



Climate Change in Your Backyard

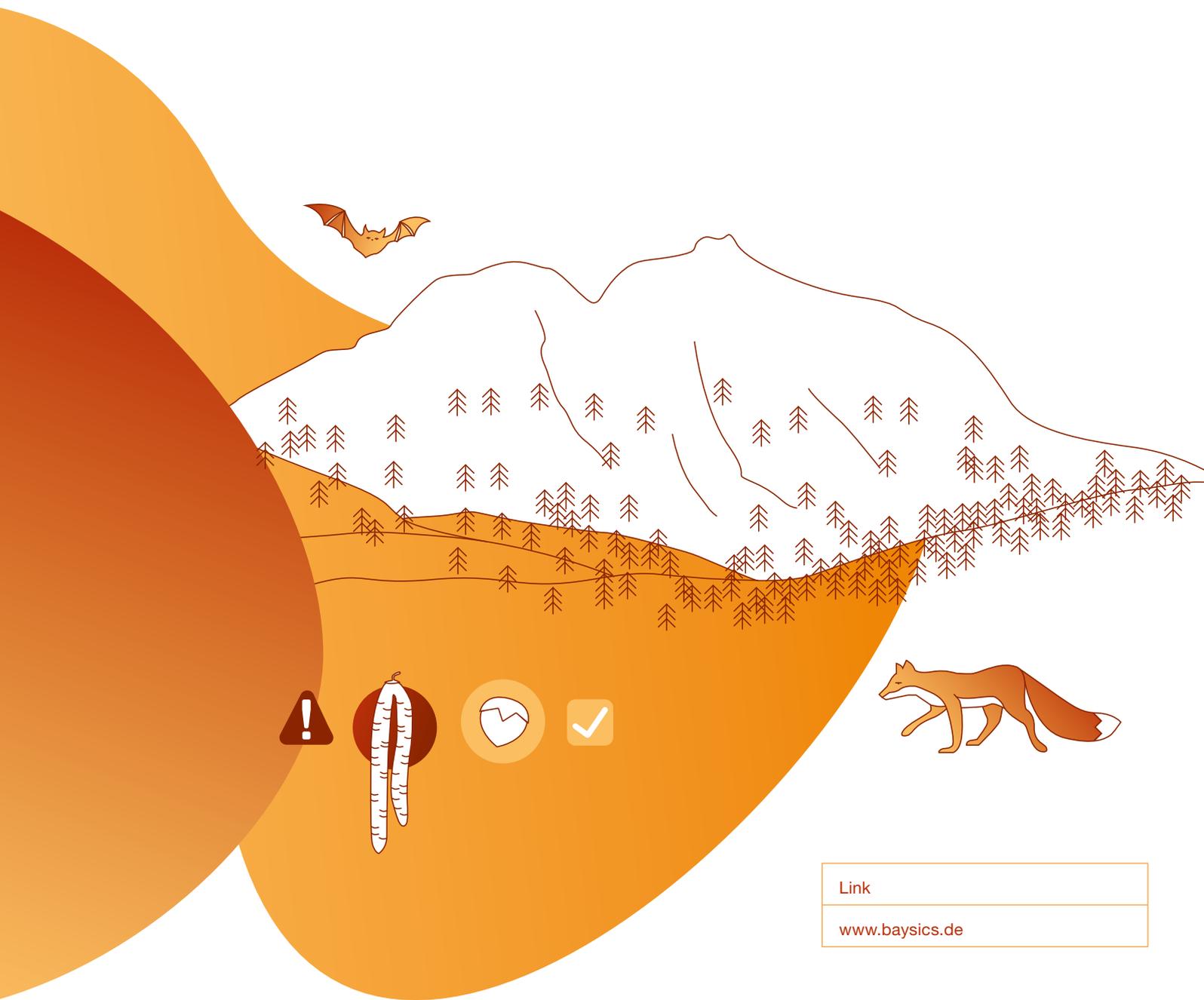
Interview with Annette Menzel about her expectations on the citizen science project.

