

DIAGONAL

FOCUS

Landscape: Much more than just a backdrop

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EDITORIAL

Dear reader

The Matterhorn in morning light, the lake district in the Upper Engadine or the vineyards in Lavaux – these are the tourist postcard images I associate with the word “landscape”. What we often forget is that the urban sprawl in many parts of the Swiss Central Plateau is also landscape.

Landscapes are not static, but are shaped and changed, particularly by us humans. As a climatologist, I think not just about construction activity, but even more about the melting glaciers.

Like the landscape itself, our perceptions of it also change. The landscapes we consider beautiful today are different from those our ancestors found attractive.

Landscape research therefore takes place at the intersection between the natural and social sciences, and also looks at such “soft” factors as wellbeing. This was new territory for me when I became Director of WSL. Perhaps some of you will also be in a similar position when you read this Diagonal. I hope that you – like me – will realize that the social science aspect of the research is not only relevant, but also fascinating!

I wish you an enjoyable read.



Prof. Dr. Konrad Steffen
Director WSL



Landscape



LANDSCAPE RESEARCH GOES TO SCHOOL

Young researchers from all over the world learned about data, tools and models for analyzing patterns and processes in landscapes.

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ONE-TWO

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LANDSCAPE UNDER CONSTANT OBSERVATION

The program “Landscape Monitoring Switzerland”, LABES, is an innovative tool for assessing and improving the quality of the landscape in Switzerland.

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OUR LANDSCAPE CONCERNS US ALL

Whatever we do, we change the landscape. Our landscape researchers take a closer look so that we can shape these transformations together.

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FOCUS We find landscape everywhere. Whatever we do, we change it. The landscape researchers at WSL take a closer look so that we can shape these transformations together.

Our landscape concerns us all

An aerial photograph of a Swiss valley. A river flows through the center, flanked by a road and a railway line. The valley floor is a mix of green fields, forests, and a town. In the background, there are large, rugged mountains under a cloudy sky. Two white callout boxes with lines pointing to specific areas in the landscape provide context.

The proportion of forest is increasing in high-lying sites because the meadows and pastureland are no longer managed. The landscape is changing.

Most Swiss rivers have been straightened to provide protection against flooding and to gain land. Today river restoration projects allow nature to have more space again.



In a WSL survey, 70 per cent of respondents said they would prefer to live in a village.

The Glarner part of the Linth Plain with Näfels (right) and Mollis (left). Oberurnen is in the foreground.

Photo: Markus Judd, Linth Administration

The Linth Plain between Lake Walen and Lake Zurich is a modern landscape on the Swiss Central Plateau. The rivers have been straightened and the land wrested from the floods is intensively cultivated. It is a typical landscape on the edge of a large agglomeration, with affordable housing and lots of green. The population, residential area and traffic are increasing particularly quickly, and humans and the natural environment are more frequently getting in each other's way – in the midst of magnificent mountain scenery.

This is where our fictive travel companion – let's call him Jonas Hauser – lives. Using him as an example, we want to show how landscapes are not just the subjects of photos, but also of their own separate branch of research – and rightly so. Hauser is 32, and lives with his wife and daughter in Schänis (SG) in a detached house close to some fields. The Hausers like life in the village, where they also grew up. The shopping center is within easy reach by car. They represent, in a sense, the average inhabitant in this type of landscape, which is widespread in Canton Aargau's Freiamt or Canton Luzern's Seetal. This "average inhabitant" is derived from the analysis of a representative survey carried out as part of WSL's Research Programme "Room for People and Nature".

Changing needs

Monday morning: the car mechanic, Jonas Hauser, drives to work in Rapperswil, Canton St Gallen, along the A3 highway. His route to work already touches on several WSL research topics. The highway runs parallel to the Linth Canal, built by Hans Konrad Escher more than two hundred years ago to tame the Linth,

which was previously prone to flooding. In summer the Hausers enjoy trips in an inflatable boat and having a break on the gravel banks where the river has recently been widened in Hänggelgiessen, creating space not only for peak floodwater but also for rare animals and plants. A new tunnel for wild animals goes under the A3. In the research study ENHANCE, WSL and partner institutions explored how roads and intensive agriculture separate deer, insect and frog populations and what can be achieved with measures to improve connectivity. Social scientists have also investigated whether and how river regeneration can create new natural areas for locals seeking places for recreation. Tips for future such projects can be found in the WSL guidelines “Socially Sound River Restoration” (available only in German ‘Sozialverträgliche Fluss-revitalisierung’).

As people’s needs have changed, so too have their attitudes to this landscape. While in 1807 it was described as a “sad bit of marsh” with “poisoned air” in a brochure to raise money to construct the canal, today it is seen as a “nursery for species diversity” where beavers, fish and rare birds can live. For the Hauser family it is welcome destination for excursions. This makes it clear that a landscape is not just made up of physical things. Landscapes are also defined through emotional and personal values. Who likes old farmhouses or lively city parks? Is a meadow valuable because of the butterflies, the nutritious hay or what it would cost on the property market? The program “Landscape Monitoring Switzerland” (LABES), managed by WSL and FOEN, the Federal Office for the Environment, records not only the physical qualities of a landscape but also how it is perceived locally (see page 16). Landscape research is therefore a very interdisciplinary research topic, which occupies biologists, social scientists and economists equally. The Landscape Research Center at WSL coordinates the different areas of expertise involved.

For more information on the Center for Landscape Research, see: www.wsl.ch/landscape_center

Little space, but many demands

Landscape research at WSL has its roots in nature conservation, when the forerunner Institute of WSL began in the 1970s to make an inventory of Swiss raised bogs. In 1987 the Rothenthurm Initiative to protect mires was approved by the Swiss electorate and social scientific landscape research was started at WSL to create a scientific basis for the inventory of “Wetlands of Outstanding Beauty”. Very soon afterwards, the focus of this research was on one of the most hotly debated conflict zones: residential areas.

An indication of how most Swiss view urban sprawl critically was the way they voted on the Second Homes Initiative in 2012, and a year later on the revision of the Spatial Planning Act. Landscape researchers at WSL asked, as part of the National Research Program “Soil as a Resource” (NRP 68), all Swiss municipalities what measures they were using to try to control urban sprawl (see Diagonal 2/16). These instruments can now be evaluated in other projects in a systematic way, and thus constitute a further important pillar of WSL’s landscape research.

The landscape affects all of us because many of the decisions we make have an impact on it, for instance, when we build houses, commute to work, play golf or vote. “In densely populated Switzerland, many demands come together within a small area,” says Matthias Bürgi, Head of the Research Unit

“Landscape Dynamics” at WSL. Jonas Hauser, for example, loves racing downhill with his mountain bike, which many hikers don’t like at all. At the same time, he gets annoyed if the parking places along the Linth are full on Sundays. WSL research tries to find solutions for such conflicts.

What kind of landscape do we want? The answer, according to WSL’s investigations, depends very much on who one asks. People living in Alpine regions, for example, tend to prefer the traditional cultivated landscape, while city-dwellers want more wilderness and the return of large carnivores in mountain areas. The Hauser family still want to live in a green area, but are totally against high-rise buildings in their village even though building more densely would help to cope with the expansion of residential areas. This is typical of the attitude “not in my backyard”, so well-known in the social sciences.

For landscapes to be developed in an environmentally friendly and socially sound way, we first need to know how human interventions affect people and the natural environment. The relevant facts can be obtained from landscape researchers’ numerous studies, such as how to reduce light pollution, which disturbs bats. The researchers are finding out which human and natural influences change mountain forests, or how tourists react to solar panels on avalanche protection structures.

Restricting individual freedom

Creating more space for the natural environment, forgoing the construction of new houses and managing sports activities all restrict individual freedom and may create costs. We therefore need to know whether the measures have the desired effects. In, for example, the project “Monitoring the Effectiveness of Habitat Conservation in Switzerland”, the Federal Office for the Environment (FOEN) assigned WSL researchers the task of assessing whether the protection of habitats of national importance was effective. Another such project is evaluating the campaign ‘Respektiere Deine Grenzen’ (gloss: “Respect your boundaries”), which is intended to keep powder-snow enthusiasts like Jonas Hauser, a passionate free-rider, away from wildlife protection zones.

