, Paris, 2012.

Prof. Vincent Kaufmann
Urban Sociology Laboratory (LASUR)
http://lasur.epfl.ch/
Urban and Regional Planning Community (CEAT)
http://ceat.epfl.ch

ROCK AND RUBBLE FLOWS IN TORRENTIAL ALPINE RIVERS

For decades, researchers have worked under the assumption that doubling the flow rate of an alpine river will double the amount of rocks and sediments that it carries – a correlation that has been confirmed time and again in laboratory experiments. But last year, when researchers from Christophe Ancey's Laboratory for Environmental Hydraulics and members of Crealp, the Center for Research on Alpine Environments, went to Zinal to work out a way to accurately measure debris flow using geophones – acoustic sensors they embedded in the riverbed – they made a surprising observation: increasing the amount of water by a factor of two led to an eight-fold increase in debris transport. Although the physics that gives rise to this cubic relationship remains to be established, this discovery has important implications in the prediction of the volumes of sediment that are deposited every year in the lower ranges of the alpine valleys.

J. Heyman, F. Mettra, H.B. Ma, C. Ancey. Statistics of bedload transport over steep slopes: Separation of timescales and collective motion. Geophysical Research Letters, 40, 128-133, 2013.

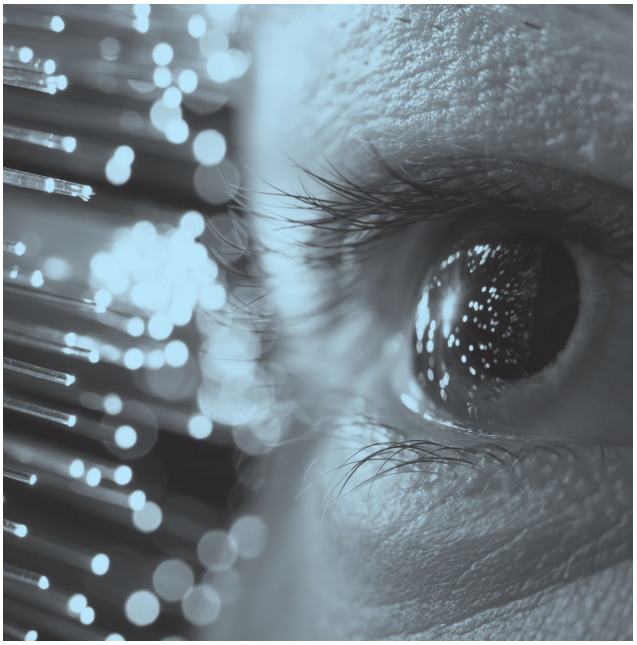
Prof. Christophe Ancey
Environmental Hydraulics Laboratory (LHE)
http://lhe.epfl.ch

EMERGENCY SHELTER THAT GOES THE DISTANCE

The transition from emergency to permanent housing following natural catastrophes is slow and fraught with obstacles, as can still be seen today in Port-au-Prince, years after the earthquake that brought the city to the ground. Last year, the Steel Structures Laboratory received funding from the EPFL's Cooperation Seed Fund to organize an international workshop to develop ideas related to fast reconstruction of disaster struck sites. The output of the workshop as well as a series of initial studies suggest a paradigm change in relief housing efforts, due largely to the increasing number of interventions in densely populated areas. Rather than focusing on individual housing, easy to assemble and disaster resistant multi-story buildings with integrated utilities and services could provide a more optimal solution. Once the need for emergency housing subsides, these buildings can be adapted to function as government or community buildings. Besides allowing for a more efficient use of space, they could also facilitate the acceptance of new technologies in developing regions.

G.S. Prinz, A. Nussbaumer. On Fast Transition between Shelters and Housing after Natural Disasters in Developing Regions. International Conference on Technologies for Sustainable Development, Lausanne, Switzerland, May 29-31, 2012.

Prof. Jean-Paul Lebet
Steel Structures Laboratory (ICOM)
http://icom.epfl.ch



THE LIGHTER THE BRIGHTER

Tests conducted at EPFL's Solar Energy and Building Physics Laboratory have confirmed the hypothesis that light acutely influences our subjective sleepiness. The researchers, led by Mirjam Münch, further showed that the effects of light exposure last until the early evening and that light intensity has an impact on cognitive performance beyond light exposure. Interested in finding out how our circadian rhythm is influenced by our perception of light during the daytime, the researchers recruited 29 young participants who, after having followed a regular sleep-wake schedules for a week, were exposed to different lighting conditions during two afternoons. Using a combination of subjective and objective assessments, including hormonal analysis from saliva samples, the researchers concluded that the volunteers who were subjected to higher light intensity during the afternoon were more alert all the way into the early evening. When they were subjected to light intensity ten times weaker, however, they showed signs of sleepiness and obtained lower scores in a difficult performance task.

M. Münch, F. Linhart, A. Borisuit, S.M. Jaeggi, J.L. Scartezzini. Effects of prior light exposure on early evening performance, subjective sleepiness, and hormonal secretion. Behavioral Neuroscience, vol. 126, num. 1, p. 196-203, 2012.

Prof. Jean-Louis Scartezzini
Solar Energy and Building Physics Laboratory (LESO)
http://leso.epfl.ch

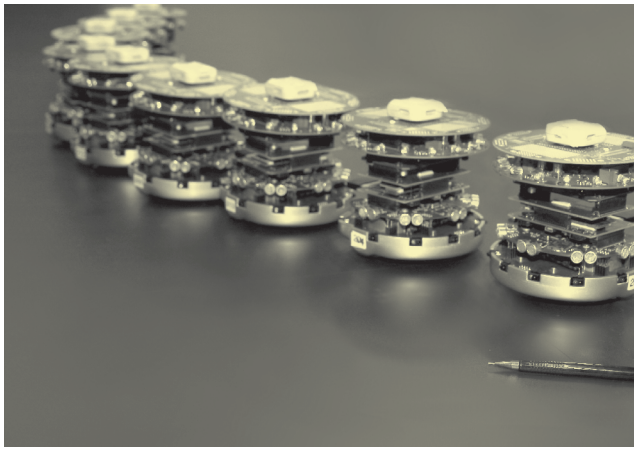
RESEARCH HIGHLIGHTS

MAPPING LAND-USE FROM ABOVE

According to a recent study, active learning strategies can help researchers improve the accuracy of automatically generated maps based on aerial images taken by drones, airplanes or satellites. All models have their weak spots, and land classification models, which are trained using a dataset generated by humans, tend to have theirs at the border between different types of land cover, in the shade, and on areas that change over time. The challenge is greater still when the images used are taken at wavelengths that are invisible to the human eye, using so-called hyperspectral imaging. In a study published last year, researchers including Devis Tuia from the Geographic Information Systems Laboratory (LASIG) showed that, by automatically detecting where the automatic recognition is most uncertain, active learning algorithms can point researchers to the locations where the smallest amount of additional human input can have the greatest impact on the accuracy of the model output.

M.M. Crawford, D. Tuia, H. L. Yang. Active Learning: Any Value for Classification of Remotely Sensed Data? Proceedings of the IEEE , vol.101, no.3, pp.593,608, 2013.

Prof. François Golay
Geographic Information Systems Laboratory (LASIG)
http://lasig.epfl.ch



ACCURATE INDOOR LOCALIZATION USING DISTRIBUTED SENSING

Researchers Amanda Prorok and Alexander Bahr working with Alcherio Martinoli have developed a way to localize objects indoors where GPS systems perform poorly. They tested their solution on a population of robots that were let loose in a room scattered with everyday obstacles – chairs, tables, boxes – as well as custom-made obstacles made of all sorts of materials. Each robot was equipped with an emitter that sends out nano-second pulses of radio signals (so called impulse-radio ultra-wideband), which were captured by receivers in all four corners of the room, allowing the researchers to pinpoint its location by triangulation. Commercially available indoor localization setups perform well as long as the robots never leave the line of sight of the receivers, but the presence of a metal obstacle can be enough to dramatically skew the results. The solution developed in Martinoli's group accurately locates the robots even when obstacles block the line of sight, by having the individual robots share information and by using numerical algorithms to compensate for the signal distortion caused by the obstacles. Potential commercial applications include inventory tracking, asset management and assembly control.

A. Prorok, A. Martinoli. Accurate Localization with Ultra-Wideband: Tessellated Spatial Models and Collaboration, in Proc. of the 13th International Symposium on Experimental Robotics (ISER), Quebec, Canada, June, 2012.

A. Prorok, L. Gonon, A. Martinoli. Online Model Estimation of Ultra-Wideband TDOA Measurements for Mobile Robot Localization, in IEEE International Conference on Robotics and Automation (ICRA), 2012.

