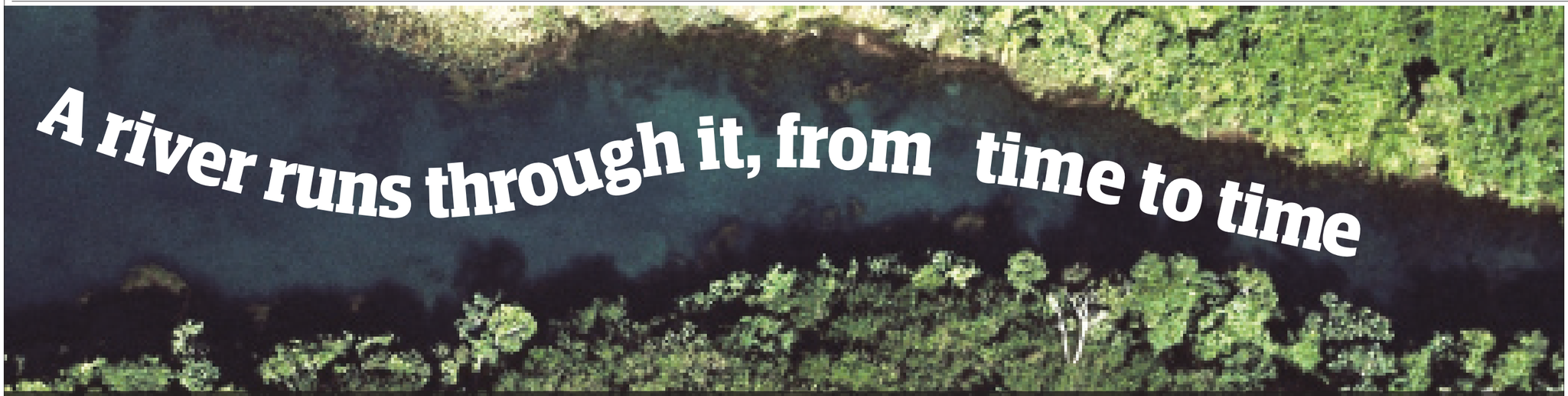

A river runs through it, from time to time

Can dry waterways be more alive than wet ones? **David Larousserie** tests the water

Every scientific discipline is matched by an ocean of ignorance. Physicists don't understand much of the universe. Biologists are still baffled by non-coding DNA, thought by some to make up 98% of the total.

Ecologists wonder about the environmental role of rivers that periodically stop flowing. Such "intermittent" or "ephemeral" rivers may be more common than their better known "perennial" counterparts. A conservative estimate suggests that intermittent rivers make up over 30% of the total length and discharge of the world's network of rivers. In Australia, for instance, about two-thirds of 3.5m km of river channels are considered intermittent. For part of the year they stop flowing, drying up naturally or in response to pressure from humans.

"The world's seven largest rivers belong to this category, the Nile, Grande and Indus, for instance … The Colorado stopped reaching the sea in the 1970s. For part of the year the Yellow river, in China, runs dry 600km before its mouth," says Thibault Datry, at the National Research Institute of Science and Technology for the Environment and Agriculture (Irstea), in Lyon, France, a specialist in this subject. "Until recently no one took much interest in rivers like this," says another specialist, Klement Tockner, head of the Leibniz Institute of Freshwater Ecology and Inland Fisheries in Berlin.

It's a topic with lots of questions and few answers. How long are these intermittent rivers, really?

How does their irregularity affect biodiversity on land and in the water, and interaction between the two types of ecosystem? What part does intermittent flow play in the carbon cycle, given that in theory biomass in the dry phase decomposes more slowly than in the wet phase? How should these streams be managed, given that their definition does not fit with the various definitions in this area?

For all these reasons, and many more, Datry and Tockner launched the 1,000 Intermittent Rivers project in 2015. "More like 1,000 rivers and as many emails," Datry quips, in reference to the pair's efforts to convince fellow scientists and answer their questions. In fact the aim is quite simple: to collect as many samples as possible from riverbeds worldwide to estimate their biological content and biogeochemical reactivity. In March this year just over 100 volunteers started gathering samples in 27 countries, including Algeria, Australia, Bolivia, the US, New Zealand and Switzerland. The dozens of little plastic bags they filled with leaves or sediment are now awaiting attention in cases at the Irstea laboratory in Lyon.

The first experiment seems easy enough. A pinch of leaves from each sample is soaked in a little mineral water for 24 hours. Then scientists measure dissolved oxygen loss and carbon dioxide release.

Both are indicators of the biological activity of bacteria and fungi present in the sample, eating up the organic matter. Labs in Germany and Spain carry out more complex additional measurements of content, testing for carbon, nitrogen and phosphorus. Another lab, in Grenoble, takes charge of sequencing the DNA in each sample.

This will open the way for comparisons at a global level and an estimate of the part played by intermittent rivers in the carbon cycle or the organisation of biodiversity, poorly represented in existing climate models. "Under no circumstances are they 'dead' rivers. They're very much alive," says Tockner.

"Indeed many species are dependent on their dry phase."

There are already indicators of good health for perennial rivers, based on the presence of certain invertebrates. Not so for intermittent rivers. "We don't know what becomes of these communities when the river dries up. But we have already identified various strategies used by species to adapt to intermittence," Datry explains. "Some can withstand the drought, breathing through their skin, burying themselves in the mud, or going to sleep. Others are what we call 'resilient'. They find a refuge somewhere, but return very quickly."