Early Flowering Signals Global Warming

*Prof. Annette Menzel
Chair of Ecoclimatology
TUM*

Climate Change Impacting Mountain Forests

*Prof. Jörg Ewald
Specialist Area of Botany, Vegetation Science
and Mountain Ecosystems
Weihenstephan-Triesdorf University of Applied Sciences*



Link
www.baysics.de

How to Avoid Hay Fever

*Prof. Susanne Jochner-Oette
Physical Geography/Landscape Ecology
and Sustainable Ecosystem Development
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Urban Animals

*Prof. Wolfgang Weisser
Terrestrial Ecology Research Group
TUM*

Climate Change in Your Backyard

We are all affected by global warming. Its impacts are already tangible and will require wide-ranging adaptations from humans and nature in future. Annette Menzel conducts research into these complex changes with the aim of finding a practical means of handling them – together with the citizens of Bavaria. An interactive online portal by the name of BAYSICS provides a forum for this dialog.

Kurzfassung · Langfassung: www.tum.de/faszination-forschung-26

Klimawandel vor der Haustür



Die Folgen der Erderwärmung sind auch in Bayern spürbar und erfordern weitreichende Änderungen des Lebensstils. Diese lassen sich in demokratischen Gesellschaften nur dann erfolgreich umsetzen, wenn sie von großen Teilen der Bevölkerung als notwendig, akzeptabel und realistisch erkannt werden. Unter dem Motto „Wissen vermitteln – Wahrnehmung fördern – Komplexität kommunizieren“ will der interdisziplinäre Forschungsverbund BAYSICS Bürgerinnen und Bürger an der Erforschung des Klimawandels teilhaben lassen. In vier Citizen-Science-Projekten haben Laien die Gelegenheit, natürliche Phänomene zu erkunden und ihre Veränderung infolge der Erderwärmung nachzuvollziehen. Inhaltliche Schwerpunkte liegen auf den klimabedingten Veränderungen des Bergwaldes, des Pollenaufkommens sowie der jahreszeitlichen Erscheinungsformen von Pflanzen und Tieren in der Stadt. Das so generierte Wissen kommt direkt den Mitwirkenden zugute. Zugleich liefert es den im Verbund Forschenden wertvolle Daten für ihre natur- und sozialwissenschaftlichen Studien. □



Climate Change

Early Flowering

Mountain Forests

Hay Fever

Urban Animals

“We’re trying to address large parts of the population and gain acceptance for climate protection measures. Only then will we be able to make a change in society.”

Annette Menzel

Link

www.oekoklimatologie.wzw.tum.de

Professor Menzel, what do you hope to achieve through BAYSICS?

This new portal is part of the Bavarian Climate Research Network. In a nutshell, we want to use the portal to spread knowledge, raise awareness, and communicate complexity. Our aim is to raise awareness of the phenomenon of climate change and its consequences among as many members of society as possible and enable them to engage in research as citizen scientists.

What exactly is citizen science?

In essence, it is when ordinary citizens participate in the scientific process. We call on citizens with an interest in the topic to explore their environment and report their observations. In doing so, they generate data and create added value for science. This not only benefits professional researchers but also the citizen scientists: they have the opportunity to conduct experiments, compare their findings against existing datasets, pose their own research questions, and reflect on what they would like to know and understand. The new BAYSICS portal offers an ideal platform for this. ▶



Citizens can participate in BAYSICS via an app. Here, Annette Menzel demonstrates the app by taking a picture, which can be uploaded.

Prof. Annette Menzel

Always striving to facilitate a dialog between research and society, Annette Menzel combines her research as a forestry scientist with her role as a forest officer. After graduating from LMU Munich, she took the state examination and spent several years at the Bavarian Forestry Commission. In 1997, Menzel obtained her doctorate in the phenology of forest trees under changing climatic conditions. After obtaining her lecturer qualification, she continued to research climate change-biosphere links at the TUM Chair of Ecoclimatology; she became acting head in 2003 and was made an associate professor in 2007. Annette Menzel was lead author of the Intergovernmental Panel on Climate Change (IPCC) assessment report from 2004 to 2008 and received a European Research Council grant in 2012.

How does the BAYSICS portal work?