“Change alone is eternal,” said the philosopher Arthur Schopenhauer (1788–1860), almost as if he himself were a landscape researcher. Or he could have lived on the Linth Plain, which is one of four model regions in WSL’s Research Programme “Room for People and Nature”. In workshops with researchers and locals on positive and negative visions for future development, it became very clear that the scenario “business as usual” is not an option as it leads to undesirable urban sprawl (see the interview on page 12).

Thanks to landscape research, the municipalities in the model regions have a concrete idea about the direction in which they should develop. They also have more idea about how they can influence the development to ensure that Switzerland does not just develop wildly in an unplanned way, but is shaped as far as possible by all those involved. Even if the Hausers really like going shopping in the town, they still want to live in the countryside. *(bki)*

For more information on the Programme “Room for People and Nature”(in German), see: www.wsl.ch/raumanspruch

Many Swiss have, according to WSL studies, rather inconsistent attitudes to wilderness, i.e. natural environments untouched by people. They tend to view them positively, but still want to have parking spaces, garbage bins and barbecue areas.





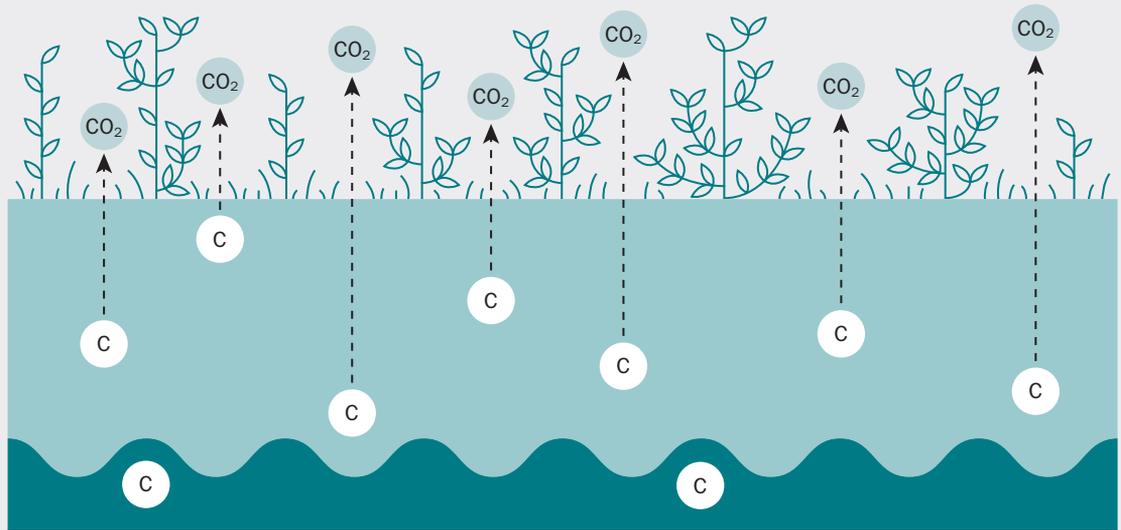
WaMos (Socio-Cultural Forest Monitoring), a joint project of WSL and FOEN, has shown that people for whom the forest was important or very important during their childhood can, as adults, relax and recuperate better there than other people.

Typical features of a popular recreation area are, according to the findings of a joint WSL and FOEN project, a stretch of water, abundant forest, varied land use and a dense network of paths. Most important, however, is ease of access.

The Chapfen Lake near Mels (SG) is a popular and easily accessible destination for recreation.

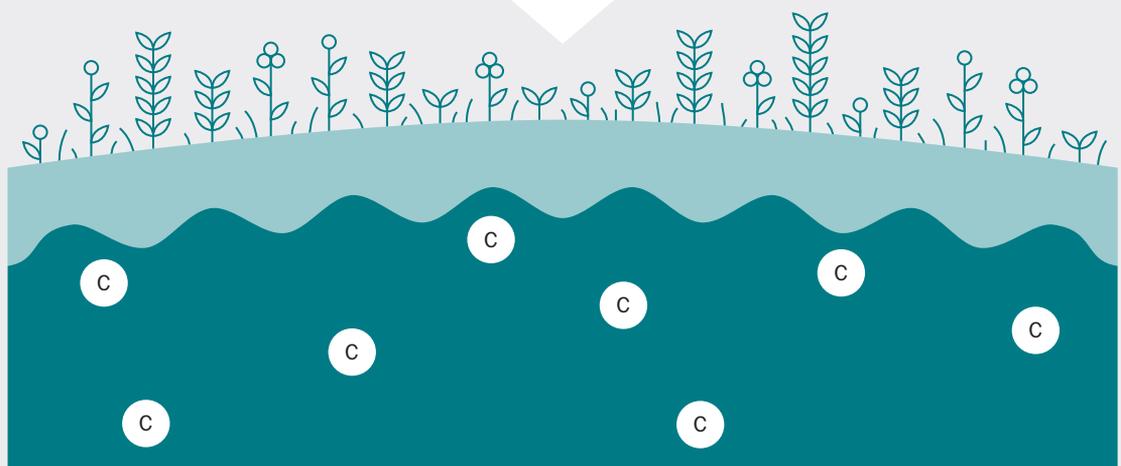
INFOGRAPHIC Protecting the climate through peatland conservation

Most of the raised bogs in Switzerland have been drained. This has led not only to the loss of a unique habitat, but also to another problem: former peat soils emit a great deal of CO₂. WSL researchers have estimated how much CO₂ emission could be prevented through rewetting raised bogs, and have produced a proposal for voluntary compensation payments.



DRAINED RAISED BOG

0.056 t org. C/m³ potential emissions
 ≅ 1026 t CO₂-equivalent/ha and 50 cm peat depth



RESTORED RAISED BOG

0.056 t org. C/m³ bound
 ≅ 1026 t CO₂-equivalent/ha and 50 cm peat depth

The figures given are averages.

REPORTAGE **Landscape research goes to school.** Young researchers from all over the world spent a week learning about data, tools and models for analyzing patterns and processes in landscapes. The Linth Plain served as the case study region.

The bus meanders unhurriedly through the valley. The travellers take in the landscape rolling by, snap photos through the window or chat. English, German, Romanian or Farsi can be heard. The young women and men in the bus could be average tourists doing the round of sights in Switzerland as fast as possible. But they are not travelling from Zurich to Lucerne or Zermatt. Instead, they are staying on the Linth Plain, where tourists normally don't stop. The "sights" they want to look at are: urban sprawl, landscape fragmentation, the Escher and the Linth Canal, the camping site Gäsi on Lake Walen and the Kaltbrunner Riet.

The raised bank of the Linth Canal is well visible during the short journey on the highway. Meadows and maize fields appear one after the other, with the mountains rising behind them a bit further away. In one of the fields storks are standing – much to the delight of the travellers. Mahsa, a 28-year-old Iranian, is one of them. She studied landscape and environmental design. It is her first trip to Switzerland, and she is really rather lucky to be on the bus today. Mahsa and the other travellers are taking part in the Summer School in "Land System Science", which became booked out very quickly shortly after it was advertised. Like the other 23 participants, Mahsa got to Kerenzerberg in Filzbach (Canton Glarus) the previous evening. During the week she will learn about the data, methods, and models that are used today in landscape research, with the Linth Plain as the case study region. To get a feeling for the landscape here, the participants are now out on the bus excursion.

How can landscapes be modeled?

It is not just by chance that the Summer School is taking place here: "The Linth Plain is an everyday landscape. It can be used to illustrate, within a small area, various aspects of landscape research, such as the consequences of urban sprawl, the interconnection of different landscape elements or the planning of nearby recreation areas with the involvement of the local population," explains the WSL landscape researcher, Janine Bolliger. She designed and organized the Summer School in cooperation with her colleague, Silvia Tobias. The number of inquiries they received took them both by surprise. "With so many people interested, we could have run two Summer Schools at once. Apparently our data- and tool-oriented course fills a niche."

The participants travelled from all over the world to get here. Many of them grew up in very different landscapes – in e.g. South Africa, the USA, Iran, Vietnam, Pakistan, Hungary or Sweden. Nevertheless they did not often consider the differences between landscapes in their country of origin and the everyday Swiss landscape so great. "In Switzerland residential areas are built very



What do the young researchers see in this landscape? On the first evening of the Summer School they exchange experiences.

differently from ours. But the landscape and the complex interaction between humans and nature are very similar in Iran,” explains Mahsa during the short walk from the viewing tower in the Kaltbrunnerriet back to the bus.