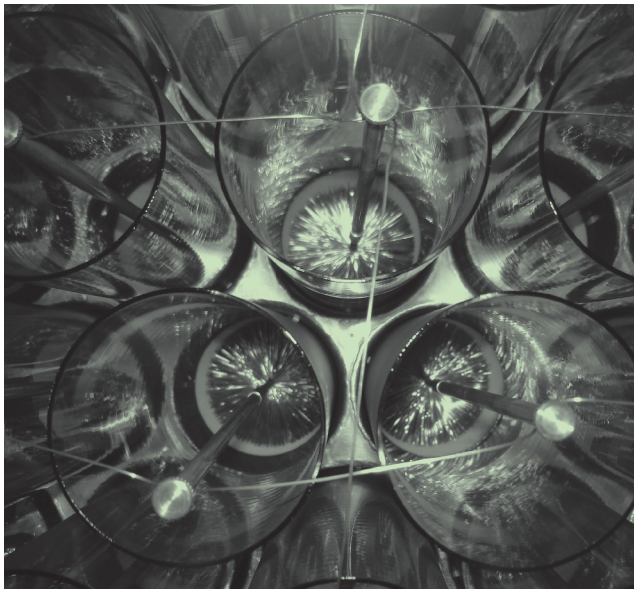
Prof. Alcherio Martinoli
Distributed Intelligent Systems and Algorithms Laboratory (DISAL)
http://disal.epfl.ch/

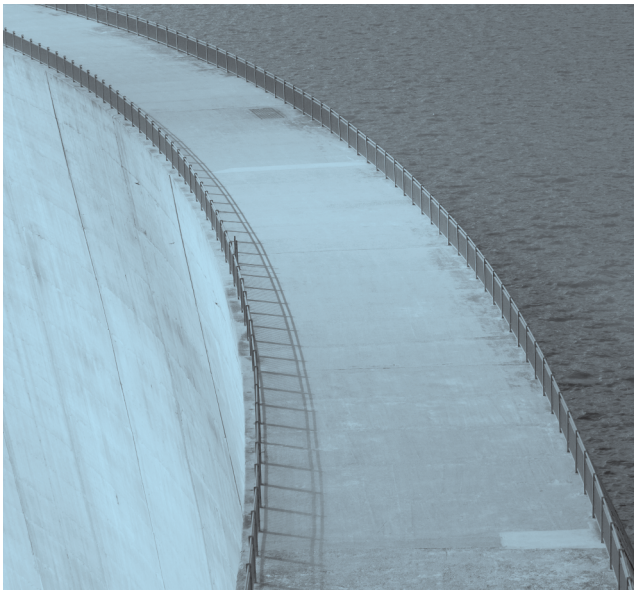
THE CHEMISTRY OF OZONE IN WATER AND WASTEWATER TREATMENT

Ozone has been used as an alternative to chlorine for water treatment for about a century. Water can be disinfected by bubbling ozone through it, as dissolved ozone kills waterborne organisms. Ozone is also increasingly applied for the oxidation of micropollutants, recently even as a polishing step in conventional wastewater treatment, and it efficiently degrades many chemical compounds. It has, however, been shown that in certain cases this leads to the formation of potentially harmful degradation products. Considering the rampant use of chemical compounds in consumer goods such as cosmetics and pharmaceuticals, understanding ozone reactions is becoming essential to predict the efficiency of the elimination of micropollutants as a barrier to their release into the water cycle. In a new book, Urs von Gunten and Clemens von Sonntag present a state-of-the-art compilation of the knowledge in the field of ozone chemistry and its applications to water and wastewater treatment. Their book covers a broad scope, from the basics of ozone chemistry to its practical application and is an important source of information for researchers, students and practitioners.

C. von Sonntag, U. von Gunten. Chemistry of Ozone in Water and Wastewater Treatment – From Basic Principles to Applications. IWA Publishing, London, 2012.

Prof. Urs Von Gunten
Laboratory for Water Quality and Treatment (LTQE)
http://ltqe.epfl.ch





PRESERVING RIVER ECOSYSTEM BIODIVERSITY DOWNSTREAM OF HYDROPOWER PLANTS

As Switzerland considers expanding its hydropower capacity, in particular with small hydropower plants, the environmental impact of this renewable energy source has come under scientific scrutiny. Last year, with funding from the Landolt Chair for Innovations for a Sustainable Future, researchers at ENAC focused on rethinking the way that water is released to rivers. While today's policy of ensuring constant minimal outflow thresholds of water may keep rivers from running dry and protect a few aquatic species, they fail to reproduce the natural variability found in natural river ecosystems at the cost of ecological biodiversity. Dynamic release policies provide one way of getting around this by artificially reproducing some of the variability found in natural rivers. By considering the utility of the water allocated to the riparian environment and its economic meaning, Paolo Perona and his colleagues argue that increasing downstream flow variability could improve ecosystem performance and reduce the need for river restoration programs in the future without necessarily implying losses in electricity generation.

P. Perona, D. Dürrenmatt, G. Characklis. Obtaining natural-like flow releases in diverted river reaches from simple riparian benefit economic models. Journal of Environmental Management, vol. 118, p. 161-169, 2013.

L. Gorla, P. Perona. On quantifying ecologically sustainable flow releases in a diverted river reach. Accepted in Journal of Hydrology, 2013.

Prof. Paolo Perona
Research group on applied hydroeconomics and alpine environmental dynamics (AHEAD)
http://ahead.epfl.ch

ENAC AT LARGE

SUPPORTING NASA ON THE GROUND

Alexis Berne has been a member of the NASA Precipitation Measurement Missions Science Team since 2012. He is involved in the Ground Validation component of the Global Precipitation Measurement (GPM) Mission. In this framework, data collected using a network of disdrometers that was deployed across EPFL's campus from 2009 to 2011 were made freely accessible to scientists around the world. Additionally, Alexis Berne's research group, the Environmental Remote Sensing Laboratory, will focus on quantifying and characterizing the vertical variability of precipitation. A better understanding of this variability will be crucial to improve the interpretation of measurements from the precipitation radar on board the GPM mission's core satellite, which is scheduled for launch in February 2014.

http://lte.epfl.ch

SOLSTIS
PHOTOVOLTAIC SYSTEMS

2012 was an especially good year for Solstis, a Lausanne-based SME specializing in solar energy and building physics, founded by two ENAC researchers in 1996. Not only was the company a multiple recipient of the Swiss Solar Prize; it also opened a new department focusing on developing engineering solutions for the Middle East and Africa, which was awarded its first mandate in Beirut. The company now employs 35 people and dominates the solar market in French speaking Switzerland, with over 150 installations totaling 70'000 m2 of installed surface.

www.solstis.ch

NEUROBAT
INTERIOR CLIMATE TECHNOLOGIES

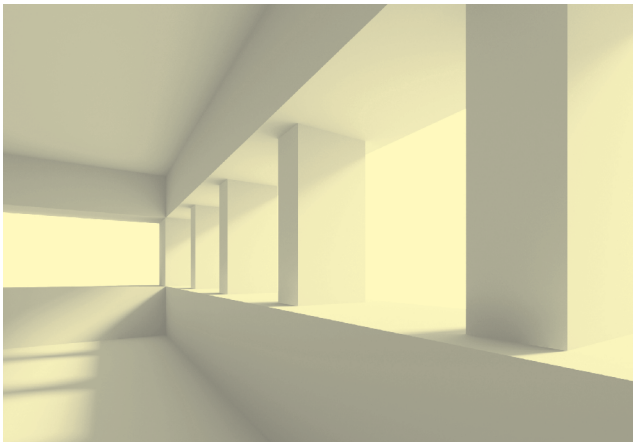
In 2012, Neurobat AG, a company founded by two alumni from the Laboratory for Solar Energy and Building Physics at ENAC, received the first prize in the "Innovation" category of the prestigious Swiss Environmental Prize. A controller developed by the company monitors a building's heating, ventilation, and air-conditioning to reduce power consumption and heating costs, while at the same time increasing the inhabitants comfort. Test have shown that using Neurobat's technology in 20% of Swiss buildings could cut CO_2 emissions by one million tons per year!

http://www.neurobat.net

GERONIMO
TAMING DAYLIGHT USING COMPUTER SIMULATION

During much of the day, natural daylight could be used as an energy neutral substitute for artificial lighting. But how can the light be made to shine into the most remote corners of offices without blinding their occupants in the summer, yet guarantee enough light in the winter? The latest generation of window panes can be used to bend light and control its diffusion, but high production costs and difficulty of use mean that they are rarely adopted. The Solar Energy and Building Physics Laboratory at ENAC developed an application to simulated complex fenestration systems. The simulator, called Geronimo 1.0, should make these technologies more accessible to a broad public.

http://leso.epfl.ch/geronimo



THE BORDEAUX SUBMARINE BASE

INTER-ACADEMIC URBANISM STUDIO

In July 2012, for the third consecutive year, fifteen recent graduates and five professors from five architecture schools (Brussels, Montreal, Paris, Bordeaux and ENAC-EPFL) met in the context of an urbanism studio. The theme for 2012: the vast submarine base built in an out-of-the-way part of Bordeaux between 1941 to 1943. A week's work gave rise to a formalized process to better understand the site and to four different action plans. External architects were involved in the deliberations that led up to these results, which were then presented and debated in the presence of the Mayor of Bordeaux, Mr. Alain Juppé.

PRESS REVIEW 2012

http://actualites.epfl.ch/presse

January

Water-faucet chemistry
Anti-depressants, cosmetics, contraceptives, pesticides, cleaning agents, and nano-particles often wind up in nature before finding their way back to the water faucet, diluted in the water we drink. Research into this issue, conducted at the University of Lausanne and at EPFL, in particular by Luca Rossi, a researcher at ENAC's Ecological Engineering Laboratory, was picked up by the press.

February

A noted appointment
Isabelle Romy, lawyer and professor at ENAC and the University of Fribourg has been appointed member of the board of directors of UBS. She specializes in international proceedings and arbitration.

What really goes on between tectonic plates
A group of researchers from ENAC's Computational Solid Mechanics Laboratory have unraveled part of the mystery of friction. Their findings add to the understanding of the magnitude of earthquakes that are caused by shifting tectonic plates.

March

Trees take the elevator
By transplanting 700 soil and vegetation samples from their original location at the Col de Marchairuz to lower altitudes, researchers from the Ecological Systems Laboratory were able to simulate and study the effects of climate change. The experiment caught the attention of the international press.

April

Climate change: a menace to snow
What will be the impact of global warming on the economy of the Canton Valais and its tourism sector? Gaëlle Serguet, an ENAC researcher, was mandated by the Chair Landoldt & Cie to study this question that is essential to the canton's economy.