The centerpiece is an app specifically designed for our citizen science projects. Unlike commercial apps you can download to your phone from the App Store, we opted for a progressive web app – which can be amended or augmented as and when new questions and topics arise in future. Prof. Dieter Kranzlmüller at the Leibniz Supercomputing Centre of the Bavarian Academy of Sciences and Humanities is coordinating the programming and back-end in close collaboration with Prof. Liqiu Meng from the TUM Chair of Cartography. Their teams are making sure that the entire infrastructure is easy to use and looks good, too.

Who is involved in BAYSICS?

We are a genuinely interdisciplinary network! There are four citizen science projects with different focuses in the natural sciences, plus three sub-projects in the social sciences. In collaboration with several Bavarian high schools, Prof. Ulrike Ohl from the University of Augsburg has devel-

oped an educational concept for “inquiry-based learning” with ideas for pupils and their teachers. Prof. Arne Dittmer from the University of Regensburg is developing concepts that will allow climate change to be addressed adequately at school – including its political and ethical dimensions. Meanwhile, Prof. Henrike Rau from LMU is interested in public opinion, asking: Who do different social groups consider responsible for climate change? How are measures to counter it evaluated and supported?

What are you hoping will come from this dialog with the citizens of Bavaria?

We want to motivate people to engage with the topic of climate change. They need to understand just how serious it is – and that our way of life must change on a fundamental level. We’re trying to address large parts of the population and gain acceptance for climate protection measures. Only then will we be able to make a change in society.