The group of students is very mixed, and so are their academic backgrounds, bringing together soil and agricultural scientists, ecosystem researchers and landscape architects. Some have just started their doctoral research, whereas one participant had already qualified as a university lecturer. But they all share a common interest: they want to assess changes in the landscape – ongoing as well as ones that may happen sometime in the future – and study how such changes affect landscape patterns. Many of them registered for the Summer School because they wanted to learn how to handle GIS data or try out landscape modeling on the computer.

Practice, practice, practice

After the field trip the work starts: Over three days the participants practice how to handle data from remote sensing. They learn how to model different types of land use on the computer and how landscape changes can be visualized. And they find out how to develop landscape scenarios for the future jointly with the public. At the same time the lecturers also give them an idea about how they as scientists can support decision-making in practice about sustainable land use. In setting up this Summer School in collaboration with the Global Land Programme, the Universities of Wageningen and Amsterdam and the Center of Development and Environment (CDE) at the University of Bern, the Center for Landscape Research WSL has made an important contribution to the further education of landscape experts.

The participants don't have much time for leisure activities during their week at Kerenzerberg. Before dinner they work in groups of three on the presentations they will give at the end of the week. Their task is to develop



24 young landscape researchers from 12 countries participated in the first Summer School on “Land System Science” that took place at the end of August 2017 in Filzbach (Glarus).

potential projects for landscape research on the Linth Plain, which is quite a challenge in such a short time. But Janine is very pleased with the way the students refer to so many of the tools they were introduced to in their project proposals. Mahsa, the student from Iran, is also happy: “During this week I have been able to work with GIS data for the first time. I enjoyed it. For my doctorate I will be performing spatial analyses, which means I will be able to immediately apply what I have learned.”

After a last lunch together on Friday, the Summer School will come to an end. Many are travelling from Filzbach directly to Zurich Airport. Mahsa is, however, staying in Switzerland. For her the Summer School is the start of a new period in her life because, in two weeks, she will begin working on her doctorate at WSL in Birmensdorf. Over the next four years she will look into the differences between the urban green spaces in Switzerland and in Iran, and thus get to know Switzerland better. But first she has her sights on a rather different adventure: a German intensive course in Zürich. *(lbo)*

Coordinated regional planning in practice.

When eight municipalities were merged to make one large municipality “Glarus North”, the zoning plan had to be revised. The Mayor, Martin Laupper, and the WSL landscape researcher, Silvia Tobias, on opportunities and challenges in the planning.

Herr Laupper, Glarus North was a case study region in the WSL Research Programme “Room for People and Nature”. Tell us about your municipality!

ML: Glarus North is located at the entrance to Canton Glarus, and is therefore in a privileged position from the point of view of infrastructure as it is, for example, close to the freeway. This makes us an economic motor for the Canton, which should help to attract new jobs. At the same time, we don’t want to cover everything with concrete. We’d like to take advantage of the wonderful recreation areas close by that the region has to offer. This means balancing out the need to be an economic driving force for the whole of Glarus, and the need for people to live and thrive here, enjoying the nearby opportunities for recreation.

ST: Glarus North lies within the sphere of influence of the greater Zurich area and the pressure on housing and infrastructure is correspondingly high. People can live in the countryside here but still commute to work in Zurich. It is just such “peri-urban” regions that we wanted to focus on in our Research Programme.

Glarus North was created in 2011 through the merger of eight municipalities ...

ST: ... which makes it particularly interesting for us: after the merger, the local planning had to be revised. This takes place regionally because the municipality is so large and is made up of several villages. Glarus North can therefore serve as a model for regionally coordinated planning.

ML: WSL’s Research Programme extended our horizons, and gave us many ideas about what kinds of things are possible. Reforming the structure of the municipality is a cultural challenge, particularly as we have to find a new identity. Confronting such a “soft” factor with the hard facts has enabled a tremendous new dynamic. Large infrastructure projects that had been blocked for decades have suddenly become possible. For example, the bypass for the villages will not only enormously improve the quality of life here, but it will also benefit the rest of the Canton because no longer will everything get stuck in traffic jams. Or take the airfield in Mollis. We took over the site from the military and now plan to convert part of the agricultural zone into a workplace zone. As compensation, we will take other sites out of the industrial zone. This is only possible if you work regionally – where, in a small municipality, can you reduce the



Martin Laupper is a member of the Liberal Party and has been the Mayor of Glarus North since the municipality was founded in 2011.



Silvia Tobias is an environmental engineer and was Head of WSL’s Research Programme “Room for People and Nature”.

size of the building zone? And now a competence center for helicopters is being set up, which will potentially create around five hundred jobs. This will also benefit local businesses, including restaurants and shops. We estimate that nearly one thousand new jobs could be attracted to the region by the Helicopter Competence Center. This will strengthen our region and make it more attractive for the general public.

ST: Our survey showed that the local people want to live in a lively village. They want, for example, to be able to go out for a drink in the evening. This alone wouldn't, however, provide enough income for any restaurant to survive. If people in the new jobs go out to lunch, the chances of a restaurant succeeding are greater. The creation of new jobs does not mean that they will necessarily go to local people already living here. New jobs in an area are usually first taken by people who commute there from elsewhere, but they still do, of course, contribute to local development.

The regional planning has thus promoted the economic development the region wants. But if only some of these job-holders live here, then urban sprawl will increase. This goes against the kind of spatial development wanted.

ML: From the point of view of financial policy, we need population growth to have more tax income so that we can improve local infra-

structure. Our aim is to have a population increase of one per cent per year. What matters is how responsibly we tackle spatial planning. For example, we have changed the zoning in all village centers so that the buildings there can be raised to three floors. We try to regulate the inner development and specify conditions to ensure it is attractive. At the same time, housing development outside the villages must remain limited.

Economic development without urban sprawl: are you trying to have your cake and eat it too?

ML: Yes. I don't know if it will really work, but in our opinion it should be possible.

ST: From a regional point of view, you can have your cake and eat it too by developing the regional centers to become small towns while deliberately cultivating rural qualities in the small villages. People who prefer more urban lifestyles and value, for example, having good public transport connections or close access to the freeway will live in regional centers like Niederurnen or Näfels. Others will prefer to live in a small village such as Filzbach, where they can have a little house in the countryside but seldom a bus. People naturally always want to "have their cake and eat it", but they know this is not possible. They decide what is more important for them, and then choose where to live accordingly.

ML: In our municipality you can have both!

Synthesis Report of
WSL's Research
Programme "Room
for People and
Nature" (in German):
[www.wsl.ch/
raumanspruch](http://www.wsl.ch/raumanspruch)

“Reforming the structure of the municipality is a cultural challenge, particularly as we have to find a new identity.”



Visualisations of the potential development of the residential areas according to WSL's Programme "Room for People and Nature" in Glarus North until 2030. Possible additional buildings are shown in red. Top: Scenario "Trend" (the development continues as in previous years). Middle: Scenario "Vision" (wishful thinking of the workshop participants). Bottom: Scenario "Pressure" (very strong economic development with, at the same time, little state control). Source: WSL Berichte, No. 35, 2015 (p. 25).

How do you put this into practice? While Glarus North has “guiding principles for spatial development”, which were defined in a participative procedure, now binding agreements with the landowners on land-use planning are needed.

ML: We have met with considerable opposition because we have to re-zone 43 hectares of privately owned land previously classified as building land. The revised Spatial Planning Law specifies that building land must not exceed what is needed for the next 15 years. This corresponds in principle with the development we want, but we would like to have more transition mechanisms. The re-zoning involves destroying property values for which we cannot pay compensation even though in most cases we don't need to. This has naturally provoked opposition. We are also meeting with resistance from the agricultural sector because of the need for space for aquatic environments and from the building sector because of the new building regulations. Everybody has their own particular interests.

ST: The approach Glarus North took to involve the local population in a workshop on the future of the municipality is very good. The resulting principles are shared aims, which the majority support. For people to now want individual exceptions is just human nature. But if you can refer to the principles that were agreed on together, then it becomes less easy to justify why just I should be an exception. I am therefore confident that the land-use planning can be implemented – which would set a good example for other Swiss municipalities.

