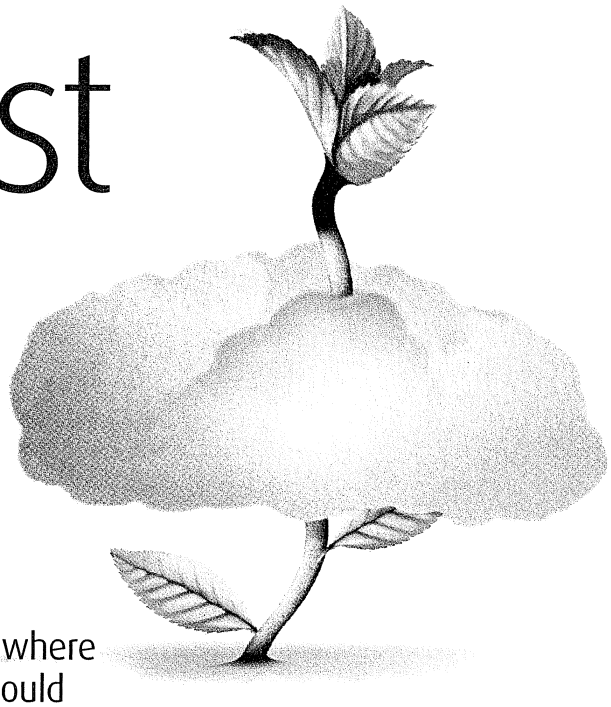
The fog catcher's forest



A bare, dusty island where the rain never falls could soon be covered with trees. **Fred Pearce** reports

WHEN Spanish sailors landed on the Canary Island of El Hierro in the 15th century they were amazed to find an aboriginal population with extensive agriculture, which they had somehow managed to sustain with virtually no rainfall. Legend has it that the Guanche people derived all their water from a single large tree, which stripped moisture out of passing fogs and dripped enough water from its leaves to support a thousand people.

However true the story may be, there is no doubt that the only thing stopping the Canary Islands from resembling the Sahara desert, just 70 kilometres to the east, is the moisture-rich fog that drifts in from the Atlantic Ocean. In the time of the Guanche, all seven of the Canary Islands had rich cloud forests that trapped moisture from the fog-laden trade winds and quenched an otherwise dry region. Since then, though, much of the islands' forests have been lost – removed for firewood, construction and to make way for farmland. Most of the islands still have some degree of forest cover, but one, Lanzarote, is all but bare.

BRETT RYDER

Sometime in the last century, the last of the trees on high ground were cut down and the land began to dry out. While some farming survived in the low centre of the island, the lack of water combined with the rise of mass tourism in the 1960s meant that across much of the north of the island agriculture went into decline.

Now David Riebold, a British forestry scientist turned schoolteacher who owns a home on the island, has a plan to reverse the trend. He wants to use artificial fog harvesting to bring back the cloud forest, in what promises to be the largest reforestation project ever attempted using the technology.

The bare hills of northern Lanzarote have been of increasing concern to the island's authorities since it was declared a biosphere reserve by UNESCO in 1993. Despite numerous attempts in the past decade, all efforts at reforestation have so far failed. With limited water supplies on the island the newly planted trees dried out and died, leaving the hilltops littered with hundreds of dead saplings.

Riebold's house is in the town of Haria from where, for years, he watched the local foresters' failed efforts. Then he read about a successful research project in Chile by a Canadian cloud physicist called Bob Schemenauer, which harvested the fogs that regularly rolled in from the Pacific Ocean and across the rainless Atacama desert. Nets erected on a ridge facing the ocean provided enough water for a small town (see "Out of the mist", page 38). Realising that Lanzarote's climate was very similar to Chile's – with plenty of fog but very little rain – Riebold began to wonder whether fog harvesting could be used to keep the saplings alive.