■ *Monika Offenberger*

Climate Change

Early Flowering

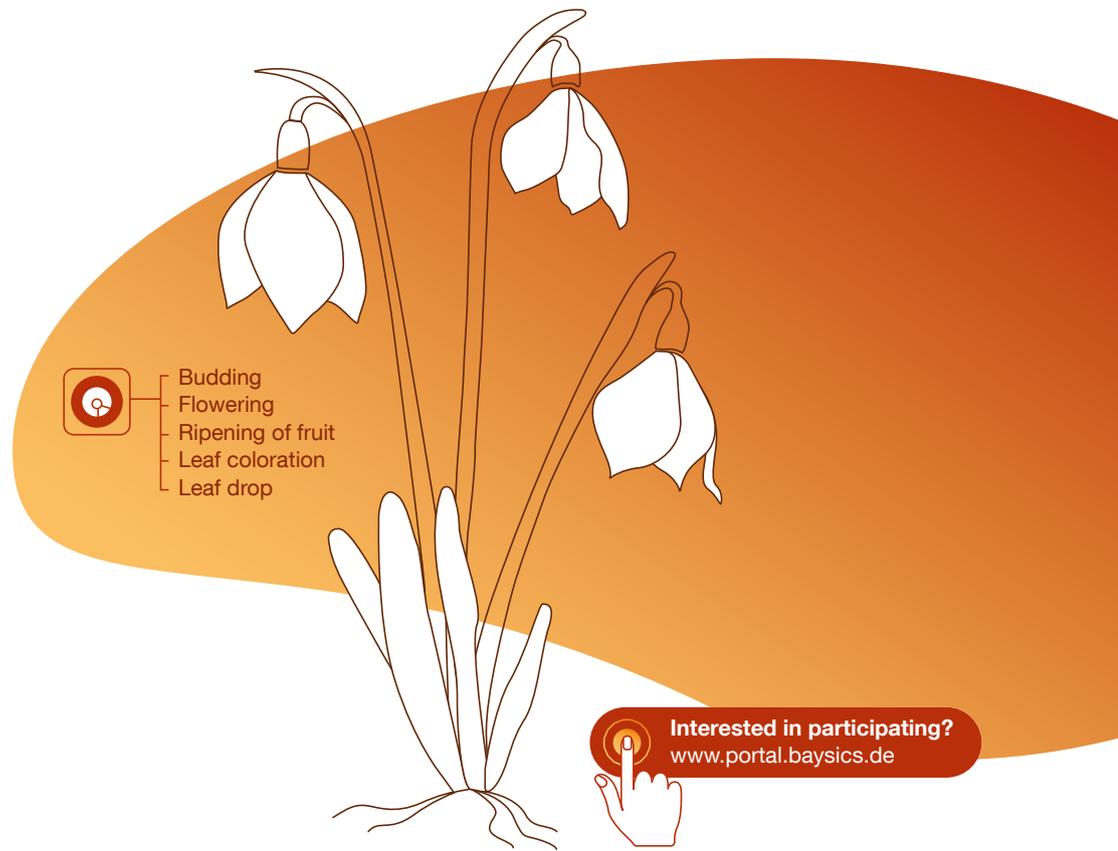
Mountain Forests

Hay Fever

Urban Animals



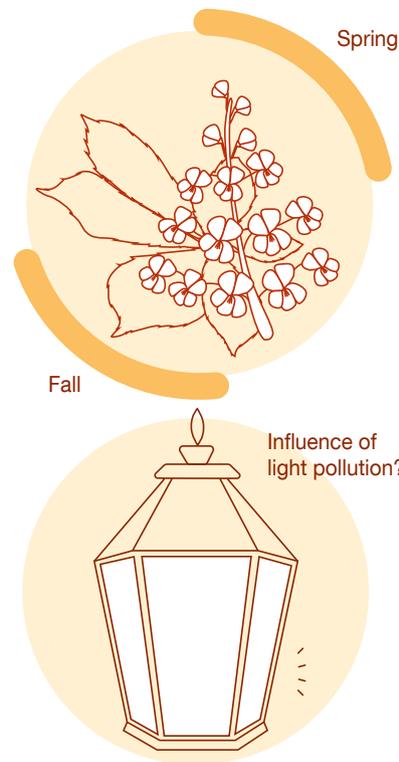
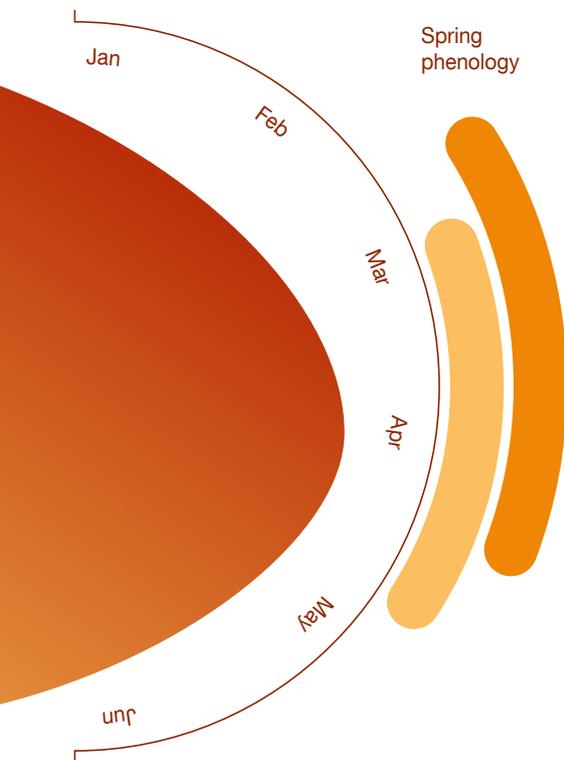
A rooftop meteorological station, high above the TUM School of Life Sciences Campus, is used for measurements and for testing measurement equipment before field use.



Early Flowering Signals Global Warming

An emaciated polar bear stranded on an ice floe in the open ocean. Images like this are often used to illustrate the dramatic consequences of global warming. When they report on climate change, media outlets tend to reach for powerful images. “But this runs the risk that many people might think it is something that doesn’t really affect them personally. The Arctic is so far removed from everyday life,” as Annette Menzel, Professor of Eco-climatology at TUM, states. But in fact even at our latitudes, climate change has long altered the seasonal rhythms of our fauna and flora. Birds are nesting earlier. Plants are coming into leaf and flowering earlier than even just a few years ago. Fruit is ripening earlier and trees are shedding their leaves later.

The study of these seasonal events is known as phenology. Changes in the timing of such events can be clearly shown to be related to global warming. Annette Menzel has analyzed data from across Europe, which, between 1971 and 2000, recorded the phenology of 542 plant and 19 animal species. Her analysis shows that a one degree Celsius mean rise in late winter temperatures shifts spring phenology forward by an average of 2.5 to 5 days. Now, Bavarians can become citizen scientists and research these correlations for themselves. “Budding, flowering,



- Climate Change
- Early Flowering
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ripening of fruit, autumn leaf coloration and leaf drop are easy to observe and citizen scientists can record these details using the new BAYSICS app, where the observations can be linked to German Meteorological Service data going back to 1951,” explains Menzel. There is also a new software package for evaluating winter twig experiments. This allows users to look back into the past, but also to get a glimpse of the future, explains the professor. “We can use statistical models to simulate the effects of rising temperatures on the natural world.”