ML: We will have a fight on our hands up to the last minute. We may have to agree to make certain compromises in order not to jeopardise the whole undertaking. But I would like to emphasise what Silvia Tobias said: This is not something that we simply dreamt up all on our own in private. We sat down with people and thrashed out the principles. And now we are implementing them. Were the local population not to stand by us, that would be really very frustrating. At the moment many people only see the disadvantages. But we have a great opportunity to make use of the energy to be found in the newly created municipality and the regionally coordinated development!

ST: Unfortunately people tend to talk mostly about the disadvantages and take it for granted that they can benefit from the advantages.

ML: Exactly. We tend to accept them as if they had just happened on their own. We often fail to see the connections. Only when you really participate in the process do you realize how much you can achieve through spatial development. This, for me personally, was the best experience. *(bio)*

LABES Landscape under constant observation. The program “Landscape Monitoring Switzerland”, LABES, is an innovative tool for assessing and improving the quality of the landscape in Switzerland.

So what is the state of the landscape in Switzerland? Do you consider the landscape where you live to be beautiful? Nine years ago, two WSL researchers, Felix Kienast and Marcel Hunziker, decided to set up, together with the Federal Office for the Environment (FOEN), an ambitious monitoring program to record not only physical changes in the landscape, but also how the public perceived it on the basis of around 30 indicators. “Landscape Monitoring Switzerland (LABES)” is today available as an exemplary monitoring program in Europe.

To record such physical indicators as forest area or freely accessible stretches of water, the researchers rely on data from WSL, Swisstopo, the Federal Statistical Office and agricultural sources. They combine these raw data and augment them with additional data from satellite images. This allows Felix to determine, for example, which areas are completely dark at night or how many rivers and streams have footpaths running along them.

To find out how the public perceive and value the landscape, the WSL researchers carry out representative surveys. Local residents are asked, for example, whether they consider the landscape of the municipality where they live to be varied and authentic, whether the elements in the landscape go well



The Kaltbrunner Riet on the Linth Plain (SG). Conservation areas increase the attractiveness of the landscape.



The Magadino Plain (TI) is dominated by a peri-urban landscape and not covered with pretty Ticinese villages, beautiful lakes or varied agriculture.

together and whether they like the landscape in general. Marcel explains: “It is not just the physical landscape that is changing, but also the way we value things. This is why it is important to record public perceptions as well. Only if we know more about both aspects will we find out whether changes in the landscape are positive or negative.” Marcel and Felix are therefore combining the natural and social science indicators to obtain estimates of how the inhabitants in different types of municipality and regions experience and evaluate the landscape. Felix summarizes the value of LABES thus: “FOEN can be proud of this instrument, which assesses both the physical and perceived landscape. It enables us to completely fulfill, for the first time, the monitoring requirements of the European Landscape Convention – an agreement that Switzerland ratified in 2013.”

Development and public assessment of the landscape

According to the indicator “Light Emissions”, which is based on satellite images, the last places where no light at night brightens the darkness disappeared in the Swiss Central Plateau in 1996 and in the Jura in 2008. Complete darkness in Switzerland today can only be found in 25 to 30 per cent of the Swiss Alpine region. Another development is that the size of settlement areas is increasing, particularly on the Central Plateau. Nevertheless the public, on average, rate the quality of the landscape in Switzerland very high. People generally think the landscape around where they live is beautiful and identify with it.

There are, however, regional differences. Rural municipalities are valued most positively. They are considered to be the most diverse and authentic. The Northern and Central Alps also receive good ratings. They tend to fascinate the public. LABES has also been able to draw interesting conclusions about the Federal Inventory of Landscapes and Natural Monuments of National Importance (BLN). The larger the proportion of BLN areas is in a municipality,

the higher the ranking of the landscape quality there. This applies in particular to the indicators “Particularity” and “Reference to the Past”, which were what were used in selecting the BLN areas. The survey suggests that people really notice the corresponding auras of such areas.

Landscapes in agglomerations score the worst. The researchers assume that the negative assessment has to do with the fast urban growth. Unlike in rural and so-called “central municipalities”, well over fifty per cent of the buildings in agglomerations were built later than 1960. This is probably why, for example, the indicator “Reference to the Past” – which is important for people to identify with a landscape – was valued less highly in agglomerations than in other municipalities. What is striking is that the suburban municipalities directly on the edge of cities are valued less highly than the peri-urban municipalities that are furthest out in a city’s surroundings. Even though the building structure is similar in both types of municipality, the peri-urban municipalities are normally less built up and have more green spaces. They often seem more rural because their structure is reminiscent of that of a typical village. As a result, the inhabitants can identify better with the surroundings where they live.

What is also noticeable is that people living in Southern Switzerland generally assess the landscape worse, even worse than the inhabitants of sub- and peri-urban municipalities on the Central Plateau do. A few physical indicators and the housing situation help to explain these low values: A landscape dominated by forest is comparably monotonous, with forest and residential areas bordering each other closely. Most inhabitants in this region live in sub- and peri-urban municipalities, which are concentrated in the valley floors together with the transport routes, thus putting agricultural areas under pressure. Moreover, most of the few agricultural plots are farmed intensively as is the case, for example, on the Magadino Plain. It is not until you reach the mountain villages, or go above the timberline or along the lake shores and river banks that you notice how attractive the landscape is, and why it has made Ticino a popular destination for tourists.

This landscape-monitoring program has shown that the quality of the landscape in Switzerland is further deteriorating, although in a few areas improvements have been made. The public tend, nevertheless, to be satisfied with their surroundings. Future surveys will show if and how long this will remain the case. *(sni)*

Benjamin Schmid, Birmensdorf

“‘Solothurn is by the sea,’ says a sign on the Aare Promenade. I grew up in Solothurn and spent many pleasant summer evenings there by the water. I frequently return to the town at the southern foot of the Jura to visit friends and enjoy the relaxed atmosphere.”



MAKING RENEWABLE ENERGY FINANCIALLY FEASIBLE

In his doctorate Benjamin Schmid is studying organizations where people jointly finance projects to produce renewable energy. The political scientist is interested in how such organizations, which

are usually cooperatives or associations, develop and how they interact with local authorities. “Through this work I have met many committed and inspiring individuals.”

FORESTS Using ancient genetic material to read the past and look into the future



After each processing step, the researchers clean the tools and containers they used with bleach.

It smells of chlorine. The room is brightly lit and has no windows. The equipment is frugal – centrifuges and shakers, with pipettes, tweezers and laboratory spatulas on the sterile lab benches. The people who work in the clean-air lab have to be extremely careful to make sure no dust particles contaminate the samples because here, in the basement of the Plant Protection Lab at WSL, researchers are investigating the genetic material of plant and animal remains that are several thousands of years old. This genetic material is present in only the tiniest amounts and is, moreover,

fragmented and damaged. Introduced particles from outside, such as flower pollen, could ruin all the analyses.

This is why the researchers take a shower and slip into white overalls before entering their workplace. They also wear face-masks, gloves and protective goggles. They frequently wash the gloves and lab benches with bleach, which destroys DNA and is the source of the unpleasant smell in the lab rooms. The air pressure in the lab is higher than in the open air to ensure no dust particles or flower pollen can get in from outside.

Silver fir in southern Ticino

Ancient DNA allows a glimpse through the keyhole into past ecosystems. “Genetic analyses of long extinct populations have proved helpful in understanding how species react to environmental changes,” says Christoph Sperisen, a population geneticist at WSL. The researcher is bending over a mechanical shaker in which he is grinding ancient wood samples into powder in order to isolate the genetic material.

Recently Christoph and colleagues from the Universities of Lausanne and Bern succeeded in reconstructing the history of a former silver fir stand in Ticino. The researchers analyzed silver fir needles retrieved from the sediment of Lake Origlio (TI). The needles were between 5,800 and 7,100 years old. During this period, settlers there started to clear the forests to obtain farmland. The results show that, with farming, the silver fir stand shrank and, consequently, so did its genetic diversity.

About 6,200 years ago, both the stand and the genetic diversity recovered again. Comparisons of the DNA from silver fir needles of different ages indicate that the stand re-established from trees surviving in the area; trees from other regions were probably not involved.

Avoiding incorrect interpretations arising from contamination

In the room next door, Christoph's colleague, Bertalan Lendvai, is pipetting a prepared solution of genetic material into small plastic tubes. Using a special technique, he will multiply, within a very short time, the small amount of ancient genetic material a million times. Since this process also multiplies the DNA from impurities, the surfaces of the samples must be thoroughly cleaned beforehand.

