

Getting to the root of the problem

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'People would just wait for the water. It was a magical event. You could almost hear it coming. All the birds would start twittering and people would get out of bed, whatever time it was. Suddenly, someone would shout, "Agua, agua", and then this tongue of water would come down the riverbed.'

Kew Gardens botanist Oliver Whaley is recalling how the local smallholders used to greet the arrival of river water in the ancient huarango forests on the south coast of Peru. This is one of the most fragile ecosystems on Earth, located in a narrow, 2,000-kilometre-long strip of desert squeezed between the Andes and the Pacific Ocean. It hardly ever rains here. Or at least it hasn't since the last ice age (unless you count the fog trapped in the forests as it rises up from the sea). To survive, vegetation must either trap the fog, suck up the seasonal water rushing down from the Andes, or stretch down to subterranean water channels located tens of metres below the surface.

Which is why the huarango tree is so suited to life here; it has the longest roots of any tree in the world. They stretch down 50–80 metres and, as well as sucking up water for the tree, they bring it into the higher subsoil, creating a water source for other plant life.

For centuries, the huarango tree was central to local people's lives. They grew vegetables in its shelter, its seed pods were used for food, its leaves and bark were used for herbal remedies, its branches were used for charcoal and its trunk was used to build houses. But now it has fallen out of favour and is disappearing. Rapidly. The majority of the huarango forests have already been cleared for fuel and agriculture – initially, these were smallholdings, but now they're huge 100-hectare farms producing crops for the international market, including asparagus destined for British supermarkets – and when the trees go, the land quickly turns to desert.

'Of the forests that were here 1,000 years ago, 99 per cent have already gone,' says





Whaley, who, together with Dr William Milliken, an ethnobotanist at Kew, is running a pioneering project to protect and restore the rapidly disappearing habitat. 'When I first came to Peru in 1994, I thought, "This is so desperate. If somebody doesn't do something now, there is no hope."

So, together with a team of volunteers, he has been documenting the biodiversity of the remaining forest in the south coast valley. It's home to more than 450 species of plant, more than 150 species of bird and a number of endangered animals, including the pampas cat and the guanaco (a relative of the llama). A panther was even spotted in the area recently (but quickly shot on local police orders). The grand plan is to protect the last relics of ancient forest and plant buffer zones around them to prevent further desertification. With funding from the Darwin Initiative (a British government scheme to promote biodiversity in developing countries), he has already created a 500-hectare forest reserve and is working to restore woodlands in the surrounding area.

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LOCAL PREJUDICES

In order to succeed, he needs to get the local people on board, and that means overcoming local prejudices. 'The knowledge of native plants is stigmatised as being associated with poverty,' Whaley says. 'Increasingly aspirational communities think that if you plant food trees in your home or street, it shows you are still poor. But if you plant a tree such as *Ficus benjamina* – probably the most common house plant in the world – it shows you are an affluent neighbourhood and no longer need to grow your own food.'





It wasn't always this way. Before the Spanish arrived in the late 15th century, the huarango tree was 'absolutely crucial' to the people living in the valley, says Dr David Beresford-Jones, an archaeobotanist at Cambridge University who has been studying the role of the huarango tree in landscape change in the Lower Ica Valley.

'It was not only a keystone ecological species, it was a very, very important human resource,' says Beresford-Jones, who believes the tree's fruits were a key component in the ancient people's diets and, because they had long roots and could reach deep water sources, allowed local people to survive drought years when their other crops failed.

But even then, they still cut down the huarango trees in order to make way for agriculture. By analysing pollen from the Nazca (300 BC – 800 AD) and Middle Horizon periods (600–1000 AD), Beresford-Jones has been able to show how, in certain parts of the valley, huarango trees were gradually replaced with crops, until there were virtually no huarango trees left, and very soon no agriculture left either.

Although archaeologists often blame the El Niño weather pattern for the cultural collapse that happened in the area, Beresford-Jones believes other forces were at play. 'If you're chopping down woodland to make agricultural land, you might cross a threshold that leads to irreversible erosion because you don't have enough hedgerows and trees to keep the soil in place,' he says.

There's nothing but desert in the Lower Ica



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Valley now. In order to stop the same thing happening in the Middle Ica Valley, Whaley is encouraging locals to love the huarangos again. 'It's a process of cultural resuscitation,' he says. He has already set up a huarango festival to reinstate a sense of pride in their eco-heritage, and has helped local schoolchildren plant thousands of trees.

SUSTAINABLE INCOME

In order to get people interested in habitat restoration, 'you need to plant a tree that is useful to them,' says Whaley. So, he has been working with local families to attempt to create a sustainable income from the huarangos by turning their products into foodstuffs. 'Boil up the beans and you get this thick brown

syrup like molasses. I stir it into yoghurt, but you can also use it to thicken and flavour soups or stews.'

And this is just the start. The flour can be made into cakes, the beans roasted into a sweet, chocolaty 'coffee', and the syrup mixed into a cocktail. 'It's absolutely this super food, packed full of vitamins and minerals,' Whaley says. 'The most traditional use of it is by the people working out in the fields. They will mix a spoonful of the syrup with water and use it as an energy drink.'

But even if he can convince the local people to fall in love with the huarango trees again, there is still the threat of the larger farms. Most worryingly, some of these cut across the forests and break up the corridors that

allow the essential movement of mammals, birds and pollen up and down the narrow forest strip.