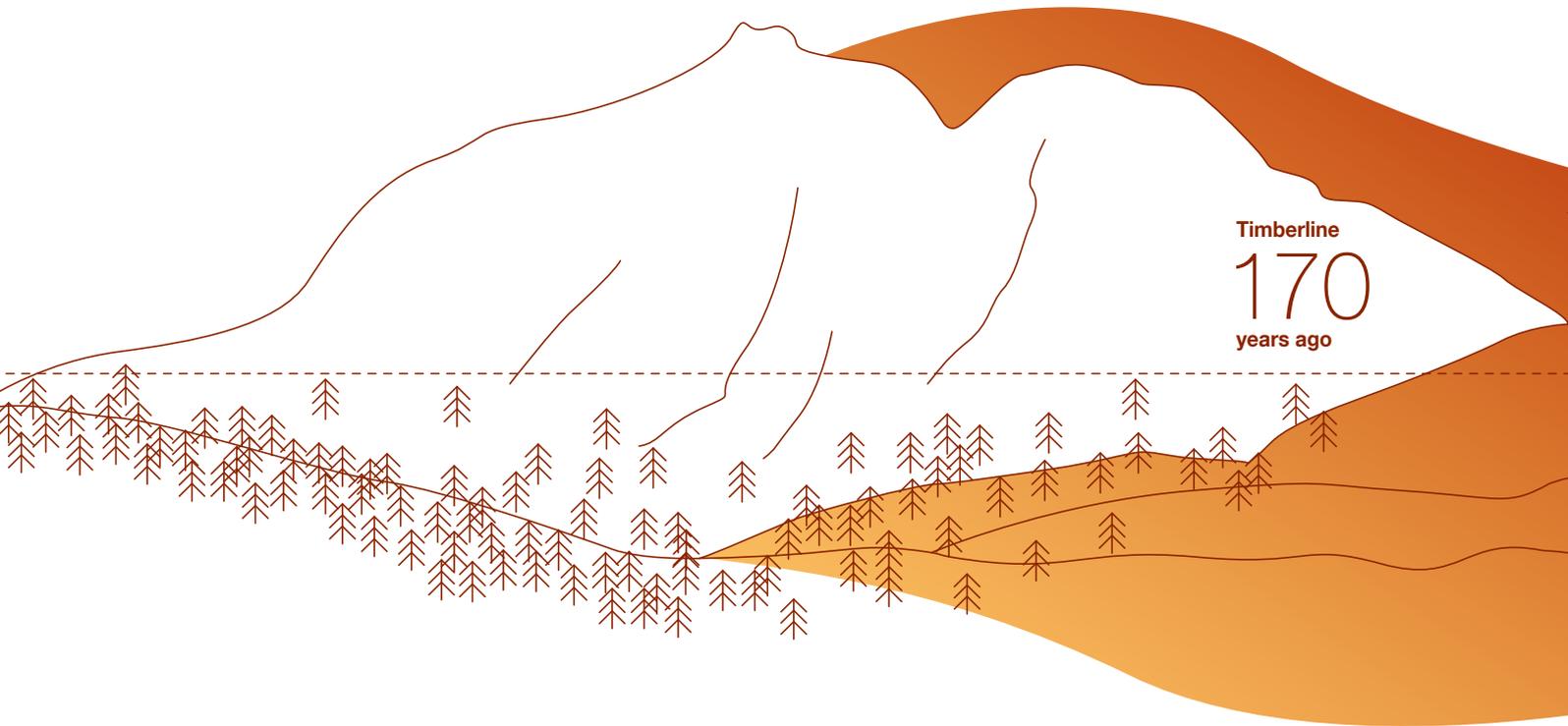
The ability to run simulation experiments like this sets the BAYSICS app apart from commercial software. “People can play with real datasets and try out different climate change scenarios. We aim to make science fun, while still managing to showcase complex interrelationships,” explains Menzel. She hopes the app will also benefit her research. Little is known, for example, about why horse chestnuts produce new flowers in autumn, or whether street lights affect autumn leaf coloration. Similarly, it’s not clear whether fruit tree blossoms are being destroyed by late frosts more often than in the past. “If enough people join in, we will be able to collect data for the first time on a wide range of poorly researched phenomena.”