This process is challenging the researchers, Christoph and Bertalan, in a project that is still ongoing: they are investigating pine stumps that are between 11,400 and 14,000 years old. WSL staff found them preserved in clay in Zürich's Binz district in 2013. The pine stumps were contaminated with pollen from present-day trees and plants sticking to the wood. The researchers therefore "burned" the wood surface using a special laser technique. They then scraped away the burnt wood together with the impurities. "When analyzing uncleaned wood, we found over a hundred plant species in the DNA analyses. After the cleaning procedure, however, only one out of a thousand molecules does not come from a Binz pine," says Bertalan.

Now the scientists would like to find out how the pines changed genetically after the Last Ice Age,

when the climate became warmer. Thus they are investigating whether the pine trees at that time contained special genetic variants that helped them cope better with the warmer temperatures. "Our findings about whether and how the pines adapted to the changing climate in a relatively short time should give us valuable information about how today's forests may react to climate change," says Christoph.

His colleague Bertalan carries the finished preparations of genetic material solution to a neighboring building where he leaves the genetic material to multiply in a machine overnight. The results may soon give us an idea about how the Ice-Age pines adapted to the warmer climate.

(ssc)

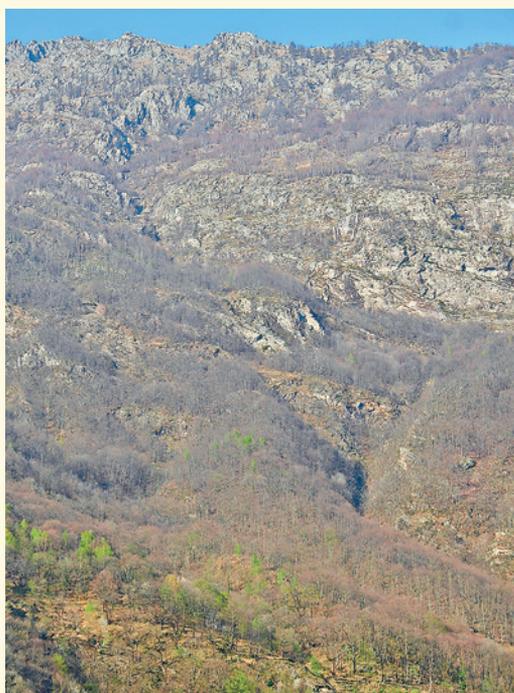


Bertalan Lendvai scrapes the laser-burned wood from a sample of the Binz pines to ensure that unwanted flower pollen does not bias the analyses.

FORESTS How results from the Research Programme “Forests and Climate Change” are translated into forestry practice



How will this forest stand develop with climate change? Ticinese forest experts and Peter Brang from WSL (far right) during the Forest Test in Bellinzona.



In future, such oak and chestnut trees (near Someo, TI, bottom of the picture) will thrive at higher altitudes.

“Forest fires and the next heavy precipitation are currently more of worry for me than climate change.” Roland David is Head of the Forestry Office in Ticino and Mayor of Faido, where, shortly before Easter, 60 hectares of forest burned down. He has at the moment literally burning questions about what “his” forest might look like in 80 years time – which is exactly what the fourth “Forest Test” – this time in Bellinzona at the end of May 2017 – is about. More precisely, it addresses the question of how forest managers can, in practice, take into account climate change. The participating forest experts are therefore “testing” a tool to help decision-making in silviculture, which was developed in the Research

Programme “Forests and Climate Change” by WSL and the Federal Office for the Environment (FOEN).

“Extreme events do indeed have a marked impact on the forest,” says Peter Brang, Joint Head of the Programme at WSL, confirming Roland’s concern. “But it is just after such a forest fire that it is good to know which tree species could grow on this site when it gets warmer.” The findings of the Research Programme indicate that trees that germinate today will already be living in a very different climate by the time they are middle aged. Climate change is taking place so quickly that is questionable whether the forest will continue to be able to perform its many functions without targeted silvicultural interventions.

Tree species are moving up

The Forest Test participants discuss in groups at different sites which interventions are suitable for converting the forest stands of today into stands adapted to the climate of tomorrow. For this they use the new forest management decision tool, which is based on the Canton’s descriptions of the forest sites available that have proved useful for silvicultural planning.

Here at 1000 m a.s.l., the test participants are standing in a typical fir-beech forest near Monti di Ravecchia high up above Bellinzona. This forest site will, according to the modeling, develop under the influence of climate change into a holly-beech forest, like the one growing today a few hundred meters lower down. The most important finding from the group work is that beech will continue to occur. In addition, sessile oak should be promoted as a drought-tolerant species to ensure the forest

can withstand drought better, and the goal should be a mixed forest that is less susceptible to pest damage. Up here, however, the numerous wild ungulates mean that expensive protection measures will be necessary to prevent browsing.

At a second Forest Test site near Sementina close to Ticino’s valley floor, introduced tree species must also be considered in decision-making since forests similar to those growing today around Genoa on the Mediterranean coast are likely to grow best here in future. “Each time we make an intervention today, we need to check whether something can be done to help the forest adapt to climate change, for example, by promoting the diversity of tree species,” says Peter Brang in summary. Rolf Manser, Head of the Forest Division at FOEN BAFU and also a participant in the Ticino Forest Test, adds: “Our experiences with the Forest Tests are helping us greatly in integrating the research findings in forestry practice and training.” *(mmo)*

www.wsl.ch/forests_climate

LANDSCAPES Land-use and land-cover statistics Switzerland: Point after point for habitat conservation



The fen (yellow outline) near Villette (Canton Valais) was more densely covered in 2010 (top, infrared image) than in 1982 (bottom).

Every hundred meters a point: The Swiss government's land-use and land-cover statistics record information about land use and land cover in Switzerland on 4.1 million data points using aerial images from swiss-topo. As part of the Project "Monitoring the Effectiveness of Habitat Conservation in Switzerland" WSL's

Remote Sensing Group is using this valuable data source to monitor the state and development of habitats of national importance – bogs and fens, dry meadows and pastures, amphibian breeding sites and alluvial areas. When dry meadows, for example, become overgrown with shrubs and woodland, they lose their value.

The researchers working with Christian Ginzler first tested how well land-cover statistics document the around 6000 habitats of national importance. With fens, dry meadows and pastures, which cover large areas, two thirds of the objects are at least covered with enough points to be able to give reliable reports about their condition. With most of the usually very small raised bogs, however, over 35 per cent of the objects receive no point at all. This data-set is therefore of limited use for monitoring their condition.

Comparing the land-cover statistics from 1979/85 and 2004/09 shows that many fens, as well as dry meadows and pastures of national importance, are becoming increasingly overgrown. Management interventions such as the closure of irrigation channels have, however, helped in some cases to reverse the trend. Moreover, not protected fens became more overgrown than those that are protected, and more bushes grew in meadows near dry meadows and pastures than in protected ones. In conclusion, with the data from the land-use and land-cover statistics, such trends can be detected and appropriate maintenance measures implemented in time. *(bki)*

LANDSCAPES From cattle-breeding to ski tourism: A village in the process of change

Lenk in Obersimmental (Canton Bern), 1840: on the steep slopes wild hay is harvested and sturdy Simmental cows are grazing on the Alps. The splendid farmhouses are testimony to the affluence of the cattle-breeders. At the end of the 19th century, bad harvests and competition from dairies in the valley impair the economic situation. Many people from Lenk emigrate and meadows and pastures are left untended due to lack of labor. The forest starts to take over. Since the 1960s, however, winter tourism has led to a turnaround and holiday houses have been built on the meadows. Agricultural subsidies, the stable economy and land-use planning regulations have since slowed down the change.

This is how the development of the landscape in Lenk can be described in fast motion. WSL researchers reconstructed it as part of the EU Project HERCULES on the basis of historical map data and interviews with older long-term inhabitants in Lenk. HERCULES is investigating cultural landscapes, i.e. the whole environment that has been influenced in some way by humans. “Cultural landscapes cannot be destroyed. They can only be transformed,” explains Matthias Bürgi, who is head of the HERCULES Project at WSL.

The initial findings indicate that most Europeans believe the current transformation is leading to a loss of valuable landscapes. This is mainly due to the intensification of agriculture, the impact of industrialization and urbanization. HERCULES determined the dynamics and patterns of the changes, as well as the driving



Lenk with the Wildstrubel mountain in about 1930.

forces behind them, in order to provide help in influencing them better.

