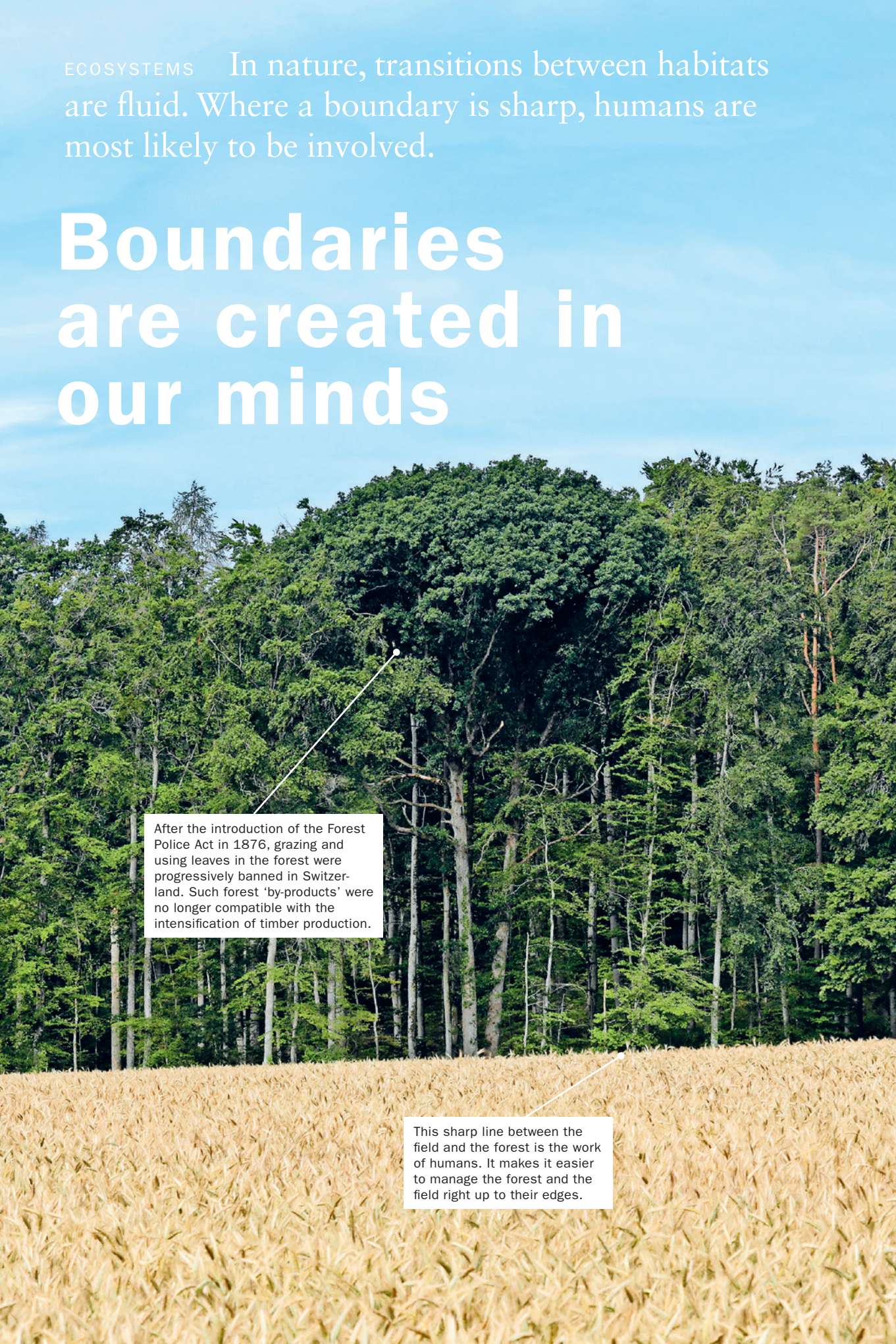


ECOSYSTEMS In nature, transitions between habitats are fluid. Where a boundary is sharp, humans are most likely to be involved.

Boundaries are created in our minds



After the introduction of the Forest Police Act in 1876, grazing and using leaves in the forest were progressively banned in Switzerland. Such forest 'by-products' were no longer compatible with the intensification of timber production.

This sharp line between the field and the forest is the work of humans. It makes it easier to manage the forest and the field right up to their edges.



A forest that is clearly separated from open land appeals to many people because they can then use the forest edge more easily. Stepped forests with a transition zone, however, are better for biodiversity, as they provide many species with habitats, shelter and food.

Stetten in Canton Schaffhausen

Photo: Ulrich Wäsem, WSL

The contrasts could not be greater: on one side is a flat and open field of corn, and on the other the closed forest, which is like a green wall of towering trees that contrasts marked by with the open field. The sharp boundary between the forest and the open land is clearly shown on the Swiss national map.