Three scenarios for the airport in Sion
A study conducted by the Intermodality and Transport Planning Group at ENAC aims to define the future of the aerodrome in Sion, Valais. They studied the economic and environmental effects of three different scenarios as well as their impact on land-use. Based on the final report, the Sion city council has called to close the airport to fighter-jets.

May

Highway traffic without the jam
One way to prevent traffic-jams is being tested on a highway segment in the vicinity of Geneva by researchers from the Urban Transport Systems Laboratory at ENAC. Traffic lights and changeable speed limits work in tandem to keep traffic flowing smoothly.

June

A beach in Geneva
Rather than converting the Eaux-Vives area in Geneva into a park, the WWF proposes converting it to an urban beach. The environmental organization mandated ENAC's Hydraulic Constructions Laboratory to run a feasibility study of their proposal.

Keeping the TGVs rails above water
How can exceptional floods damage or even sweep away the ballast under the high speed train's tracks? ENAC's Laboratory for Hydraulic Constructions replied to this question asked by the French National Railway Corporation.

July

Railway station research labs
The Swiss Federal Railways and EPFL set up sensors in Swiss railway stations to study pedestrian behavior. Using their data, they hope to find a way to decongest traffic during peak hours by improving their infrastructure. ENAC's Transportation and Mobility Laboratory was involved in this project.

Studying the potential of bacteria
Deep bedrock is considered one one of the safest places to store nuclear waste. But human intervention into these isolated territories can lead to intense bacterial activity. Researchers at ENAC's Laboratory for Environmental Microbiology are trying to understand how bacteria adapt to the underground environment and whether their presence could compromise the security of the waste deposits.

August

Music under the moon
The opening night of the 2012 edition of the St. Prex Classics was a huge success. Besides classical music, the audience was also provided another unique experience: the concerts were performed under an inflatable dome, "Luna," designed by the Design Studio on the Conception of Space.

September

A weak network
A critical report on the state of Geneva's public transport network sparked off a headed debate among the city's politicians. The report, drafted by Vincent Kaufmann, professor at ENAC and expert in the field of mobility, revealed a number of the public transport network's flaws and called for the reintroduction of certain tram lines.

Do the Alps hold the solution to our energy worries?
Under climate change, mountain lakes are expected to replace melting alpine glaciers. A team or researchers including Anton Schleiss, the director at the Laboratory of Hydraulic Constructions at EPFL, is studying the potential of these new natural reservoirs. Their hydro-power potential, in particular, could be significant.

October

Mathematics vs. avalanches
Several factors are involved in triggering an avalanche. At ENAC, Paolo Perona and his team have developed a model that relies on probabilities to describe this particularly complex process. Once calibrated and tested in an alpine environment, this model could help improve the reliability of avalanche risk maps.

A close look at the Réseau Ferré de France
The Group for Intermodality, Transport and Planification published a new audit on the state of the Réseau Ferré de France, the French railway network, following a previous audit in 2005. The report draws attention to national railway lines that are well beyond their economically justifiable lifespan. The Réseau Ferré de France was given 6 months to draft a plan to address these issues.

November

Geneva and its multi-national companies
Geneva is a small global city, says a report published by ENAC's Chôros Laboratory and the University of Geneva. Using hard numbers, the report outlines the significant impact of the international public sector on the city-canton's economy. The results also topple a number of deep-seated stereotypes.

December

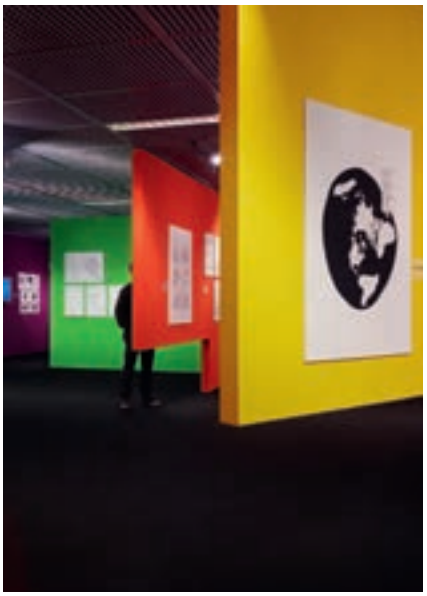
Honoring Vaudois Architecture
A new book, edited by ENAC professor Bruno Marchand, examines buildings erected between 1920 and 1975 in the canton of Vaud. The book, which was published by the Press Polytechniques et Universitaires Romandes, catalogues architectural gems, but also highlights buildings that often go unnoticed. Bruno Marchand is professor for theory and history of architecture.

ARCHIZOOM

ENAC'S PERMANENT EXHIBITION GALLERY, IS DEDICATED TO THEMED PUBLIC EXHIBITIONS OF RESEARCH AND PROJECTS ACCOMPANIED BY SEMINAR SERIES, WITH THE GOAL OF ILLUSTRATING THE MULTIDISCIPLINARY ASPECTS OF ARCHITECTURE.

The "Timber Project" exhibit, highlighting new wooden structures, continued its tour of French-speaking countries with two stops in France, at the Galerie de la Forêt et du Bois near Cluny, and at the Ecole d'architecture at Marne-la-Vallée.

The spring exhibit "Pièces à conviction, une périphérie prend forme" focused on the transformation of the periphery of Lausanne into an urban center. It highlighted the exemplary planning approach adopted by the Land Development Planning Office for Western Lausanne. Several speakers including Vittorio Magnago Lampugnani, Emmanuel Jalbert and Astrid Hervieu, Olivier Mongin, and Pierre Bélanger gave presentations on different facets of urban planning.



In September, the "Best of Architecture EPFL" exhibit displayed the best student work from all classes. A new display setup in the SG buildings on campus gave students more room to present their models.

In the fall semester an exhibit entitled "Yona Friedman – Genesis of a Vision" revisited over five decades of work by Yona Friedman, whose contributions remain at the margins of mainstream architecture despite their strong influence on generations of architects and urban designers. Manuel Orazi, Juan Miguel Hernandez Leon and Dominique Rouillard presented various aspects of Friedman's life.

In parallel to this program, Archizoom organized conferences held by invited professors Pia Durisch and Aldo Nolli, Steinthor Kari Karason, Nanako Umemoto and Jesse Reiser, and Pierre Bonnet and Mireille Adam Bonnet. Jürg Conzett held for a conference organized in partnership with the SIA and Indian Architect Rahul Mehrotra held an exceptional conference, organized in partnership with the UPIAV. Francis Diébédo Kéré, the laureate of the Holcim Foundation Prize, gave an excellent conference at the reward ceremony, co-organized by Archizoom. And the engineer, architect and historian Antoine Picot gave a public conference marking the inauguration of his involvement in the doctoral program for architecture and urban science.

ARCHIZOOM

EPFL – Building SG – Station 15
1015 Lausanne
Exhibition Room SG 1212 – Entry free
+41 (0) 21 693 32 31
http://archizoom.epfl.ch

Events since 1974:
http://archizoom.epfl.ch/archives

LANDOLT & CIE CHAIR

INNOVATIVE STRATEGIES FOR
A SUSTAINABLE FUTURE

For the first half of 2012, the Landolt & Chair was occupied by Jose Torero, a top expert in fire safety engineering from the University of Edinbourg, who began his term in September 2011. Aside from holding conferences in Switzerland and abroad, Jose Torero was involved in setting up of a doctoral course in "Structural Fire Safety." Jose Torero also hosted an ENAC week that focused on establishing an integrated analysis of the renovation of the University of Geneva's Bastions buildings.

THREE PUBLIC LECTURES WERE HELD IN 2012

20.03.2012: Jose Torero gave a public conference entitled "11.09.2001 to 11.09.2011: 10 years – 10 lessons for sustainable infrastructure." He presented lessons for sustainable infrastructure drawn from a decade's worth of investigation and innovation following the arguably most dramatic display of the failure of today's structural engineering practice: the collapse of the World Trade Center towers.

10.10.2012: Jonathan Ledgard, political journalist at the Economist based in Africa, gave a talk on "Future Africa." The African population is projected to double by 2050 and the urban population is expected to increase fourfold. While Africans are better educated than ever before and commodities prices are at record highs, Africa is having trouble keeping up with food production and jobs. Jonathan Ledgard discussed the future of the continent and the potential of science and technology to make a difference.

31.05.2012: Pierre Landolt, founder of the Landolt & Cie Chair, gave a keynote lecture at last year's Tech4Dev conference hosted by EPFL's UNESCO Chair. He presented the PIRARUCU project, an exemplary public private partnership to foster economic development in the Brazilian state of Rondonia. To stimulate the economy, authorities decided to promote fish farming based on pirarucu, a local fish species, in large hydrological reservoirs. Once on the verge of extinction, the species has made a strong comeback. And thanks to a DNA tracking program, the origin of each filet can be precisely determined.

INNOVATIONS FOR A
SUSTAINABLE FUTURE

EPFL – Building GC – Station 18
1015 Lausanne/Ecublens
+41 (0) 21 693 20 44
http://chaire-landoltetcie.epfl.ch

KEY MOMENTS

CHAIR GAZ NATUREL

GEO-ENGINEERING AND CO_2 STORAGE

2012 saw the inauguration of the "Chair Gaz Naturel" in soil mechanics, geo-engineering and CO_2 storage. The new chair, for which the CO_2 storage activities are sponsored by Vevey-based Petrosvibris, will benefit from expertise acquired at ENAC in the fields of geochemistry and geomechanics. Professor Lyesse Laloui's Laboratory for Soil Mechanics, LMS, has gained international renown for its expertise relating to long-term storage of nuclear waste. According to Laloui, director of the chair, this expertise will be instrumental when investigating into the storage of CO_2, as the storage of CO_2 and that of spent nuclear fuel have much in common: the geophysics found thousands of meters below the earth's surface, a constant high temperatures of around 150° Celsius, and the complex interaction of gases, liquids, and rocks under these conditions. As is the case for nuclear waste storage, safety and long-term monitoring of storage sites are of prime concern.