In the Obersimmental-Lenk case study region, better road and rail connections, the mechanization and motorization of agriculture, and tourism have been decisive for the landscape changes over the last 150 years. More recently, people have also started to notice how climate change is having a serious impact on the landscape: “The glaciers are melting quickly. You can no longer see them from the bottom of the valley.”

What use is this information? “Being confronted with the development can help to change how people view the places where they live, and convince them to deal with the landscape more carefully,” says Matthias. *(bki)*

<http://hercules-landscapes.eu>

BIODIVERSITY BetterGardens: Urban gardens benefit humans and nature

Getting your fingers dirty in the soil, watching the plants grow and spending a pleasant time with friends after work: urban gardens provide small oases in the midst of the hectic of city life. The city population is, however, growing and the pressure on these open spaces is increasing.

In the Project BetterGardens, WSL is studying private and allotment gardens in Swiss cities in cooperation with the Research Institute of Organic Agriculture FiBL. The aim is to find out which types of garden can best promote biodiversity in a city. What influences how city gardeners decide what to plant and how to tend their gardens? How does gardening affect the biodiversity and its impact on, for example, soil quality and insect pollination? How does gardening influence the wellbeing of the gardeners? Researchers are exploring

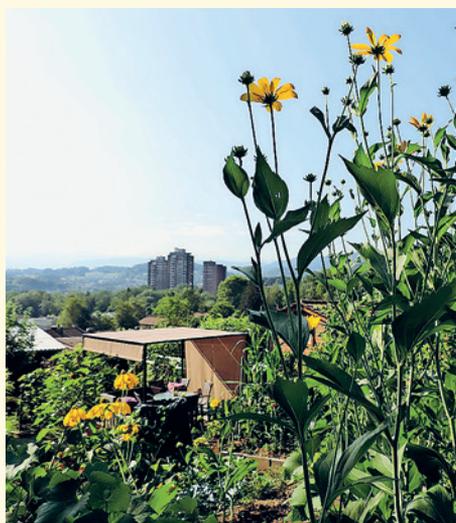
these questions in four subprojects in Zurich, Bern and Lausanne.

The biologist, David Frey, surveyed the diversity of Zurich's city gardens in his doctorate at WSL. He and his colleague Andrea Zanetta found 1070 different plant species in these gardens, but invasive neophytes were only sporadic. They identified as many as 1100 invertebrate species, 12 of which were recorded for the first time in Switzerland or on the Swiss Central Plateau. In the survey, "those gardens less focused on production" scored, as expected, better, i.e. gardens where species diversity is consciously promoted. "It is worth motivating gardeners to include different structures and plant species even in small areas as this promotes biodiversity," says David.

Chris Young and Nicole Bauer from WSL are studying how the gar-



What is growing in Zurich's private gardens and allotments? David Frey (in the photo) and Andrea Zanetta identified 1070 different plant species.



Allotments take up around 1.25 km² of land in the city of Zurich, which is equivalent to about 17 football fields.

dens affect the quality of life of those tending them. Their analyses show that gardens are important for cultivating social contacts and relaxing. Thus half of the respondents said that, after spending time in the garden, they felt much more relaxed

than beforehand. Chris is also interested in who is using the allotments: “It used to be mainly working class people, often with migrant backgrounds. Today, it is increasingly people with degrees in higher education who want to have an allotment.”

Currently further analyses are being carried out in all the sub-projects. The results should provide arguments for maintaining the green oases in cities. *(lbo)*

www.bettergardens.ch

BIODIVERSITY Monitoring habitats with insects: “Fauna Indicativa” makes this possible

Insects – like plants – have species-specific requirements for their habitats. Some like it warm and dry, others damp and shady. Plants have been used for a long time as indicators for site conditions. Since insects react more quickly to changes because of their shorter generations, they can be used to supplement vegetation surveys.

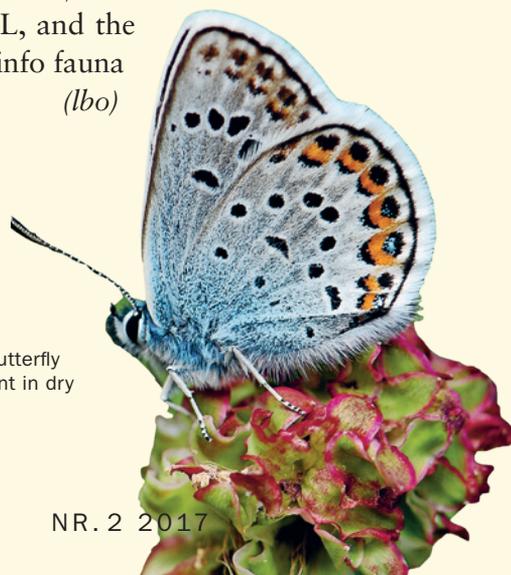
Researchers at WSL have, together with other experts, for the first time summarized, in tabular form, the requirements and biological characteristics, such as body size or time of emergence of mature insects, of all dragonflies, grasshoppers, ground beetles and butterflies found in

Switzerland. This “Fauna Indicativa” allows data on insects to be used more simply in a standardized way to describe the condition and changes in the habitats in Switzerland. FOEN supported the Project. The relevant report (in German) can be obtained from WSL, and the digital tables from info fauna CSCF. *(lbo)*

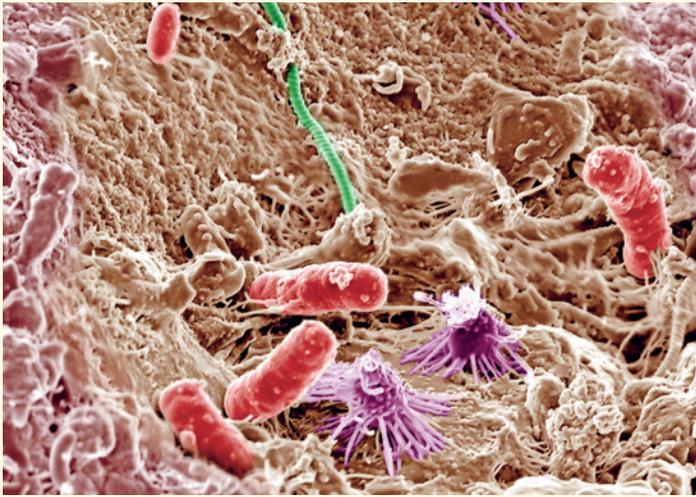
www.wsl.ch/berichte

www.cscf.ch

The silver-studded blue butterfly (*Plebejus argus*) is frequent in dry and semi-dry grasslands.



BIODIVERSITY Some like it dry, some like it wet: Soil microbes under climate change



Various soil microorganisms enlarged about 10,000 times under an electron microscope.

Around a billion bacteria, fungi and other microorganisms can be found in just one teaspoon-full of forest soil. “We know very little about many of these microorganisms, but they play an important role in global material cycles, and are involved in soil formation and supplying nutrients to plants,” says Martin Hartmann, a microbiologist at WSL. What we do not know is how these tiny organisms and the microbial processes associated with them respond to warmer and drier climates. This is, however, crucial to understand since climate models predict that dry and hot periods will become more frequent.

In Pfywald, a semi-arid pine forest in Canton Valais, WSL researchers have been irrigating different experimental plots since 2003. There they are trying to find out whether drought is responsible for the extensive pine dieback in this region. For this experiment, the Research Group at WSL headed by Beat Frey have analyzed the differ-

ences in the composition of the soil microbes in dry and irrigated plots.

Living with restrictions

To identify the species in both the irrigated and dry soils, the researchers investigated the genetic composition of the microorganisms in the corresponding soil samples. The composition of the microbes differed greatly: the organisms living in the moist soils release a lot of CO₂ due to their rapid growth and higher nutrient demand. The species in the dry soils produce, in contrast, little CO₂ because they grow slowly and are less demanding.

Trees growing on dry sites filter less CO₂ out of the air, which means less carbon is deposited in the soil. Through their reduced respiration, however, the drought-specialized microorganisms keep the quantity of carbon stored in the soil at a stable level. “This is a valuable insight as forest soils are important carbon reservoirs,” says Martin, and adds: “We are not sure, however, whether the microbes adapted to these dry conditions can, with their reduced activities, supply trees with enough nutrients like nitrogen and phosphorous to sustain them in the long term.” (ssc)

www.wsl.ch/forests_drought

Csilla Szántó, Davos

“To glimpse the peak of the Brünnelistock reddening at the break of dawn, stroll along the frozen lake or simply linger on the shore – I love immersing myself in the world around this lake, Glarner Obersee, with its changing moods and colors. This is where I can really breathe deep and get reinvigorated.”