Beyond reach

Even in the hottest months, clouds form over the mountains of northern Lanzarote. As the trade winds blow over the island the mountains force moisture-rich air to rise and cool and condense water vapour into droplets. The surface of the mountain is too hot for this to happen at ground level, so the fog rarely touches the ground. Instead, it hovers about a metre above the soil. "That's why the saplings died," says Riebold. "They never get tall enough to touch the fog and capture the moisture on their leaves."

On paper, fog harvesting looked like a solution to the island's reforestation problems, but convincing the authorities to give it a try wasn't easy. For more than a decade Riebold tried and failed to convince the local government and environmental groups to back his idea. With the appointment of the present mayor José Torres Stinga in 1999, his luck changed and the scheme was finally approved.

"Proyecto David", as the locals call it, got under way last summer. The town authorities erected eight modest fog-collecting devices on three of Lanzarote's mountains: Aganada, Peñas del Chache and La Quemada. Each is made up of a metal frame about 1 metre wide containing a plastic mesh, rather like a coarse net curtain. Any moisture that condenses onto the mesh runs down into a gutter and then empties into a plastic bottle. Larger scale set-ups can be fed into an irrigation system to supply water to growing plants.

The initial results look promising. A litre a day should be enough to support one seedling, and Riebold has found that on ▶

Out of the mist

Fog harvesting is the brainchild of Bob Schemenauer, a Canadian cloud physicist, who first used the technology 15 years ago to provide water for a small fishing town called Chungungo on the edge of Chile's Atacama desert. Chungungo can go years without a drop of rain, but as in Lanzarote, fogs regularly roll in off the ocean.

Schemenauer came up with the idea of erecting large sheets of polypropylene netting on a ridge over the town to catch moisture from the passing fog. The scheme was an immediate success, and more nets were erected. At one point in the late 1990s the nets were delivering some 10,000 litres of water a day to the town. In the end, though, the technology proved too successful for its own good. With a secure water supply, the town revived – so much so that the local authority invested in a water pipeline to supply the new residents. The nets were no longer needed and were finally abandoned about five years ago.

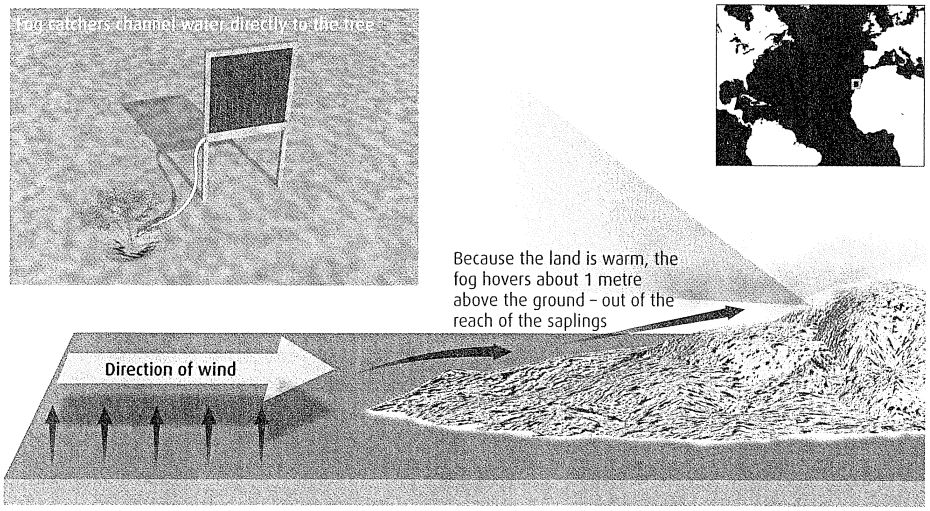
Schemenauer is now working on similar projects for communities in Yemen, Eritrea, Namibia and Guatemala and has conducted field trials aimed at demonstrating how the technology could help regenerate forests. The most successful was at Mejia, covering 2 hectares of the coastal hills of southern Peru, just up the coast from Chungungo. Funded by the European Union, it cost just 60 cents per tree to set up and ran successfully for three years. While many of the trees are still standing today, when the project finished and the foreign scientists left, the locals abandoned fog harvesting. No other forest projects have gone beyond the demonstration phase – until now. If it succeeds the Lanzarote reforestation project will be the first use of fog-catching for major permanent reforestation and ecological revival, and could inspire similar projects around the world.