EPFL – Building GC – Station 18
1015 Lausanne
+41 (0) 21 693 23 15
http://chaire-gaz-naturel.epfl.ch

MARGARETHA KAMPRAD CHAIR

LIMNOLOGY AND ENVIRONMENTAL SCIENCE

On December 3, 2012, EPFL and Ferring Pharmaceuticals inaugurated a chair for the study of lake environments. The partnership aims to improve our understanding and protection of these vital and fragile ecosystems. Lake Geneva, the largest lake in Western Europe, provides an exceptional research opportunity for local scientists.

The chair is held by Professor Alfred (Johny) Wüest, whose research focuses on biological phenomena in Lake Geneva, in particular on phytoplankton, which are both an indicator of the health status of the lake and the first link in the lake's food chain. In the next two years, the bulk of his work will be conducted in the context of the elemo program, which includes a component to explore Lake Geneva and Lake Baïkal (Russia) using ultralight aircraft equipped with multiple sensors.

The goal of this Chair is to bring together all the research that is being done on lake environments by scientists in every field, in Switzerland and in neighboring France.

EPFL – Building GR – Station 2
1015 Lausanne
+41 (0) 21 693 63 92
http://aphys.epfl.ch

ENAC's public relations activities promote the school's research and teaching activities to the outside world and bring valuable feedback from institutions, future students, lecturers, researchers, political bodies and professional associations.

MANAGING FLOODS OF THE YANGTZE RIVER IN CHINA

Models of complex hydrological systems are crucial tools for engineers in charge of managing hydraulic installations and setting up safeguards against floods. In early 2012, a delegation of Chinese scientists participated in a workshop hosted and organized by the Hydraulic Constructions Laboratory at ENAC. The workshop's goal was to train them in using software developed at EPFL as part of the MINERVE research project to forecast and manage high waters in the Rhone River watershed upstream of Lake Geneva. After the workshop, the delegation headed back home to adapt these tools to the Yangtze – quite a challenge considering that the surface of its watershed is 43 times that of Switzerland.

http://lch.epfl.ch

JAZZING IT UP WITH ARCHITECTURE

At the Montreux Jazz Heritage Lab, visitors can embark on a journey through the Montreux Jazz Festival's digital archives – 45 years' worth of jazz, blues, and rock music. By taking seat inside a small wooden cocoon-like structure, they can immerse themselves into the festival's rich musical history. The final structure, composed of 1'300 pieces of wood, was unveiled last June. It contains an interactive table to browse the festival's archives and a large concave screen and multiple loudspeakers to bring the concerts back to life. The structure is designed to let beams of light shine through its walls from the bright interior to the outside. It was created as a collaboration between several research labs at EPFL, among them, ENAC's Design Studio on the Conception of Space.

Later last year it was Luna's turn to grab the attention of the media. Luna is a temporary and modular stage that was dreamt up by students working at the Design Studio on the Conception of Space for the St. Prex Classics music festival. The stage is connected to a huge balloon that, eventually, will be filled with helium and will float 50 meters above the musicians and the wooden grandstand where the audience is seated. For the 2012 edition of the festival, the balloon was only filled with air, giving the architects an opportunity to precisely measure its movements and calibrate the exact tension of each of its lines to avoid damaging any of the historical buildings that are located near the stage.

http://alice.epfl.ch

KEY MOMENTS

INTERNATIONAL WORKSHOP:
"ADVANCES IN MULTIPHYSICAL TESTING OF SOILS AND SHALES"

An International Workshop on "Advances in Multphysical Testing of Soil and Shales" was held at the EPFL from the 3rd to the 5th of September, 2012, organized by Prof. Lyesse Laloui and Dr. Alessio Ferrari from the Soil Mechanics Laboratory – Chair Gaz Naturel Petrosvibri (LMS). The workshop attracted more than 80 participants from 22 countries and aimed at stimulating the debate on advances in experimental geomechanics. 48 contributions on unsaturated soil testing, non-isothermal experiments, shale testing, micro-scale investigations and image analysis techniques were presented and discussed. Six thematic lectures were delivered, and a short course on advanced experimental geomechanics rounded off the Workshop programme. The conference topics are closely related to the current activities at LMS, covering geological nuclear waste storage, CO_2 sequestration, geothermal energy, shale gas, as well as landslide hazards.

A book entitled "Multiphysical Testing of Soils and Shales" by L. Laloui and A. Ferrari has been published in the Springer Series in Geomechanics and Geoengineering.

http://amtss.epfl.ch

SYMPOSIUM LATSIS EPFL 2012
"1ST EUROPEAN SYMPOSIUM ON QUANTITATIVE METHODS IN TRANSPORTATION SYSTEMS"

If we want to make smart decisions regarding the future of our transportation infrastructure, we have to be able to anticipate trends and detect emerging needs. The European Association for Research in Transportation (hEART) was established in September 2012 following the first European symposium on quantitative methods in transportation systems. It's goal is to promote European research in the field of transportation, and it does so by organizing annual conferences among its members and by putting in place an information exchange network to facilitate interactions between them.

http://latsis2012.epfl.ch
http://www.heart-web.org

RISK INSIGHT
PUBLIC EXHIBITION

Combining science, arts and society, the Risk inSight exhibition aimed to present risks and to highlight how and why they play an increasingly important role in modern societies. It was held at the Rolex Learning Center at EPFL and was open to the broad public, providing an opportunity to explore notions of risk via visual and sound installations, photographs, video modeling, interactive interfaces, and a documentary film. The exhibition, organized by Valerie November, a researcher at the CNRS, included the participation of 24 scientists, 9 risk experts, and 6 artists. A catalogue of the exhibition was published by the Press polytechniques et universitaires romandes (PPUR).

http://espri.epfl.ch/riskinsight

SAMPLING OF INTERNATIONAL EVENTS ORGANIZED BY OUR SCHOOL'S LABORATORIES

18-20/01/2012
Deuxième rencontre annuelle du projet européen ERMITAGE — Economics and Environmental Management Laboratory

21/02/2012
Symposium Kirkenes, concluding with a full day seminar "Living and working in the Barents — Exploring Infrastructure" — EPFL Laboratory Basel

29/03-12/05/2012
Séminaire de 3e cycle Conférence Universitaire de Suisse Occidentale "Les horizons de la gouvernance territoriale" — Urban and Regional Planning Community

24/04/2012
Colloque interdisciplinaire "Le béton, matière en devenir" — Laboratory of urban architecture

23-24 & 29-30/05/2012
MesoHABSIM Training Workshop, Rushing River Institute — Hydraulic Constructions Laboratory

14/06/2012
Workshop "CO_2 State of Expertise" — Soil Mechanics Laboratory

15/06/2012
ENAC Research Day "Energy in the City" — ENAC Deanship

17-21/06/2012
IUTAM Symposium on Materials and interfaces under high strain rate and large deformation — Computational Solid Mechanics Laboratory

28-29/06/2012
Challenging Glass Conference — Steel Structures Laboratory

20/07/2012
Workshop Sino-Swiss Science and Technology Cooperation Program (SSSTC) — Hydraulic Constructions Laboratory

4-7/09/2012
LATSIS Symposium "1st European Symposium on Quantitative Methods in Transportation Systems" — Urban Transport Systems Laboratory & Transportation and Mobility Laboratory

12-13/09/2012
Journées d'études internationales "Building Environment and Interiors Comfort in 20th-Century Architecture: understanding issues and developing conservation strategies" — Laboratory of Techniques and Preservation of Modern Architecture

14-30/09/2012
Exhibition "Learning from vernacular," at the Bordeaux submarine base — Archives of Modern Building

15-19/10/2012
Complexdesign: Penser à grande échelle (PAGE 01) — Laboratory of Architecture and Urban Mobility

16/10-5/11/2012
Risk inSight Exhibition — Study Group on the Spatiality of Risks

30/10/2012
Journée d'étude "L'affiche dans la ville. Comment l'affichage peut "faire espace public"?" — Urban Sociology Laboratory & Construction and Conservation Laboratory

30/10-1/11/2012
Colloque "Représentations et imaginaires de la mobilité," groupe de travail n°23 de l'Association Internationale des Sociologues de Langue Française & conférence annuelle "Governing mobilities," Cosmobilities — Urban Sociology Laboratory

3/11/2012
Journée suisse des Archives — Archives of Modern Building

3-5/11/2012
Advances in Multiphysical Testing of Soils and Shales workshop — Soil Mechanics Laboratory

16/11/2012
5th Low Carbon Energy University Alliance Workshop — Soil Mechanics Laboratory

21-22/11/2012
Workshop on Large Scale Optimization — Transportation and Mobility Laboratory

13/12/2012
MESSAGE Workshop "Uncovering the genetic basis of adaptive change: On the intersection of landscape genomics and theoretical population genetics" — Geographic Information Systems Laboratory

FACULTY

REACHING OUT ACROSS THE ETH DOMAIN

Over the past years, the already strong ties between ENAC and research institutions from across the ETH domain have grown even stronger. ENAC's Institute of Environmental Engineering in particular shares many research interests with the ETH Zürich, the aquatic research center (EAWAG), and the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), which encompasses the Institute for Snow and Avalanche Research (WSL-SLF).

Joint appointments between the institutes have contributed to fostering closer collaboration, sharing know-how and resources, and bringing about innovative and cutting edge research. And they have given students access to classes taught by world leaders in their fields.