SOFTWARE SOLUTIONS FOR AVALANCHE WARNING

The software developer, Csilla Szántó, works at SLF in the Group “Warning and Information Systems”. Among other things, she co-developed “GIN”, the Common Information Platform for Natural Hazards used by experts of the federal go-

vernment, cantons and municipalities. Currently she is implementing and further developing software tools for avalanche warning. “What I like is when a new product we developed through creative ideas really works in practice.”

NATURAL HAZARDS Automatically detecting avalanches: Soon possible thanks to infrasound?



The observer from the Forestry Office in Goms, Matthias Lauber, installing an automatic camera to monitor the opposite side of the valley.

The avalanche services responsible for road safety are confronted with many questions when heavy snowfall occurs: Have the main avalanches already released? Was the avalanche control successful? Can roads be opened again? It's also very important for the avalanche forecasters at SLF to receive near real-time information on avalanche occurrences.

If it is dark or the snowfall heavy, it is usually impossible to visually detect whether avalanches have re-

leased. While radar systems can automatically record avalanches under such conditions, only a relatively small area can be monitored. FOEN therefore commissioned SLF to evaluate Infrasound Detection of Avalanches (IDA) systems in Frutigen, in Leventina und in Goms. IDA systems have the advantage of being able to record signals up to several kilometers away.

Winters with little snow in 2015/16 and 2016/17

The Head of the Project, Alec van Herwijnen, says: "Avalanches produce low frequency sound waves that cannot be detected by the human ear, so-called infrasounds. It is not, however, easy to distinguish signals generated by avalanches from those with other infrasound sources, such as wind." To verify the recorded signals, automatic cameras were installed to monitor the surrounding area. In addition, the local avalanche services also document avalanche occurrences.

The tests confirm the hypothesis: the likelihood of recording an avalanche with infrasound is greater the larger the avalanche is, but decreases with distance. Detection worked best with larger dry snow avalanches. Since little snow fell during the last two winters and only a few large avalanches occurred, further measurements are necessary to be able to make a more definite assessment of the performance of IDA systems. *(sni)*

NATURAL HAZARDS **Avalanche expertise for cableways: Detecting hazards in good time**

The largest ski area expansion project in Switzerland is currently being realized between Andermatt and Sedrun, where 16 installations should modernize and connect the two small resorts. Mark Schaer, a civil engineer at SLF, joined the Project seven years ago. He used the avalanche-dynamics modelling software RAMMS to assess whether the planned installations and ski-slopes are at risk. He says: “In the section Gütsch-Oberalppass, three cableways and around fifteen kilometers of ski-slopes are planned. Initially, the cableway operators did not think that avalanches posed a serious threat in the area. Our evaluations have, however, shown that the avalanche problem here is complex.”

In this section area, Mark identified 120 avalanche-starting zones. The “Russengraben” was one of the tricky places because the top station of a cableway will be built close to it. Mark calculated how strong the forc-

es of avalanches would be after they have crossed the Russengraben (red arrow in the photo) and reach the station. “We had to take into consideration how snow-slides and snow-drifts can fill up the Russengraben and thus change the topography there.”

At six of the eight sites originally intended for cableway stations, the avalanche risk turned out to be so great that avalanche protection structures would not have been possible at reasonable cost. New locations therefore had to be found. Two installations had to be shortened by several hundred meters. As Mark says: “When planning a new ski area, it is important to involve an avalanche expert at an early stage in order to avoid delays and unnecessary costs. Certainly in the case of Andermatt-Sedrun, the cooperation has been worth it.” *(sni)*



Snow deposits in the Russengraben on 15 July 2013. Just outside the frame of the picture on the right is where the top station of the Nättschen-Gütsch cableway will be built.

Hard race-courses and fast skis: The high-performance sport benefits from simulations of snow cover

In ski races, it is often just hundredths of a second that separate the winners from the losers. Ensuring the piste is in the same condition for all the athletes is, therefore, an important prerequisite for a fair competition. This means the ski-runs for the races must meet high quality requirements. They should be as robust as possible so that the athletes are not too badly affected on their rapid descents.

The race organizers often use water in various ways on the pistes to make them extremely stable and prepare the courses. The water freezes in the snow pores, increasing its density and thus the strength of the race-course. Using too much water, however, unnecessarily raises the costs and the consumption of re-

sources, and can even in some cases impair the quality of the pistes. How much water is then really necessary? And how long does it take for it to freeze completely?

Cold pistes need more water

This is why SLF was commissioned by the World Cup organizers to test how to optimize the irrigation at the Ski World Championships in St. Moritz in February 2017, at World Cup events and at SLF's experimental sites. The SLF researchers used the snow-cover model "SNOWPACK", developed at SLF, to simulate the water transport in snow-cover under different snow and weather conditions. They found out that, contrary to earlier assumptions, it is not



A piste machine waters the piste at St. Moritz with the machine bar at the front of the vehicle.

mainly the hardness of the piste and the amount of pressure used that determines how much water the piste absorbed. Rather it is the temperature of the snow that is decisive. The density and the grain size also play a role: the colder and finer the snow, the more water must be used.

With the “SNOWPACK” computer simulations, the researchers were able to predict, with a precision of up to 5 cm, how far the water would penetrate into the snow cover under different weather and snow conditions, as well as how quickly it would freeze. The first to benefit from these findings was the Ski World Championships in St. Moritz. The model has now been adapted so that it can also help the piste-preparation specialists in other ski resorts to plan the best form of irrigation.

A small advantage for the Swiss team

SLF’s snow researchers will also be working on snow-cover simulations at the XXIIIth Winter Olympics in South Korea in February 2018. They have been commissioned by Swiss Olympic to estimate roughly 24 hours in advance what snow conditions can be expected and to exclusively inform the Swiss team about the snow consistency and the temperatures of the snow surface for the whole race-course. With this information, the service technicians will be able to choose and prepare the fastest skis possible under the snow conditions prevailing at the time of the competition.

In addition to the snow-cover model “SNOWPACK”, the researchers use the expanded model “Alpine 3D”, which can depict the local terrain in three dimensions and which was also developed at SLF. To ensure



Wendy Holdener won a Gold and a Silver medal at the World Ski Championships in St. Moritz 2017. At the Winter Olympics in February 2018 she will hopefully add further medals to her successful career.

the forecasts are as precise as possible, they already accurately surveyed the runs in Pyeongchang last year. In their calculations, they also refer to models of the terrain, satellite images, weather forecasts and the weather stations installed locally. In Sochi (2014) and in Vancouver (2010), the researchers were able to successfully use their simulations to support the Swiss team, giving the athletes a small, but perhaps in cases where it is really close, decisive advantage to keep the athletes one step ahead.

The two numerical models developed at SLF are “Open Source”, which means that everyone can access and use them. *(jwe)*

www.slf.ch/snow-cover-modelling



Felix Gugerli, Birmensdorf

“At home in Langenbruck I can unwind from the mentally-demanding office work at WSL. Here I can do things outdoors, get my fingers dirty in the garden and generally switch off. Our home used to be a holiday house, and sometimes when I come home, it feels as if I were here on holiday.”

DECODING THE INFORMATION IN GENES

How do alpine plants adapt to climate change? How do roads or ecological corridors influence the spread and connectivity of animal and plant populations? And how many individuals actually live in a particular population? Felix Gugerli and

his team are investigating the genetic material of animals and plants to find answers to such questions. A favorite hobbyhorse for the botanist is the Swiss stone pine: “It grows high up in beautiful places with wide views.”



Cold plays an important role in nature: it ensures, among other things, that enormous stocks of water are stored in the form of glaciers and that the permafrost on rocky slopes in the mountains remains stable. With the higher temperatures due to climate change, however, cold is becoming an increasingly rare phenomenon. WSL researchers are studying the effects this has in Switzerland and in the polar regions, which means they often have to protect themselves against frosty temperatures. They also deliberately use cold in their research to conserve samples, for example, or to produce snow.