Monika Offenberger

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Annette Menzel, TUM

Climate Change Impacting Mountain Forests



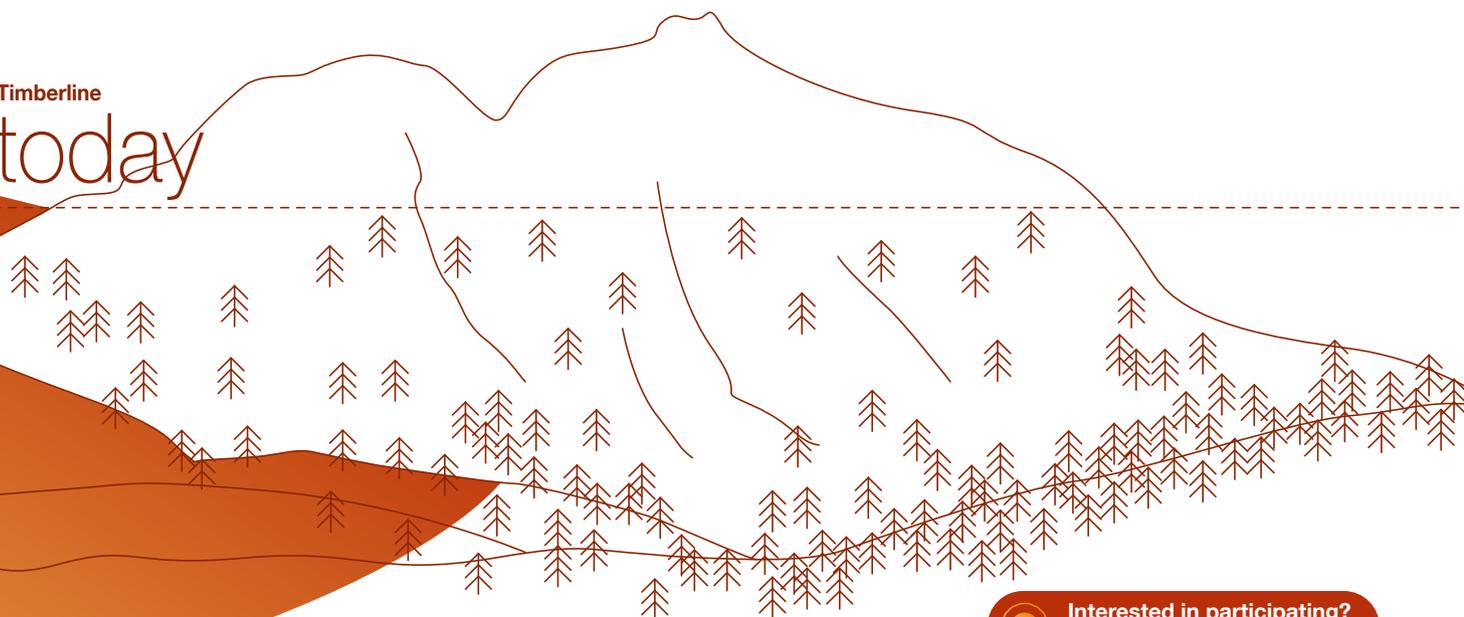
“What we need now is as much current data as we can get hold of.”

Jörg Ewald,
Weihenstephan-Triesdorf University of Applied Sciences

People hiking in the Alps enjoy not only the exercise, but above all the experience of being surrounded by nature. “It’s the transition between forest and rock that makes mountain landscapes so aesthetically pleasing,” says Jörg Ewald, Professor of Forest and Forestry at Weihenstephan-Triesdorf University of Applied Sciences. At which altitude trees and bushes are still able to grow and at which altitude they stop is determined by climatic conditions. With these conditions being transformed by climate change, more and more plant species globally are moving up from lower altitudes towards higher mountain regions.