The first joint appointment between EPFL-ENAC and the WSL was the creation in 2004 of the Ecological Systems Laboratory under the direction of Prof. Alexandre Buttler. In 2008, Sam Arey was hired in a joint appointment with EAWAG as professor in environmental chemistry modeling. 2010 saw two more joint appointments with the same institute, with Janet Hering, director of EAWAG, joining the ranks of the ENAC faculty, along with Kristen Schirmer, professor in environmental toxicology. In 2011, Urs von Gunten, an EAWAG specialist in drinking water purification followed, as did Michael Lehning, an expert in the physics of snow and permafrost from the WSL-SLF. And in 2012, the faculty grew by two more members from the ETH domain.

NEW PROFESSORS APPOINTED AT ENAC IN 2012

Konrad Steffen

Full professor in cryospheric sciences

Konrad Steffen, an expert in climatic interactions between polar and alpine regions, was named full professor in the ENAC faculty at EPFL. He was also named full professor at ETH Zurich and was appointed as director of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), following in the footsteps of James W. Kirchner. Konrad Steffen's research focuses on the cryosphere, in particular on the effects of climate change on dynamic processes in glaciers and on the sea level. Konrad Steffen became professor in the geography department at the University of Colorado in Boulder (USA) in 1997. Starting in 2002, he took over the direction of the Cooperative Institute for Research in Environmental Sciences (CIRES).

Alfred (Johny) Wüest

Full professor in aquatic physics

Alfred Wüest has been directing the department of aquatic physics at Eawag since 2006. In parallel to his activities at Eawag, he has been involved as an expert and consultant in the analysis of surface waters, mainly in Switzerland but also abroad. Alfred Wüest has made significant contributions to research in limnology, the science of inland waters, by combining fundamental research, field experiments, and practical applications. His contributions towards understanding lake turbulence are considered to be authoritative reference works. Throughout his career, he developed a number of modern techniques to analyze oceanographic physics and understand the behavior of methane emitted from the depths of the ocean. At EPFL, Alfred Wüest will be heading the Physics of Aquatic Systems Laboratory – Margaretha Kamprad Chair.

PROMOTION

Appointed MER
Luca Pattaroni

DEPARTURES

Prof. Patrick Berger
Prof. Patrick Mestelan
Prof. Martin Schuler

ENAC FACULTY MEMBERS APPOINTED OUTSIDE EPFL

Prof. Nikolas Geroliminis
Adjunct Assistant Professor
Department of Civil Engineering, University of Minnesota, USA

Prof. Franz Graf
Full Professor
Academy of Architecture, Università della Svizzera italiana

Prof. Lyesse Laloui
Adjunct professor
Department of Civil and Environmental Engineering,
Duke University, Durham, USA

Prof. Fernando Porté-Agel
Adjunct Research Professor
Department of Civil Engineering, University of Minnesota, USA

Prof. Andrea Rinaldo
Full Professor
Dipartimento Di Ingegneria Civile, Edile E Ambientale,
Università degli Sudi di Padova, Italy

Prof. Kristin Schirmer
Adjunct Professor
University of Waterloo, Ontario, Canada

Prof. Ian F.C. Smith
Adjunct Professor
Carnegie Mellon University, Pittsburgh, USA

VISITING PROFESSORS AND ACADEMIC HOSTS 2012

ARCHITECTURE
Jean-Pierre Adam, Marco Bakker, Alexandre Blanc, Félix Claus, Pia Durisch, Urs Egg, Paul Ehret, Philipp Eversmann, Anja & Martin Frohlich, Christian Gilot, Sandra Giraudi, Philippe Gueissaz, Erich Hubmann, Jeannette Kuo, Aldo Nolli, Pier Nicola Pagliara, Bruno Reichlin, Paolo Tombesi, Andreas Vass, Maria Zurbuchen-Henz

CIVIL ENGINEERING
Shinichi Akutagawa, Maurizio Brocchini, Georges Cailletaud, Alan Carter, Peter Gonsowski, John Mark Gray, Gary Marquis, Piotr Parasiewicz, António Pinho Ramos, Mark Randolph, Blake Tullis

ENVIRONMENTAL ENGINEERING
Michael Bahn, Keith Beven, Andreas Christen, Ismael Colomina Fosch, Elizabeth Wentz

URBAN & REGIONAL PLANNING
Christophe Picouleau, Konstantinos Zografos

ENAC
Jonathan Ledgard

DISTINCTIONS & AWARDS

Our school has made an impact in the world: here is a sampling of awards received in 2012

THE US NATIONAL ACADEMY OF SCIENCES

In May 2012, Andrea Rinaldo was elected as foreign associate of the prestigious US National Academy of Sciences. Andrea Rinaldo's research and his multi-disciplinary approach have made him a renowned expert in the fields of water resources and eco-hydrology. He is especially interested in the role of river networks as ecological corridors and in their impact on species, populations, and pathogens. In the course of his career, he has received several prestigious awards, among them the Dalton Medal in 2005. Andrea Rinaldo was both surprised and honored to be elected into the Academy. He said that he hopes to live up to the responsibility of the being a member, which involves closely following the development of important scientific and social questions as part of the group of experts that the US government calls on for advice.

http://echo.epfl.ch

THE UNIL – EPFL DURABILIS AWARD

The Durabilis Award, formerly the OUI-DD Prize, recognizes student projects that incorporate the three axes of sustainable development: the environment, society, and economics. All EPFL and Unil Master's or Bachelor's students are eligible to participate. Out of four projects that received an award in 2012, three were led by architecture students from ENAC.

"The Holistic Conception of an Eco-neighborhood in Lausanne – Simulation and Optimization of its energy supply," by Caroline Naef and Héloise Sierro, on upgrading the Vallon neighborhood in Lausanne. In this project, the authors gave special attention to energy related issues in their economic, social, and environmental context.

"From the countryside to the city: consolidation and development of an ephemeral habitat," by Clio Gachoud and Minh-Luc Pham, on problems pertaining to reconstruction efforts in the wake of natural disasters. This project presents a case study conducted in Haiti over the course of several decades. The study outlines an approach that strongly involves the local populace, calling into question the central role commonly played by architects.

"Densification and reappointment of an abandoned railway line in Clarens," by Julie Hennemann and Julien Emery, on developing the abandoned site in Clarens to improve the functional mixity in the neighborhood, the railway station, and in their surroundings. Their solution is based on high quality public spaces and a broad variety of financially affordable, but socially rich accommodations.

http://developpement-durable.epfl.ch/durabilis

Teaching and Research Awards

ANDERSEN Marilyne
Best Paper Award (with John Mardaljevic, Nicolas Roy & Jens Christoffersen), Building Simulation and Optimization (BSO12), Loughborough, UK

BARRY David Andrew, WISSMEIER Laurin, PARLANGE Jean-Yves, CRAPPER Martin
Environmental & Water Resources Institute (EWRI) Journal Award, 2012 best discussion, Albuquerque, USA

BONVIN Florence
Outstanding Poster Award, Environmental Sciences: Water Gordon Research Conference, New Hampshire, USA

BORISUIT Apiparn
Civil and Environmental Engineering Doctoral Program, PhD Mobility Award, EPFL Lausanne

DESSIMOZ Raphaël
3rd prize "Immeubles de logements au chemin Clair-Val à Thônex," Genève

DUGUÉ Violaine
3rd Best Poster Award, ENAC Research Day, EPFL Lausanne

FORMERY Sara, KÖSSLER Sibylle
(with Alexandre Noël, Wynd van der Woude, Olivier Regazzoni)
4th prize, "Transformation et extension du centre communal," Carouge, Switzerland

FUMEAUX Loïc
3rd Best Poster Award, ENAC Research Day, EPFL Lausanne
3rd prize, as a partner of xy-ar.ch, "Transformation de deux collèges en centres de vie enfantine," Lausanne

GUGGER Harry / Harry Gugger Studio Basel
Selected competition, High-rise Housing and Hotel, Berlin, Germany; Competition, Port Austerlitz, Strasbourg, France; Competition, Pavillon Place Cosandey, EPFL, Lausanne; Museum Plus (M+) Design Competition, West Kowloon Cultural District, Hong Kong

JAFARNEJAD Mona
Best Poster Award, ENAC Research Day, EPFL Lausanne

KAWAMURA Key / kawamura-ganjavian studio
2nd prize, Concours d'Architecture pour l'agrandissement de l'école et nouvelle salle de gymnastique à La Verrerie (FR), La Verrerie, Switzerland

KELLER Thomas
Elected International Institute for FRP in Construction (IIFC) Fellow, International Conference on FRP Composites in Civil Engineering 2012, Rome, Italy

LACROIX Elsa
3rd Best Poster Award, ENAC Research Day, EPFL Lausanne

LALOUI Lyesse
Vardoulakis Lecture, University of Minnesota, USA

LAMUNIÈRE Inès / dl-a, designlab-architecture
1st prize "Immeuble multifonctionnel pour la Cité Internationale des Savoirs," Ferney-Voltaire, France; 1st prize "rénovation de l'école des Pâquis (J.-J. Oberson, 1970)," Genève; 1st prize "Immeubles de bureaux Euronantes Gare," Nantes, France

LECOULTRE Cyril / bunq architectes, Rolle et Corsier
1st rank Housing for the "Institution de Lavigny," Lavigny; 1st rank & mention Housing and services, Céligny, Genève; 1st rank Airport Firehouse in Cointrin, Genève

LENHERR Lukas
1st prize, Bab al Bahrain Open Ideas Competition, Manama, Bahrain; Finalist, Swiss Art Awards, Office fédéral de la culture OFC, Swiss Confederation; ARC-AWARD 2012, category "habitations collectives," Docu Media Schweiz GmbH, Switzerland

MARKFORT Corey D.
Outstanding Student Paper Award, 2012 Fall Meeting American Geophysical Union (AGU), San Francisco, USA

MATTLE Michael Jon
Civil and Environmental Engineering Doctoral Program, PhD Mobility Award, EPFL Lausanne