Of course, this hard boundary is anthropogenic and not natural. It was created to make farming and forestry more economic and efficient. “The Swiss Forest Police Act of 1876 provided a basis for professionalising forestry across Switzerland,” says Matthias Bürgi, head of the ‘Land Change Science’ Research Unit at WSL, who studies landscape history. “The law regulated how the land was to be used, with conditions and responsibilities clearly specified, and allowed cultivated land to be used more intensively for forestry and agriculture.” This is how the phenomenon of having clear boundaries between forests and fields first arose – and changed the landscape.

If the transition between open land and forest is left to nature, it will be more gradual and much less abrupt. There will be a herbaceous fringe with grasses and meadow flowers along the edge of fields, followed by a belt of young trees and shrubs, and then the forest mantle, which consists of adult as well as old or dead trees. Each section in the transition zone will be interwoven with the adjacent one. This transitional area between two ecosystems is called an ecotone, and is also constantly changing. Unless interventions are made, shrubs will spread out onto the open land, which will then become overgrown and eventually turn into forest – at least in Central Europe.

For more information
on the Blue-Green
Biodiversity research
initiative, see:
wsl.ch/en/bgb

The biodiversity in such a natural forest edge tends to be much higher than inside the forest, as a WSL study in the 1990s showed. It provides – at least close to the ground – a habitat for around four times as many plants and twice as many insects and spiders as the forest. This diversity is possible because light and shade, and warmth and cold alternate within a confined space in the border area between the open land and the forest. “The variation in the site conditions there allows species with very different habitat requirements to thrive,” says Martin Obrist, a zoologist involved in the study.

This is why the researchers found in this ecotone not only insects that are considered forest species as well as those that occur predominantly in open land, but also species that live exclusively along the forest edge. “A forest edge is not just an overlap zone, but a habitat in its own right,” Martin explains. The transition zone also serves as a refuge for many animals. For example, insects take shelter here when the adjacent field is ploughed up or harvested. “The results have shown how important natural forest edges are as refuges for biodiversity in cultivated land,” says Martin.

Transition areas are attractive

Places where two ecosystems meet are not only popular with animals and plants, but often with people as well. This is especially true for bodies of water. In 2020, Marius Fankhauser, a social scientist at WSL, conducted a survey of people living in the Glatt Valley for a study that was part of the Canton of Zurich’s ‘Fil Bleu Glatt’ improvement project (see Diagonal 2/21). The focus was on the role of the river Glatt as a local recreation area, and whether and how they wanted it improved. “The Glatt is important for people. They like to go there to linger or to explore its banks,” according to Marius. Having attractive places to spend time along the river banks and safe access to the water is valued highly, and children and young people in particular want to have places to swim.

In this respect, the transition between forest and open land is similar. Here, too, it is important to have facilities that people can use, such as a bench with a view. But people prefer a forest that is clearly separated from the open countryside rather than a stepped, natural forest edge, according to studies conducted by WSL in the 1990s. “It’s more difficult to use a natural forest edge as it is impenetrable,” Marcel Hunziker explains. He is head of the ‘Social Sciences in Landscape Research’ Group at WSL and supervised the work. Another reason is that: “A forest edge with overhanging trees makes people feel secure, and allows them at the same time to have an unobstructed view of the landscape. This makes it inviting and people want to linger there. That’s why they prefer having a clear boundary.”

Interconnected systems

Sharp boundaries can be found not only between ecosystems but also between scientific disciplines. For example, processes in water and on land are often studied separately. This is something researchers at WSL and the Eawag Water Research Institute would like to change, which is why they launched the ‘Blue-Green Biodiversity (BGB)’ Initiative in 2020. “We want to integrate biodiversity research on land better with biodiversity research in water, and be able to



Valentin Moser is investigating, as part of his doctorate, how beavers change their habitats. His project is part of WSL and Eawag's 'Blue-Green Biodiversity BGB' Research Initiative

combine proposed measures on how to preserve and promote biodiversity in both habitats,” says Catherine Graham, an ecologist at WSL. She is leading the initiative together with Florian Altermatt from Eawag.

In the real world there is also a lively exchange between aquatic and terrestrial habitats. Amphibians, for example, live as larvae in the water, but when they are adults, they normally also make use of the adjacent habitats on land. Leaves that fall from the trees into the water are an important food source for microbes, aquatic insects and fish. And beavers ‘beaver away’ reshape entire banks, which has an impact on the living organisms in the water and on the land, as well as on the material and energy flows in both systems.

Initial results of the BGB Initiative have provided insights into the many interconnections between the two ecosystems. For example, one of the research projects showed that songbirds often feed their young with aquatic insects as they are more nutritious than terrestrial insects. Another study found that creating new ponds for amphibians is worthwhile so long as the water-bodies are well-connected over land.

“The causes of the current dramatic decline in biodiversity, such as climate change and intensive agriculture, are anthropogenic. To stop the loss, we need to look at both aquatic and terrestrial habitats at the same time,” Catherine says. And this means transcending the boundaries in our own minds. *(lbo)*