Agata van Oosten-Siedlecka collects samples in a stream.

Shade for creatures of the stream

Stream-dwelling animals are sensitive to rising temperatures and fluctuations in water flow. Alterra researchers are collecting data on this to help efforts to ward off the effects of climate change. An exploration of the Rovertse Ley stream with a fishing net. **TEXT** MARION DE BOO **PHOTOGRAPHY** THEO TANGELDER, BUITENBEELD, FOTO NATURA

'Look, a dragonfly larva!' Agata van Oosten-Siedlecka fishes a spindly creature out of her net and lets it crawl over her glove. The Alterra researcher – in green wading trousers and a red and black diving jacket - is up to her knees in the water of the Rovertse Ley, an idyllic little stream that winds its way through the Gorp and Roovert estate near Goirle in the south of the Netherlands. She has just fished a load of debris from the bottom of the stream. Between the twigs wriggle dozens of amphipods, little shrimp-like creatures that feed on leafy waste. The net also contains the larvae of the caddisfly, a moth-like insect which spins itself a protective casing camouflaged with leaf debris. 'In the lab we identify all the animals under a microscope. In a sample like this there are 18 to 25 different species, but they are camouflaged and keep out of sight.'

The Roverste Ley, which flooded extensively last winter, is now surprisingly shallow, with no more than 20 centimetres of water. The sandy bed is visible through the clear water. There are rowan trees and young ferns growing along the two-metre high steep banks. Sunlight glistens on the water, the birds are warbling away. Upstream the forest gets thicker and shadier. Downstream the landscape opens up and the stream winds its way through the fields towards Goirle.

COOLING EFFECT

'The variation between sun and shade makes this stream a very suitable model system for researching the influence of the water temperature on the ecosystem', says Agata van Oosten. The Polish researcher has been living in the Netherlands for four years and explains her work in fluent Dutch. 'We are researching how trees and shrubs beside the stream can mitigate the warming effects of climate change. Trees and shrubs provide shade, they keep the water cool, moderate temperature fluctuations and increase the stream's capacity to retain oxygen. We also want to know what influence the rising water temperature has on the species composition among the macro fauna.' The macro fauna include all the invertebrates that can be seen with the naked eye, such as beetles, slugs, leeches, worms and dragonfly larvae. Van Oosten uses sieves with a mesh size of one millimetre to sort her catch. 'There are many hundreds of species of macro fauna. Sometimes a family can include as many as 20 closely related species that can only be told apart by miniscule differences in the length of their antennae, but which all have their own niche in the ecosystem. We would really like to know how they react to climate change.'

All these stream-dwellers are sensitive to climate change. 'They are cold-blooded creatures that cannot regulate their temperature themselves. That makes them extremely sensitive to temperature fluctuations in their environment', says project leader Piet Verdonschot of Alterra, part of Wageningen UR. 'As soon as the water becomes one degree too hot, their internal physiological processes are threatened with breakdown. Running-water species are more sensitive to this than still-water species: they can start dying off at temperatures above 16 degrees Celsius.' What is more, climate change is bringing with it drier summers and heavy

Caddisfly larva

Waterlouse

Amphipod

Dragonfly larva

> **'As soon as the water becomes one degree too hot, internal physiological processes are threatened with breakdown'**

rain showers, adds Verdonschot. 'If streams dry up, aquatic animals die. And with peak runoff, they are washed out of their familiar stream habitat into rivers or the sea, where they do not survive.'

One possible approach to keeping streams cool is to plant their banks with trees that provide cooling shade. Trees not only offer a suitable habitat for animals and plants, they also help stabilize the banks of the stream with their roots. And these roots add to the variety in the flow of the stream, while leaves and wood increase the variety in both flow and habitats. What is more, the stream's capacity to store water is increased, as is its sponge-like function, helping to maintain the height of the water table. 'We want to study all this in the field', says Verdonschot.

'Water managers really need experimental results. Models have reached the limits of their usefulness. You can go on modelling for ever, but without reliable data you cannot work out what the water manager needs for the restoration of ecosystems. We have to get back to field work!'