MENZEL Götz / Roland Gay bureau d'architecture, Monthey
1st prize place du Centenaire, Vernayaz, Valais; 2nd prize, centre est de Collombey, Valais; 2nd prize, centre scolaire Salvan, Valais

MICHELON Benjamin
Prix de thèse sur la ville 2012, 33e Rencontre nationale des agences d'urbanisme, Bordeaux, France

MUTZNER Raphael
2nd Best Poster Award, ENAC Research Day, EPFL Lausanne

OSORIO PIZANO Carolina
EURO Doctoral Dissertation Award 2012, Association of European Operational Research Societies (EURO) 2012 Conference, Vilnius, Lithuania

PICCOLO Deborah / Decroux+Piccolo sàrl
3rd prize "Espace public, administration communale, UAPE, bureaux, commerces, logements, logements protégés, extension de l'établissement médico-social de la Venoge, maison de paroisse," Penthalaz

REY Emmanuel /
BAUART Architectes et Urbanistes SA, Neuchâtel
Prix Lignum 2012, Mention région Centre-Ouest for the "Espace central du nouveau Marin Centre," PROHOLZ Lignum, Luzern
1st rank Bundesamt für Bauten und Logistik (BBL) Office Building, Bern

ROCKCASTLE Siobhan, ANDERSEN Marilyne
Best Paper Award, Symposium on Simulation for Architecture and Urban Design (SimAUD), Orlando, USA

ROJAT Fabrice
Prix Jean Kérisel, Comité Français de Mécanique des Sols et de Géotechnique (CFMS), Bordeaux, France

SCHLEISS Anton
"Prix Polysphère" 2011-2012 for the best teacher of ENAC School, EPFL Lausanne

SCHLEISS Marc
Luce Grivat Award for best doctoral research, EPFL Lausanne

SHANI Noam
Luce Grivat Award for best doctoral research, EPFL Lausanne

SKALOUD Jan, LICHTI Derek
Karl Kraus Medal, XXII Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS), Melbourne, Australia

SUN Liang
ENAC PhD Fellowship in "Earth Sciences," ENAC Research Day, EPFL Lausanne

WALTER Benjamin Andreas
Prix Ryhming, EPFL Lausanne

WEINAND Yves / Bureau d'études Weinand
Grand Prix d'Architecture de Wallonie 2012, dans la catégorie III "Bâtiment non-résidentiel à usage collectif," pour l'Espace Culturel "Victor Jara" à Soignies, Belgique

ZHENG Nan
Medal for outstanding work in the field of Transport, Mobility and Infrastruture, Transport Research Arena 2012, Athens, Greece

DISTINCTIONS & AWARDS

BS/MS student awards

PRIX A3-EPFL – ARCHITECTURE
Edouard Philippe / Architecture

PRIX BCV
Estelle Balet / Architecture
Alessia Catellani / Architecture
Olivier Di Giambattista / Architecture
Joachim Nils Fritschy / Architecture
Meret Hodel / Architecture
Dominique Kühnhanss / Architecture
Martha Muller / Architecture
Julien Ngao / Architecture
Anael Poveda / Architecture
Elsa Savoy / Architecture
Tess Walraven / Architecture
Carole Westhoff / Architecture
Valeria Zamora Marco / Architecture
Anna Zurbruchen / Architecture

PRIX BETON HOLCIM
Cyril Mouquin / Civil Engineering

PRIX BG INGÉNIEURS-CONSEILS:
CONSTRUCTION ET DEVELOPPEMENT DURABLE
Steffan Heath / Architecture
Edouard Philippe / Architecture

PRIX BG INGÉNIEURS-CONSEILS:
SYSTÈMES ET DÉVELOPPEMEMT DURABLE
Raphaël Sandoz / Civil Engineering

PRIX DURABILIS UNIL-EPFL
Julien Emery / Architecture
Clio Gachoud / Architecture
Julie Hennemann / Architecture
Caroline Naef / Architecture
Minh-Luc Pham / Architecture
Héloïse Sierro / Architecture

PRIX DE LA COMMUNE D'ECUBLENS
Julien Emery / Architecture
Julie Hennemann / Architecture

DISTINCTION GCO – GROUPE SPÉCIALISÉ POUR
LA CONSERVATION DES OUVRAGES SIA
Christophe Aebi / Architecture
Philippe Schiltz / Civil Engineering

PRIX GEOSUISSE – SOCIÉTÉ SUISSE DE GÉOMATIQUE
ET DE GESTION DU TERRITOIRE
Silvia Oppliger / Environmental Engineering

LUCE GRIVAT AWARDS
Nicolas Fuellemann / Environmental Engineering

PRIX IM – BUREAU D'INGÉNIEURS MAGGIA
Alexandre Pachoud / Civil Engineering

PRIX JACQUES MARTIN-ZWAHLEN & MAYR
Christophe Hänggeli / Civil Engineering

PRIX MAURHOFER
Pierre Chevremont / Architecture
Lucien Favre / Architecture

PRIX ORLANDO LAUTI
Aurélie Monet Kasisi / Architecture

PRIX SHS – SCIENCES HUMAINES ET SOCIALES EPFL
Silvia Oppliger / Environmental Engineering
Michaël Rusconi / Environmental Engineering
Christine Wiedmann / Environmental Engineering

PRIX SIA SECTION VAUDOISE
Julien Emery / Architecture
Julie Hennemann / Architecture
Caroline Naef / Architecture

PRIX STUCKY
David Zumhofen / Civil Engineering

PRIX UPIAV – UNION PATRONALE
DES INGÉNIEURS ET ARCHITECTES VAUDOIS
Thomas Benninger / Architecture
Rama Elias / Architecture
Alexandre Gonin / Architecture
Grégoire Henrioud / Architecture
Jérémie Jobin / Architecture
Sara Teodori / Architecture
Bernard Valette / Architecture
Yiqun Zhang / Architecture
Denis Boillet / Civil Engineering

EPFL WISH FOUNDATION PRIZE
(Architecture and / or Civil Engineer Study Visit)
Laura Baer / Architecture
Aurélie Monet Kasisi / Architecture

BOOKS

The full list of ENAC's scientific output is available online:
http://infoscience.epfl.ch/enac

INTERNET, CHANGER L'ESPACE, CHANGER LA SOCIÉTÉ

Les logiques contemporaines de synchorisation

Boris Beaude

FYP éditions, Limoges 2012

ISBN 978-2-91657-169-0

TECHNOLOGIES AND INNOVATIONS FOR DEVELOPMENT

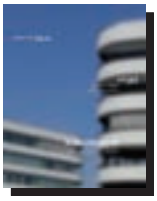
Scientific Cooperation for a Sustainable Future

Jean-Claude Bolay (ed.), **Magali Schmid** (ed.), **Gabriela Tejada** (ed.), **Eileen Hazboun** (ed.)

Springer, Berlin 2012

ISBN 978-2-8178-0268-8

SUBURBANITÉ



Des théories urbaines au logement collectif contemporain

Frédéric Frank

Presses Polytechniques et Universitaires Romandes, Lausanne 2012

ISBN 978-2-88074-913-2

L'ARCHITRAVE LE PLANCHER LA PLATE-FORME

Nouvelle histoire de la construction

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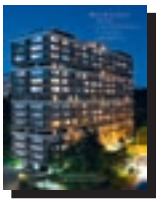

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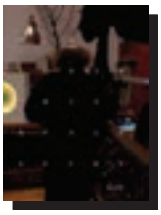

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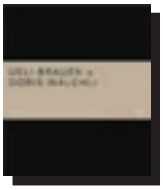

PÉRENNITÉS

Textes offerts à Patrick Mestelan

Bruno Marchand (ed.)

Presses Polytechniques et Universitaires Romandes, Lausanne 2012

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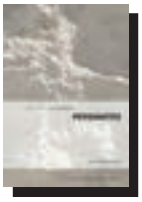

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Pramod Rastogi (ed.), Erwin Hack (ed.)

Wiley-VCH, Berlin 2012

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Nicolas Gillio, Emmanuel Ravalet

CERTU, Lyon 2012 – ISBN 978-2-11129-429-9

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Pour une maison saine et à basse consommation d'énergie

Claude-Alain Roulet

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Clemens von Sonntag, Urs von Gunten

IWA Publishing, London 2012

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Planning, Design, and Construction

R. K. Goel, Bhawani Singh, Jian Zhao

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ADVANCES IN DISCONTINUOUS NUMERICAL METHODS

and Applications in Geomechanics and Geoengineering

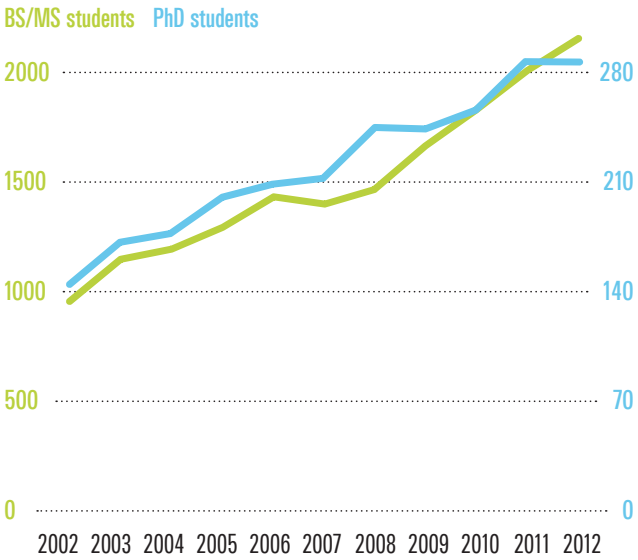
Jian Zhao (ed.), Yuzo Ohnishi (ed.), Gao-Feng Zhao (ed.), Takeshi Sasaki (ed.)