So are mountain forests in the Bavarian Alps also experiencing this kind of change? Are beech, spruce, mountain pine and arolla pine growing at higher altitudes than before? In the middle of the 19th century, long before climate change, Munich botanist Otto Sendtner was com-

Timberline today



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missioned by King Maximilian II of Bavaria to record the precise altitudes at which our native trees were able to survive. “At that time, the highest arolla pine in the Berchtesgaden Alps stood at an altitude at 2,041 meters and the highest spruce at 1,860 meters. We looked at and digitized a total of 441 of these old records. We use them as reference data for making comparisons with today’s trees. What we need now is as much current data as we can get hold of,” explains Jörg Ewald. That’s how Ewald, a passionate mountaineer, came up with the idea for a citizen science project aimed at measuring the altitudinal boundaries for a total of 22 tree species.

The project will particularly appeal to lovers of mountain hikes, many of whom take an interest in the surrounding flora and, with a little practice, are usually able to correctly identify trees and shrubs. Jörg Ewald explains what they need to do: “On the way up you tend to be focused on

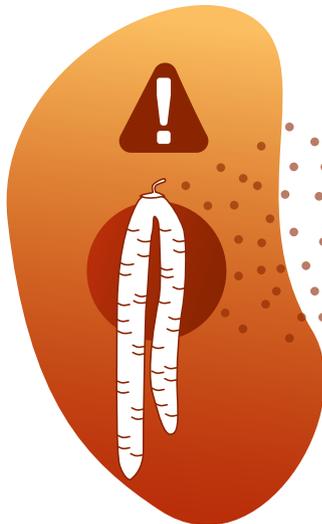
the exercise aspect of your hike, and on getting to the summit. On your way down, however, there’s plenty of time to record the highest mountain pine, green alder or rowan and GPS data for its location.” Ideally, the BAYSICS researcher would like his citizen scientists to record separately the highest seedling, shrub and tree for each species and take photos. “That way we can estimate age and time of colonization.”

Over the summer, numerous alpinists and students have entered their observations on the BAYSICS portal. The data so far suggests that treelines for most species are today about 150 meters higher than in Sendtner’s era. Ewald hopes that the new data will also help to answer other interesting research questions. “Nobody knows how the montane forest as a whole changes when individual tree species are subject to competition from species moving up from lower altitudes.” ■ *Monika Offenberger*

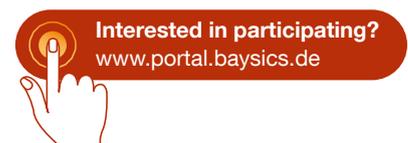
“Beyond simply asking our citizen scientists to provide data, we are providing them with useful feedback and scientific insights.”

Susanne Jochner-Oette,
Catholic University of Eichstätt-Ingolstadt

High intensity
of birch pollen
in the red areas



Low intensity
of hazel pollen
in the orange areas



How to Avoid Hay Fever

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For people with a pollen allergy, springtime often begins as early as January, when hazel trees and shrubs release their pollen. Other tree species follow suit and, as from April, grasses and herbs make spending time outdoors even harder for allergy sufferers. The number of people with such allergies continues to rise and currently accounts for around 15% of the population. Climate change is a contributing factor to this trend – as Susanne Jochner-Oette, Professor of Physical Geography, Landscape Ecology and Sustainable Ecosystem Development at the Catholic University of Eichstätt-Ingolstadt, explains: “Higher temperatures result in pollen grains being produced in greater quantities and released earlier. They also tend to contain more allergens and therefore trigger more severe reactions.”