CUTTING OFF

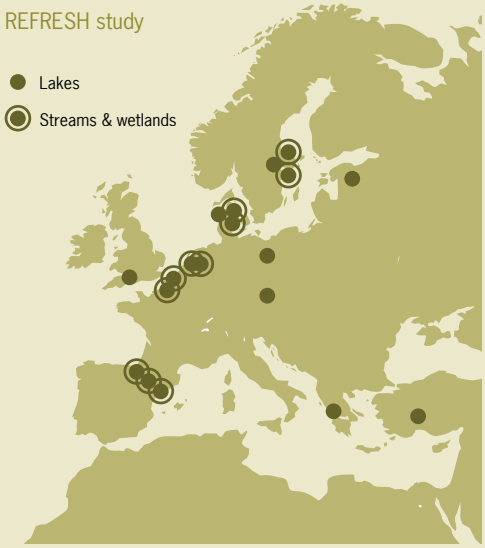
This summer Alterra will be doing research along the Groote Molenbeek, a stream in central Limburg in the south of the Netherlands, to learn more about how streams respond to summer droughts. The Peel and Maas Valley water board have built a construction for the field tests, with weirs and a specially created side stream. Van Oosten: 'From July we shall cut off the stream for ten weeks and make the water flow through the canal, to see how the ecosystem responds to a drought period and how the stream-dwellers survive.'

Alterra is also going to research how long a stream can dry up for without causing major problems, and what effect low runoff has. One of the things the researchers want to know is whether little corners and pools of water remain in which stream-dwellers can survive the drought. The assumption is that a greater variety of habitats makes a stream more resilient to climate change, while in practice intensive management has done away with many of these little refuges.

Back on the Gorp and Roovert estate, Van Oosten is driving the minibus full of lab equipment over rough sandy tracks towards a shady brook. Loaded down with buckets, nets and measuring equipment, we trudge into the woods. At the chosen location, there are large chunks of wood in the stream. The researcher chooses the places where she will take samples carefully. Preferably there should be lots of organic matter such as leaves and twigs, as food for the stream-dwellers. With her hand she gently stirs up

MAKING STREAMS CLIMATE-READY

Dozens of European research institutions are working together on REFRESH, a large-scale study of the impact of climate change on freshwater ecosystems commissioned by the European Commission. Obtaining more insight into how streams and lakes react to climate change is important for water managers. According to the European Water Framework Directive, water managers should ensure ecosystems stay healthy and protect threatened species from extinction. They are also expected to make freshwater areas more resilient to climate change. Which measures can do this effectively? That is what REFRESH is to provide guidelines on. Within this project, Alterra (part of Wageningen UR) is leading an international study on the impact of climate change on streams. In the summer, the stream water warms up, or the streambed can be dry for months. Peak runoff, which used to occur once a century, probably occurs more often nowadays. The stream research is being done in six countries on the Atlantic coast. In each country, researchers are going to take samples from twelve streams. In order to measure the effects of summer droughts, streams will be dammed during the summers of 2011 and 2012 and diverted with bypasses.



the soft substratum just in front of the net. Creatures that were feeding on the leaf waste are startled and get washed into the net. Van Oosten drives a stick into the ground so that Victoria Silvestre Osuna, an intern from Valencia, knows exactly where to measure the speed of the stream's flow and its depth. The net is rinsed out in a plastic bucket. One bucket is filled with 3 nets' worth. A little further upstream they take three more samples, which go into a second bucket. 'If we don't have enough creatures, we cannot draw statistically significant conclusions about the influence of sun and shade on the ecosystem', says the researcher.

BRICKS HIDING

At various points on the streambed, bricks with holes in them have been placed with the idea of catching creatures that like to hide in holes. 'The organic material on the streambed varies, but these bricks are the same everywhere, which made it an interesting idea', says Van Oosten. But the bricks are not popular in this stream – thanks to the extremely high water that caused the stream to burst its banks last winter, the bricks are now covered in sand and remain uninhabited. That is a downer for the researcher, but she cheers up again when she finds that the data logger – a gadget the size of a spectacles case – on the streambed is still intact. It takes the water temperature every 20 minutes. Across a distance of a few hundred metres there are often demonstrable differences in temperature in stream water that flows from shady to exposed patches, or vice versa. The instrument that measures the light intensity and the air temperature on the spot is also working well. 'Up to now, we have lost hardly any loggers, apart from one misunderstanding about the clearing of streams by the water board. In Germany more data loggers disappeared, especially during high water.' Minor mishaps are all part of the job. In Germany she once had to have her car pulled out of a swampy stream bank by a tractor, and on another occasion she lost a mobile phone when she fell flat in the stream. And just as she is telling the story with a laugh, Victoria stumbles on a stone in deeper water and her wading trousers fill with water. Luckily, the car keys are safe and dry in the front pocket. ■

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