If Lanzarote's trees can't get to the fog, why not bring the fog to them

FRED PEARCE

GREENING LANZAROTE

Trade winds blow moisture-rich air over the island. As the air rises over the land it cools and the water vapour condenses, forming fog. Fine mesh nets placed on the tops of the mountains can then catch the moisture to water saplings below



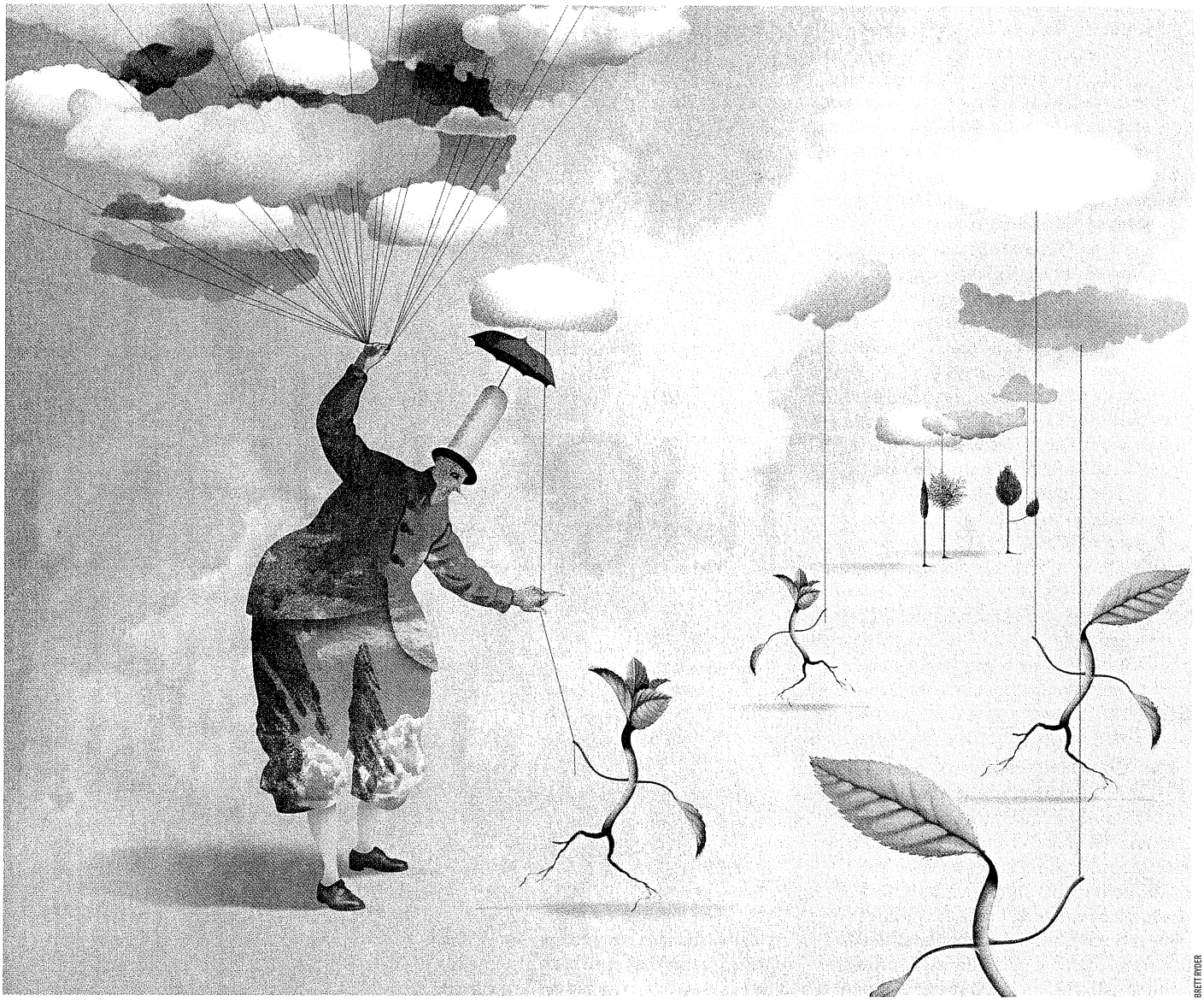
some sites, a square metre of net catches an average of 2 litres of water each day. One site on Mount Aganada averaged 5 litres a day even at the hottest time of year.