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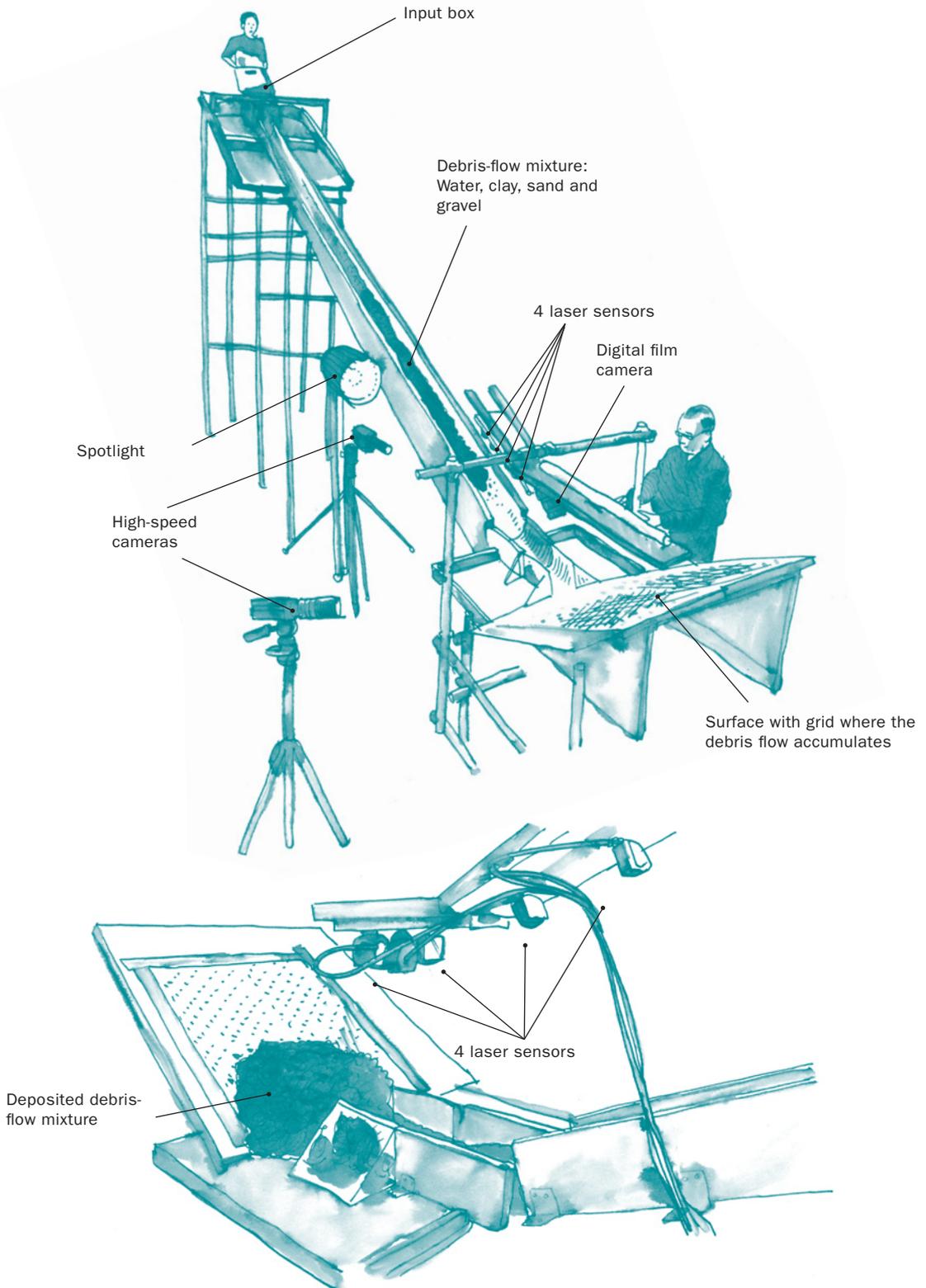
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PEOPLE



The WSL editorial team, from left to right, top row: Reinhard Lässig, Birgit Ottmer, Sara Niedermann, Christine Huovinen; bottom row: Lisa Bose, Sandra Gurzeler, Beate Kittl

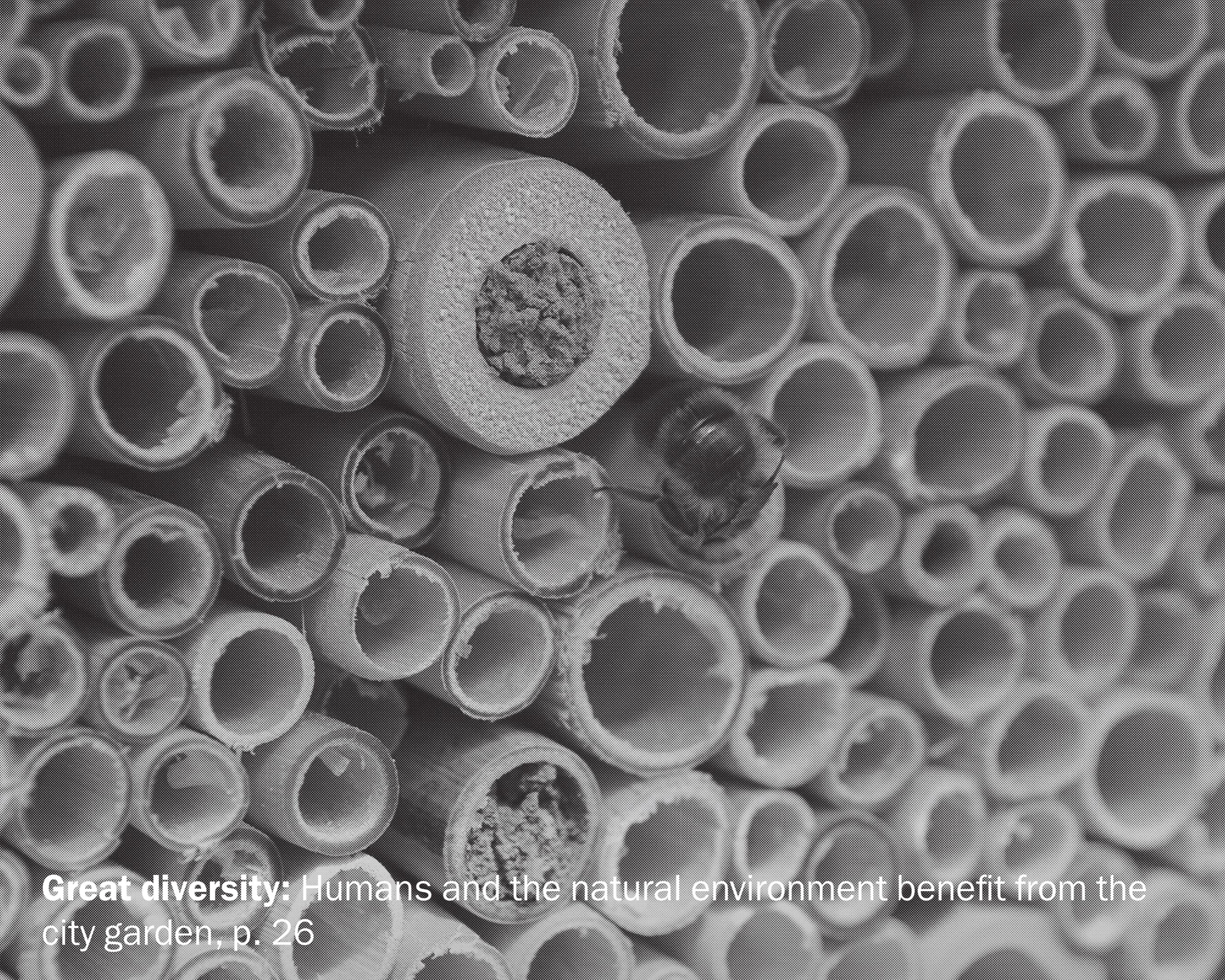
DEBRIS-FLOW SLIDES



A debris flow is a fast-flowing and destructive mixture of water, fine sediments and pieces of rock. Researchers release model debris flows onto an eight-meter long slide in the mountain hydrology lab at WSL. This enables them to test the flow, impact and deposition behavior of different debris-flow mixtures.

Video at:
www.wsl.ch/object





Great diversity: Humans and the natural environment benefit from the city garden, p. 26



Model: Snow researchers make top sportsmen and women faster, p. 32