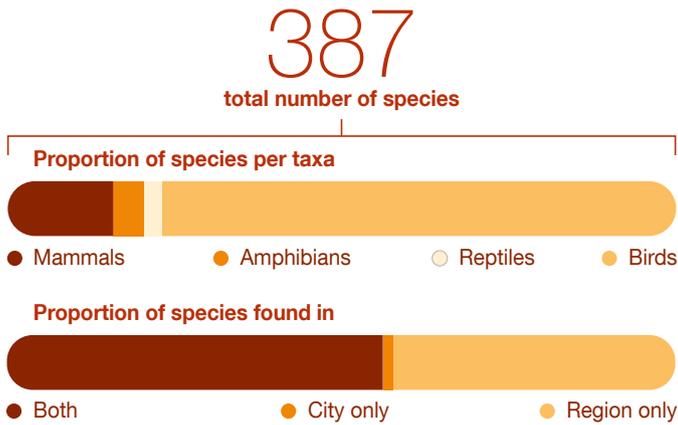
A citizen science project has been launched to investigate these interrelationships and help those affected to understand them better. “We want to make people aware of why pollen is present in the air earlier and in greater quantities nowadays – as well as how they can protect themselves more effectively,” the geographer explains, inviting anyone with an interest to share their observations with like-minded people via the BAYSICS app. Where and when do birch, hazel, dock, ribwort and grasses flower in your town? Do you experience any allergic symptoms as

a result? If so, what symptoms? Making connections between certain plants and physical symptoms can help allergy sufferers to avoid specific locations. In addition, the app allows users to compare their findings with existing data, such as when certain plants flower across Bavaria and pollen count data from previous years.

“Beyond simply asking our citizen scientists to provide data, we are providing them with useful feedback and scientific insights. That’s what separates our projects from other research offerings,” emphasizes Jochner-Oette. She also decries the media’s habit of announcing blanket time windows in which allergy sufferers should air their homes – without any scientific basis. “We hope that BAYSICS will provide us with more precise data, thereby closing gaps in our understanding and allowing us to issue well-founded recommendations in future,” she says. Her doctoral student Johanna Jetschni, who has been collecting and analyzing pollen samples in and around Ingolstadt for the past two years, has made a significant contribution. Initial analyses indicate that the air in rural areas contains significantly more grass pollen than the city center and residential areas. Pollen counts, however, follow the same pattern in all areas over the course of the day, reaching their peak between 12pm and 2pm.

■ *Monika Offenberger*

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Observations of animals in Nuremberg and surroundings (50 km around center). More than 50 percent of all species live in both the city and its surroundings (data: Global Biodiversity Information Facility).



Urban Animals

“Anyone who enters their own findings [...] can also compare them against existing datasets.”

Wolfgang Weisser, TUM

Humans are not the only ones for whom cities make an attractive home. More than one hundred species of birds breed in the Munich municipal area alone; foxes and beavers have established territories in the city, while eight species of bat hunt for prey in Munich’s parks and urban courtyards. “Many animals live in the city. For a lot of people, urban nature is the only form of nature they come into contact with during their day-to-day life,” says Wolfgang Weisser, Professor of Terrestrial Ecology at TUM. Despite this, urban planning remains poorly attuned to the realities of human-animal coexistence. “The city is becoming increasingly compacted and green spaces are disappearing,” the biodiversity researcher says. “Many buildings are being refurbished – also in response to climate change – to the extent that sparrows and swifts can no longer find places to nest. As a result, more and more potential habitats for animals are disappearing.”



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People in positions of responsibility in housing associations and planning offices are often unaware of the consequences of their actions – as shown by a national survey to which Weisser’s team contributed. “Many said they would pay greater attention to animals’ needs if only they knew how. And if residents welcome the animals,” the Munich-based biologist explains. It is the attitudes of these residents that Weisser now hopes to explore. “We want to know which animals people like in their area and which they do not – and whether they would support measures to support certain species in their neighborhood,” he says. A test study with around a thousand students showed that preferences for and aversions to certain animals also depended on the respondents’ gender and background.

A citizen science project has now been established to drill down into the different motivations at play. It also aims to

encourage citizens to engage with the world around them. “We are purposefully asking about specific animals such as hedgehogs, squirrels and hummingbird hawk moths. Where and when have they been sighted? Anyone who enters their own findings into the BAYSICS portal can also compare them against existing datasets. This means that ordinary citizens can learn to understand how climate change and urban densification influences the lives of animals,” explains Prof. Weisser. The initiative is also intended to benefit the citizens who submit reports. As Weisser explains, their efforts should help urban planning processes give greater consideration to the needs of humans and animals in future: “In the interests of environmental justice, everyone must have the opportunity to experience nature where they live and work – including in cities.”



Monika Offenberger