This summer, having declared the initial experiment a success, the island council plans to install eight much larger nets covering 12 square metres each. These will discharge around 200 litres of water a day into a pumped drip irrigation network designed to keep the saplings watered. Riebold hopes that this will form the pilot phase of a full-scale reforestation of the mountains of northern Lanzarote. This could be done in one of two ways, he says. Either the hilltops could be covered with nets to grow new forests all at the same time, or it could be done in stages with a smaller number of nets being moved around to reforest each area in turn. After perhaps two years of water from the fog collectors, saplings would be tall enough to collect the fog water themselves. Then the nets could be moved to the next site to begin watering another set of saplings.

Island revival

If the initial results scale up, a new cloud forest could restore the island to its former glory. The Lanzarote government has targeted an area of about 20 square kilometres in the north of the island that was originally covered by olive and pistachio forests, though Riebold believes that the potential area for reforestation using fog collectors could stretch to 50 square kilometres. Marciano Acuna, Haria's town councillor in charge of the environment, says he hopes the trees will trigger a more widespread greening of northern Lanzarote and have an impact on the whole local ecology. Once the trees are back, the quality of the soil will improve, and a long-lost forest ecosystem will have a chance to return, providing habitat for species long since confined to other islands in the Canaries.

While previous reforestation attempts used non-native trees, Riebold has persuaded the island authorities to confine their efforts to close relatives of the wild olives and pistachios that would have been in the original cloud forests. The Canary Islands are a reservoir of unique species and Lanzarote, he says, has more native plants than any of its neighbours. Riebold is well-known on the island as an expert on the subject – his garden in Haria contains more examples of some native species than just about anywhere else on Earth. "My garden is a miniature version of the ecosystem I want to revive," he says. "For example, I have several fine examples of the local wild olive *Acebuchi lanzarotes*. Only three others are known to remain in the wild."



BRETT RYDER

"Once the trees are back, a long-lost ecosystem will have a chance to return"

The knock-on effects of reviving the forests go beyond restoring the local ecology. Eventually the forests should capture enough moisture to help recharge the local underground aquifers, many of which have remained empty since the forests disappeared. If this happens wells down in the valleys could also refill, reducing the island's growing dependence on expensive desalinated seawater, especially during the summer tourist season.

The technology could also allow the revival of an ancient method of tapping underground water. Centuries ago the island's inhabitants carved tunnels up the mountainside and into underground aquifers. These drained into collecting areas lower down. The islanders call these tunnels *galerias*. Once they were the island's main source of water, but with the emptying of many aquifers, even those that could still potentially be tapped have fallen into disuse. Reinstating the cloud forest could bring them back to life.

Since the decline of the *galerias*, water in Lanzarote has become expensive, so desalinated water cannot officially be used to irrigate farmland. This has made farming increasingly difficult and, combined with the rise of tourism as a source of revenue, has turned it into a weekend occupation at best for many residents.

Whether or not fog harvesting will prompt a large-scale return to farming on the island remains to be seen, but the lessons learned from harvesting fog on the island's hilltops may be adapted for people living not far away, and with a greater need to see their landscaped greened and watered. Lanzarote is just a short hop from West Africa, and the island's average annual rainfall is less than that of many parts of the Sahara desert. If Lanzarote can catch moisture from the air and convert it to forests and farmland, then perhaps its famine-prone neighbours could do the same. ●