In the hope of counteracting this, he's persuading farmers to let him plant forest corridors on their land. He believes the extra woodland will also benefit the farms by reducing their water usage through a lowering of evaporation, providing a refuge for bio-control insects such as parasitic wasps and preventing mudslides.

And some farmers are already planting huarangos. Alberto Benevides, owner of Ica Valley's only certified organic farm, which Whaley helped set up, has been planting the tree for 13 years. 'There are people who tell me that I'm crazy and should not be growing huarangos but other crops that can give me more money,' he says. 'But we keep planting huarangos, especially in places where nothing else will grow but the native tree.'

He uses the fruits to make syrup and flour, and sells these products along with pumpkins, beans, honey and olives at an organic farmers market in Lima. His farm is relatively small and doesn't yet provide enough money to live on, but he hopes this will change. 'The organic market is growing rapidly in Peru,' Benevides says. 'I am investing in the future.'

And there are others in the farming community who can see the benefits of supporting Whaley's work. Maria Sonia Arenas, head of sustainable development at Agrícola Chapi, a 590-hectare farm business that exports asparagus, avocados and mangoes worldwide, has given 6.64 hectares of land to Whaley for his wildlife corridor project. She believes this creates a 'win-win situation.' 'People living around here have better lives because the environment is improved. But the company also benefits because our clients appreciate this type of practice.'

HAPPY ENDING?

So will there be a happy ending for the huarango forests? Whaley believes there could be. 'If we can record biodiversity and see how it all works, then we're in a good position to move on from there. Desert habitats reduce down to very little,' he explains. 'It's not like a rainforest that needs to have this huge expanse. Life has always been confined to corridors and islands here. If you just have a few trees left, the population can grow up quickly because it's used to exploiting water when it arrives.'

He sees his project as a habitat restoration model that has the potential to be rolled out across other arid areas around the world. 'If we can do it here, in the most fragile system on Earth because it's the driest, then that's a real message of hope for lots of places, including Africa, where there is drought and they just can't afford to wait for rain.'

Messages from the past

I'm standing on a cusp of the Andes – a huge rib of dry rock jutting out into the Ica desert plain towards the Pacific Ocean, from where a pure, cool wind blows. The place looks inhospitable to most life, but strangely I don't feel alone – as far as the eye can see are 'figures' of one of the world's most extraordinary plants – *Neoraimondia arequipensis*. Even on the driest mountain tops, these huge cacti stand defiant for centuries without apparent need for shade or water.

Working on habitat restoration here in southern Peru, we're always on the lookout for indicators that can shed light on the fragmented ecological history, and *Neoraimondia* tells us things as no other does – literally. Even in the remotest habitats of *Neoraimondia*, someone has been there before us. We know this from the remarkable messages left on these ancient cacti. Local people have plucked out a cactus spine and engraved inscriptions, signed and dated, onto the smooth stems. They're often in a delicate hand – a fine line that darkens with time, making it legible a century later.

The more you read, the more enthralling these inscriptions become. The earliest one we've found so far is dated 1902, which corresponds with the arrival of a preacher, when people learnt to write. The inscriptions seem mostly to record moments of water and love – especially the annual arrival of river water: '1934 ... waiting for the water', and, less surprisingly, the love affairs of the local community. The poems addressed to lovers and wives are sometime lewd, but more often romantic and beguiling: 'LOVE, when in the mornings the wind awakens you, don't be afraid because it's a sigh of mine for you, ROSA.'

From an ecological point of view, the spontaneous inscriptions that conjure up a past landscape are the most interesting: 'Today 14 April 1957, I came to cut a bit of reed from the orchard when it was one in the afternoon on the day of Palm Sunday, Pablo.' Pablo was probably gathering reeds along the edge of an irrigation channel to repair his house; today, houses are still made of quincha – reeds covered with mud and dry leaves.

But why are there no reeds or orchards in the area now, and why are there so many abandoned terraces? All is now windblown, with telltale indicators of desertification and overgrazing. Old people in the valley wistfully remember collecting cactus fruit, but today, the same cacti produce no fruit, and many of the inscriptions have shrunk back into deeply concave stems. Clearly these writings were scribed in times when the stem was more swollen and able to bear fruit.

On the Pacific coastal desert of Peru, agriculture and vegetation depend on the lifeline of annually flowing rivers bringing water from the high Andes between January and April. So it's hardly surprising that *agua* (water) is the most common word in the cactus scripts. The dates of the arrival of river water are the single most recorded information, and they provide us with insights into hydrological systems and corresponding plant phenology. For example, the inscriptions show that between 1917 and 1957, the water tended to arrive during January or early February, whereas today, it usually arrives significantly later, in April.

Today, advanced desertification has set in, and the villages and irrigation canals are largely abandoned, but the inscriptions tell of better times. For hundreds of years, this was a productive area, and the cacti tell us that as recently as 1957, water flooded the lower valley. One inscription, made 55 years ago, says: 'The water came here,' indicating the 1953 water level. Today, the riverbed is ten metres below this mark. **Oliver Whaley**

This is an edited extract from a story that originally appeared in Kew Magazine. To read the unedited text, visit www.kew.org/kewmagazine/winter07/cactus-writing-Peru.pdf