However, other features of intermittent rivers are better known. For example scientists now think that when a dry riverbed suddenly fills with water the massive influx of undigested biomass, swept down from upstream, can cause the sudden death of aquatic species. An event of this sort resuscitates greedy microscopic species, which absorb all the available oxygen at the expense of fish. Marie-George Tournoud, a lecturer at Montpellier University, has observed another negative effect when a drought ends abruptly. "It can trigger pollution shocks downstream, due to discharge overloaded with contaminants," she says. "We're looking at ways of managing these shocks more effectively or preventing them altogether."

Datry's team has demonstrated that intermittent watercourses require careful management. Halving the period of immersion reduces the breakdown of dead leaves by almost as much; it also halves the biodiversity of aquatic invertebrates. "We receive frequent inquiries from river basin authorities and fishing clubs regarding the impact of the length and frequency of droughts, but we don't have all the answers yet," Datry says.

In a 2012 paper Tockner listed a series of advantages for such rivers, including unique biodiversity, acting as a refuge for seeds and eggs, a corridor for migration and a reservoir of organic matter. "We see them as extremely valuable ecosystems, rather than treating them like tips, as is often the case," Tockner says. "Contrary to what some people say, a river with no flow can be a thing of beauty," Datry adds.

"We'll never have enough mineral water," Datry complains with a grin as he contemplates the samples flooding into his lab. With fellow researcher Arnaud Foulquier, at Grenoble University, he is already planning a follow-up. They want to place strips of wood or cotton fabric in rivers to study the rate at which they biodegrade. Meanwhile, he is involved in several European projects and still busy drumming up interest in intermittent rivers. He has started a global database on rivers and would like to design a mobile phone app to report dried-up riverbeds. "We're building a worldwide network to facilitate cooperation and future projects," Tockner adds. Little streams, big river. **Le Monde**

Sue Cunningham Photographic/Alamy

Robo-mermaid dives where humans cannot

Robin McKie

Robotics scientists at Stanford University in California have achieved a remarkable first: they have successfully sent an automated avatar – which they describe as a robo-mermaid – down to an ancient shipwreck to retrieve a vase from the sunken vessel.

La Lune, the flagship of Louis XIV of France, sank 30km off the city of Toulon in 1664. Only a few dozen of the hundreds of men on board survived. The wreck, which lies at a depth of 100 metres, had never been disturbed until the OceanOne robot craft reached it last month and recovered the grapefruit-size vase.

The humanoid diving robot was piloted, using virtual reality techniques, by Oussama Khatib, professor of computer science at Stanford. Sitting in a boat on the surface, he used joysticks to control the little underwater craft. Khatib said that combining human skills with the robo-mermaid's robust structure will transform underwater exploration.

"The human can provide the robot with intuition, expertise and cognitive abilities. The robot can do things in areas too dangerous for a human, while the human is still there," he told Stanford News.

Difficulties with air supply and the danger of decompression sickness – the bends – limit divers' abilities to probe ancient wrecks and other deep-sea features. However, OceanOne's success suggests it may be possible to extend underwater explorations for longer and at greater depths.

The spur that led to the design of OceanOne was a desire to study coral reefs beneath the Red Sea. These can be reached only by robot submersibles, and the Stanford project will combine human skills with the robustness of an automated submarine.

The craft, which looks like a person, has human-like vision from two forward-facing cameras, while its "hands" have fully articulated wrists with force sensors that relay a sense of touch to Khatib's hands, using a process known as haptic feedback.

The operator can "feel" whether an object in his robot hands is light and fragile or heavy and solid. In future, said Khatib, this sensitivity will be enhanced with tactile sensors. During OceanOne's dive, Khatib was able to reach out to the vase on the deck of La Lune as the craft hovered. He could feel its contours and assess its weight before he shut it in a special basket and had it carried to the surface. According to Stanford News, the vase, which had not been touched for centuries, is in remarkably good condition although it was covered in ocean detritus and smelled like raw oysters.

"The intent is to have a human diving virtually – to put the human out of harm's way," said Khatib. **Observer**

OceanOne … Stanford's humanoid robotic diver

Dispatches

Strange streaks on Mars may be from boiling H_2O

Mysterious streaks that appear on the steep slopes of Mars may form when seeping water boils with such violence that it blasts dust off the ground. The seasonal tracks come into being in the summer months and grow for hundreds of metres before they vanish again in the winter. Pictures taken from orbit have found evidence that the streaks are produced by flowing water, but with Mars so parched in modern times, scientists have struggled to explain why the features grow so large. Marion Massé at the University of Nantes and her colleagues used an environmental chamber to mimic the low atmospheric pressure found on Mars. They showed that water seeping through sediments just beneath the surface boiled with such violence that it propelled dust grains off the ground and into small heaps that collapsed in minor avalanches.

Why labradors gorge

Labrador dogs are well known for being fond of their food, but research suggests their greedy nature could be down to genetic mutation. A team of researchers led by scientists at the University of Cambridge delved into the dogs' genetic makeup. Their results revealed that more than a fifth of labradors carry a variation in their DNA that could predispose them to weight gain. "There is some hard-wired biology behind that persistent food-seeking behaviour," said Eleanor Raffan, a co-author of the research.

Antibiotic misuse in US

Nearly one-third of Americans prescribed antibiotics during doctor's office visits probably should not have received the drugs, were not given a long enough course or did not get the right dose, according to research. The study into how doctors prescribe antibiotics to Americans in outpatient settings comes as rates of antibiotic-resistant bacterial infections are on the rise.

Cook's Endeavour found

Researchers said they believe they have located the wreckage of the Endeavour, a ship sailed by the famous British explorer James Cook, which was sunk off the US. The ship was scuttled in 1778, leading up to the Battle of Rhode Island between American colonists and the British. It now appears to have been located by the Rhode Island Marine Archaeology Project at one of nine sites containing 13 ships. The ship, which Cook sailed in the Pacific Ocean, passed through a number of hands before being renamed the Lord Sandwich and used in the revolutionary war.