CRC Press, Taylor & Francis, London 2012 – ISBN 978-0-41568-404-0

FACTS & FIGURES

2418 students, including 283 PhD students who contribute to ENAC's long-term research
706 collaborators, or 585 full-time equivalent positions
80 million CHF — total ENAC budget
66 % of staff between 20 and 40 years old
78 nationalities
21 research and technology transfer agreements, totaling 4.5 million CHF

STUDENT NUMBERS



PEOPLE 31.12.2012

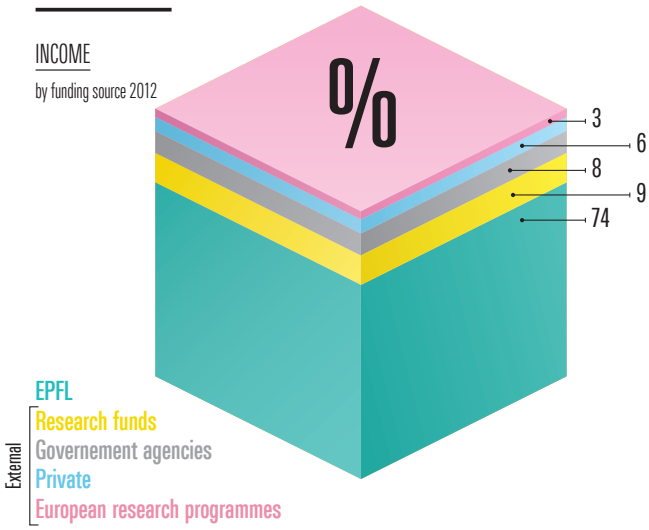
	EPT	% Women	% Foreigners
Professors	45.6	11%	48%
Adjunct professors & Senior scientists	11.7	7%	37%
Scientific collaborators	409.3	34%	69%
Technical & Administrative staff	118.6	39%	9%

	No.	% Women	% Foreigners
BS/MS students	2135	36%	33%
PhD students	283	39%	74%

FINANCES

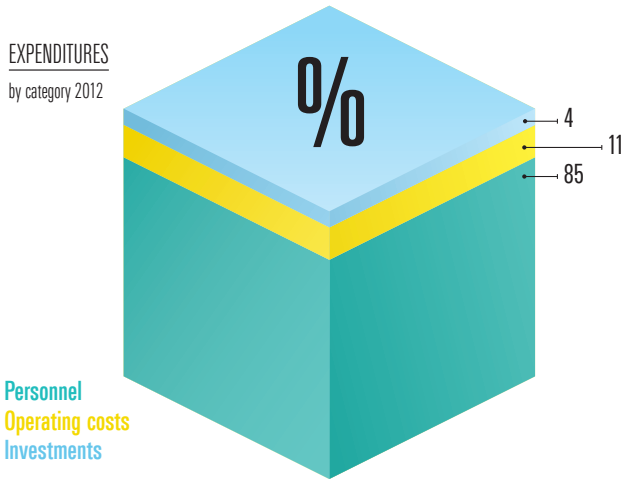
INCOME

by funding source 2012



EXPENDITURES

by category 2012



INCOME BY FUNDING SOURCE 2005-2012

in Mio CHF rounded up

	2005	2006	2007	2008	2009	2010	2011	2012
EPFL	51	50	53	50	53	54	59	59
External	22	17	20	20	20	21	22	21
Total	73	67	73	70	73	75	81	80

EXPENDITURES BY CATEGORY 2005-2012

in Mio CHF rounded up

	2005	2006	2007	2008	2009	2010	2011	2012
Personnel	59	57	59	60	62	64	66	68
Operating c.	11	8	10	8	8	9	10	9
Investments	3	2	3	2	3	2	5	3
Total	73	67	73	70	73	75	81	80

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AREAS OF EXPERTISE

Dynamic list on the web: **http://enac.epfl.ch/faculty**

ARCHITECTURE

ABOU JAOUDÉ Georges – *Associate Professor*

The architectural and digital model as representation of the project, Photography and digital photo architecture and hypermality of the domain of computer science

Informatic and Visualization Laboratory (LIV)

ANDERSEN Marilyne – *Associate Professor*

Sustainable architecture, Daylighting strategies, Energy-efficient design, Façade technology, Human comfort and health in buildings, Climate-responsive envelopes

Interdisciplinary Laboratory of Performance-Integrated Design (LIPID)

BASSI Andrea – *Associate Professor*

Urban project, Construction technologies, Energy considerations for building

Laboratory of urban architecture (LAURE)

COGATO LANZA Elena – *Senior Scientist*

Theory of urban and territorial design, History of urbanism

Construction and Conservation Laboratory (LCC)

DIETZ Dieter – *Associate Professor*

Processual knowledge in architectural training, Cultural analysis at the interface between the theory and practice of a project

Design Studio on the Conception of Space (ALICE)

FREY Pierre – *Adjunct Professor*

History of architecture, Archiving and recording of projects in architecture and civil engineering

Archives of Modern Building (ACM)

GARGIANI Roberto – *Full Professor*

Theory and history of techniques, Materials, Working processes, Structural systems, Analysis of constructive aspects of buildings

Theory and History of Architecture Laboratory 3 (LTH3)

GRAF Franz – *Associate Professor*

Building and comfort technologies, Preservation and reuse project of the modern architecture

Laboratory of Techniques and Preservation of Modern Architecture (TSAM)

GUGGER Harry – *Full Professor*

Architectural design, Urban planning, Project management, Construction management, Research in teaching methods, Research in architectural production

Laboratory Bazel (LABA)

HUANG Jeffrey – *Full Professor*

Design thinking, Interactive space smart buildings, Digital architecture

Media and Design Laboratory (LDM)

LAMUNIÈRE Inès – *Full Professor*

Architectural history in urban environments, New typologies of buildings, Contemporary re-qualifications of the notion of "city"

Urban Architecture and Mobility Laboratory (LAMU)

LUCAN Jacques – *Associate Professor*

Theory of architecture, History of the theories of composition

Theory and History of Architecture Laboratory 1 (LTH1)

MARCHAND Bruno – *Full Professor*

Theory of architecture, Rational architecture, Relationships between public spaces and collective housing

Theory and History of Architecture Laboratory 2 (LTH2)

ORTELLI Luca – *Full Professor*

Architectural design within historic contexts, Re-use and transformation of existing buildings, Housing as urban project

Construction and Conservation Laboratory (LCC)

REY Emmanuel – *Assistant Professor Tenure Track*

Sustainable architecture, Urban and architectural project, Sustainable construction technologies, Regeneration of urban wastelands, Sustainable districts

Laboratory of Architecture and Sustainable Technologies (LAST)

AREAS OF EXPERTISE

CIVIL ENGINEERING

ANCEY Christophe – *Associate Professor*

Rheology & fluid dynamics of geophysical flow and the resulting hazards, Modeling of natural hazards induced by water and avalanches, Physics of bed load transport

Environmental Hydraulics Laboratory (LHE)

BEYER Katrin – *Assistant Professor Tenure Track*

Performance-based seismic design and assessment of structures, Displacement-based design, Seismic behaviour of reinforced concrete and unreinforced masonry structures, Large-scale testing, Structural dynamics

Earthquake Engineering and Structural Dynamics Laboratory (EESD)

BRÜHWILER Eugen – *Full Professor*

Safety and reliability of existing structures, Durability of reinforced concrete structures, Ultra-high performance fiber-reinforced concrete for the rehabilitation of structures

Structural Maintenance and Safety Laboratory (MCS)

DENARIÉ Emmanuel – *Senior Scientist*

Rehabilitation of reinforced concrete structures, Engineering and applications of ultra-high performance fiber-reinforced concretes, Time dependent response of cementitious materials

Structural Maintenance and Safety Laboratory (MCS)

DUMONT André-Gilles – *Full Professor*

Design of traffic facilities and transport infrastructures, Transport and telematics, Infrastructure maintenance management

Traffic Facilities Laboratory (LAVOC)

KELLER Thomas – *Full Professor*

Structural design, Advanced composite materials, Multifunctional sandwich structures

Composite Construction Laboratory (CCLAB)

LABIOUSE Vincent – *Senior Scientist*

Cliff instabilities, Design of deep tunnels, Mechanical behaviour of poor rocks, Foundation engineering

Rock Mechanics Laboratory (LMR)

LALOUI Lyesse – *Associate Professor*

Geomechanics, Geotechnical and environmental engineering, Mechanics of multiphase porous materials

Soil Mechanics Laboratory (LMS)

LEBET Jean-Paul – *Adjunct Professor*

Design evaluation of structures, Failure analysis, Steel-concrete composite bridge behaviour, Steel-concrete composite columns and beams

Steel Structures Laboratory (ICOM)

LESTUZZI Pierino – *Senior Scientist*

Seismic behavior of reinforced concrete and masonry structures, Seismic evaluation of existing structures, Seismic vulnerability of cultural heritage buildings

Applied Computing and Mechanics Laboratory (IMAC)

MOLINARI Jean-François – *Full Professor*

Damage mechanisms in materials and structures, Contact mechanics, Multiscale modeling: from atoms to continuum, Scientific computing

Computational Solid Mechanics Laboratory (LSMS)

MUTTONI Aurelio – *Full Professor*

Conceptual design and dimensioning of structures, Mechanical behavior of ultra-high performance concrete elements and soil-structure interaction

Structural Concrete Laboratory (IBETON)

NUSSBAUMER Alain – *Adjunct Professor*

Structural design of steel and steel-concrete composite structures, Tubular structures and bridges, Fatigue and fracture of new and existing steel and aluminum structures, Probabilistic fracture mechanics and size effects

Steel Structures Laboratory (ICOM)

RASTOGI Pramod – *Adjunct Professor*

Development of new speckle techniques, Development of new holographic techniques, Fringe analysis using phase shifting techniques

Applied Computing and Mechanics Laboratory (IMAC)

SCARTEZZINI Jean-Louis – *Full Professor*

Daylighting systems, Photometry & colorimetry, Biomimetic control, Optimal stochastic control, Energy in buildings, Decision tools

Solar Energy and Building Physics Laboratory (LESO-PB)

SCHLEISS Anton – *Full Professor*

Hydraulic engineering and design of hydraulic structures and schemes, Interaction hydraulic structures with water, air, sediments and rock, Numerical and physical modeling, Flood modeling and forecasting

Hydraulic Constructions Laboratory (LCH)

SMITH Ian – *Full Professor*

Active structures, Structural identification, Sensor network design, Computer-aided engineering, Engineer-computer interaction

Applied Computing and Mechanics Laboratory (IMAC)

VULLIET Laurent – *Full Professor*

Design and testing of geostructures, Constitutive modeling, elasto-visco-plasticity, numerical modeling, Natural hazards: risk management

Soil Mechanics Laboratory (LMS)

WEINAND Yves – *Associate Professor*

Composite frames of wood and glass, Timber rib shells, Origami, Fractal geometry, Welding for wood, Stability of ribbed wooden shells

Chair of Timber Construction (IBOIS)

ZHAO Jian – *Full Professor*

Rock dynamics, TBM excavation, Rock engineering of tunnels: slope and foundation, Testing characterisation and monitoring, Earthquake and blast protection

Rock Mechanics Laboratory (LMR)

URBAN AND REGIONAL SCIENCES

BIERLAIRE Michel – *Full Professor*

Transportation analysis, Operations research, Discrete choice models, Nonlinear optimization

Transportation and Mobility Laboratory (TRANSP-OR)

BOLAY Jean-Claude – *Adjunct Professor*

Social practices in urban societies, Rural-urban interface, Urban environment and social disparities, Director of international cooperation

Urban Sociology Laboratory (LASUR)

GEROLIMINIS Nikolas – *Assistant Professor Tenure Track*

Traffic flow and control, Transport analysis, Transport operations

Urban Transport Systems Laboratory (LUTS)

GNANSOUNOU Edgard – *Adjunct Professor*

Integrated energy planning, Vulnerability of energy supply, Life-cycle analysis of energy systems, Sustainability of renewable energies (incl. bio-energy)

Bioenergy and Energy Planning Research Group (BPE)

KAUFMANN Vincent – *Associate Professor*

Mobility, Habitat and residential history, Violence and security, Urban sprawl and gentrification, Commuting

Urban Sociology Laboratory (LASUR)
Urban and Regional Planning Community (CEAT)

LÉVY Jacques – *Full Professor*

Urbanism, Land use planning and territorial development, Globalization, Political space, Epistemology of social science

Chôros Laboratory (LAC)

PEDRAZZINI Yves – *Senior Scientist*

Urban sociology, Urban studies, Violence and insecurity, Urban planning and development, Southern urbanization

Urban Sociology Laboratory (LASUR)

PATTARONI Luca – *Senior Scientist*

Habitat and housing policy, Sustainable urban development, Reciprocating movement, Social work, Sociology theory, Action theory, Political and moral philosophy

Urban Sociology Laboratory (LASUR)

THALMANN Philippe – *Associate Professor*

Environmental economics, Economics of sustainable development, Housing economics, Real estate economics

Economics and Environmental Management Laboratory (REME)

AREAS OF EXPERTISE

ENVIRONMENTAL ENGINEERING

AREY J. Samuel – *Assistant Professor Tenure Track*

Environmental chemical processes affecting organic pollutants, Computational quantum chemistry and thermodynamics, Phase partitioning and sorption models, Oil spills, Two-dimensional gas chromatography (GCxGC)

Environmental Chemistry Modeling Laboratory (LMCE)

BARRY D. Andrew – *Full Professor*

Water quality, Contaminated land/soils, Numerical modeling, Constructed wetlands

Ecological Engineering Laboratory (ECOL)

BERNE Alexis – *Assistant Professor Tenure Track*

Hydrometeorology, Radar remote sensing, Geostatistics

Environmental Remote Sensing Laboratory (LTE)

BERNIER-LATMANI Rizlan – *Assistant Professor Tenure Track*

Metal-microbe interactions, Metal bioremediation, Gene expression, Biogenic nanoparticles, Geobiology

Environmental Microbiology Laboratory (EML)

BUTTLER Alexandre – *Adjunct Professor*

Ecology, Quantitative methods, Ecosystem and landscape restoration and management, Biodiversity, Biogeochemical cycles, Wetlands, Pasture woodlands, Invasions

Ecological Systems Laboratory (ECOS)

DE ALENCASTRO Luiz Felippe – *Senior Scientist*

Analytical chemistry of environmental trace pollutants, Fate and impact of contaminants in the ecosystem, Water quality, Scientific cooperation with developing countries

Central Environmental Laboratory (GR-CEL)

GOLAY François – *Full Professor*

GIS application design, Spatial decision support systems, Geospatial data infrastructures, GIS for environmental management and for urban studies and design

Geographic Information Systems Laboratory (LASIG)

HERING Janet – *Full Professor*

Biogeochemical cycling of trace metals and metalloids, Mineral weathering and reactions at mineral surfaces, Water treatment processes for removal of inorganic contaminants

Prof. Hering Group in Environmental Chemistry (UPHCE)

HOLLIGER Christof – *Associate Professor*

Bioremediation, Wastewater treatment, Environmental microbiology, Anaerobic digestion, Biogas and biofuels

Laboratory for Environmental Biotechnology (LBE)

KAPLAN Jed Oliver – *SNF Assistant Professor*

Climate change and global biogeochemical cycles, Earth system modeling, Land-atmosphere interactions, Evolution of agriculture, technology, and civilizations, Paleoclimate and paleoenvironmental change

Soil-Vegetation-Atmosphere Research Group (ARVE)

KOHN Tamar – *Assistant Professor Tenure Track*

Degradation and elimination of chemical pollutants, Solar disinfection of viruses, Low-cost water treatment

Environmental Chemistry Laboratory (LCE)

LEHNING Michael – *Full Professor*

Interaction cryosphere-atmosphere in particular snow processes, Natural hazards warning and forecasting, Turbulence and boundary layer flows over alpine terrain, Mountain hydrology and permafrost modeling

Laboratory of Cryospheric Sciences (CRYOS)

LUDWIG Christian – *Adjunct Professor*

Waste processing, Materials cycles and resource recovery, Thermochemical processes, Trace compounds in hot process gases, Chemistry at the solid/water interface

EPFL-PSI Joint Professorship on Solid Waste Treatment

MARTINOLI Alberto – *Associate Professor*

Swarm intelligence, Distributed and networked robotics, SSA networks

Distributed Intelligent Systems and Algorithms Laboratory (DISAL)

MEIBOM Anders – *Full Professor*

Isotope geochemistry and cosmochemistry, Biomineralization processes, Environmental proxies, Ion-microprobe analyses

Laboratory for Biological Geochemistry (LGB)

MERMINOD Bertrand – *Full Professor*

Acquisition of topographical data, Geodesy, Satellite positioning, Pedestrian navigation, Indoor positioning, Least squares estimation, Kalman filtering

Geodetic Engineering Laboratory (TOPO)

PARLANGE Marc – *Full Professor*

Land-atmosphere exchange, Large Eddy Simulation (LES), Evaporation, Snow physics, Atmospheric boundary layer

Environmental Fluid Mechanics Laboratory (EFLUM)

PERONA Paolo – *SNF Assistant Professor*

River mechanics and erosion processes, Alpine catchments ecohydrology, Rheology and fluid mechanics, Time Series Analysis, Stochastic and dynamical systems theory, Optimization and decisional techniques

Applied HydroEconomics & Alpine environmental Dynamics Group (AHEAD)

PORTÉ-AGEL Fernando – *Full Professor*

Fluid Dynamics (environmental and computational), Wind Energy, Hydrokinetic Energy, Large-Eddy Simulation, Turbulence

Wind Engineering and Renewable Energy Laboratory (WIRE)

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Groundwater and surface hydrology, Solute transport processes, Fluvial geomorphology, Ecohydrology

Laboratory of Ecohydrology (ECHO)

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Ecotoxicology, Environmental toxicology and risk assessment, Nanotoxicology

Laboratory of Environmental Toxicology (TOX)

SKALOUD Jan – *Senior Scientist*

Kinematic positioning and attitude estimation mobile mapping, Satellite and inertial navigation, Sensor integration and calibration, Direct georeferencing

Geodetic Engineering Laboratory (TOPO)

STEFFEN Konrad – *Full Professor*

Polar climatology, Ice sheet mass balance and sea level change, Changes in the cryosphere in a warming climate, Remote sensing applications for climate system studies

Prof. Steffen Group in Cryosphere Sciences (UPSSC)

TAKAHAMA Satoshi – *Assistant Professor Tenure Track*

Measurement, analysis, and modeling of atmospheric aerosols, Simulation of multiphase chemistry and physics, Spectroscopy and spectromicroscopy analysis for particle composition and morphology characterization

Atmospheric Particle Research Laboratory (APRL)

VON GUNTEN Urs – *Full Professor*

Drinking water quality, Physical chemical water treatment, Oxidation and disinfection processes, Micropollutant elimination, Disinfection by-product formation

Laboratory for Water Quality and Treatment (LTQE)

WÜEST Alfred Johny – *Full Professor*

Turbulence and mixing in natural waters, Modelling of currents and internal waves, Boundary layer processes and double diffusion, Aquatic system analysis (climate, water quality)

Physics of Aquatic Systems Laboratory – Margarethe Kamprad Chair (APHYS)

CHAIR OF LAW

DUBEY Jacques – *Associate Professor*

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