

# A tree of life

David Beresford-Jones extols the long-lived *Prosopis* trees that sustained ancient civilisations in the coastal deserts of Peru.



Huge *Prosopis* tree in forest fragment, Usaca, Nasca Valley.



When 16th Century Spanish conquistadores encountered the dazzling Inca civilizations of the Andes, they had actually come across only the culmination of some 5,000 years of sophisticated and unique cultural developments, whose roots lay along the arid coast of modern Peru.

The Andes run like a spine up the western side of South America. To the East lies the enormous moist expanse of the Amazon basin. To the west, along the Pacific coasts of Peru and Chile, stretches one of the oldest and driest deserts in the world. Some southern parts of this desert have not seen rain for millions of years because of interactions between cold Pacific sea currents, trade winds and the mountain range. But the rivers draining the western slopes of the Andes cross this barren landscape en route to the Pacific, sustaining lush oases. It was in these that the first South American civilizations developed, supported by irrigation agriculture and the rich marine life of the cold Pacific waters.

These people grew maize, cotton, potatoes, tomatoes, pumpkins and chillies on the floodplains. But as in other arid American environments with intermittent water sources, wild plants always provided a crucial supplement to agricultural produce. The most important of these were *Prosopis* trees, known on the south coast of Peru as the hurango.

*Prosopis* produce sweet nutritious pods that can be processed into flour and beverages, or fed to livestock. We know people ate them because we can still find the evidence in fossilized human excrement. Our excavations in the Samaca Basin of the lower Ica Valley contained the remains of pods eaten around 500-1000 AD.

The hurango survives in the desert thanks to tremendous roots that can tap ground water 50m deep. So the tree can reliably produce fruit almost regardless of

erratic river flows. The hurango grows slowly, and can live for over 1,000 years. Its wood is harder than oak or teak and makes an excellent construction material and firewood, as local people have long appreciated. Unusually for this group, most of the *Prosopis* species on the south coast of Peru have no thorns. They also have masses of particularly sweet fruit. Perhaps humans nurtured trees with these two characteristics, selecting them over millennia.

*Prosopis* is also extraordinary important to desert environments, providing islands of fertility and moisture. The trees are legumes, and fix atmospheric nitrogen into desert soils. Their interactions with fungi and bacteria improve the soil, and falling leaves add organic material. *Prosopis* shade increases soil moisture, while roots lift deep ground waters into upper soil levels through a recently-appreciated process called hydraulic lift. The trees can even lower the high pH values typical of desert soils. Today, the basins of the lower Ica Valley are almost completely abandoned, despite extensive remains of human habitation, and ancient irrigation and agricultural systems. What could be the reason for this dramatic change?

About 500 AD (towards the end of the Nasca Period), huge El Niño floods devastated the desert, burying some irrigation systems. Others were left high (and dry) as swollen rivers cut deep into the valley floor. But the floods weren't entirely to blame. We now think that failing to appreciate the vital ecological role of the *Prosopis* trees could have contributed to these peoples' downfall.

Today, the old river terrace supports not a single blade of grass, but it does hold archaeological clues. Pollen and

desiccated plant fossils, including dozens of relict *Prosopis* tree trunks, are preserved in the dry desert climate. These remains record gradual ecological change in the Samaca Basin. The pollen record shows a landscape densely forested with *Prosopis* trees. These were slowly replaced by maize and cotton until, at some point towards the end of the Nasca Period and the beginning of the subsequent Middle Horizon period, tree pollen practically disappeared. This was the time of the great El Niño floods. Without trees, especially ones with roots systems as deep as *Prosopis*, the river valley was vulnerable, first to the effects of floods, causing the river to cut into the valley floor; and then to the gradual effects of wind erosion. The winds blowing in off the sea in the lower Ica Valley are very strong. Over time they have even blown away enough soil to leave ancient canal courses standing proud above the land surface. After the gradual loss of trees, occasional floods brought dramatic and irreversible changes.

Sadly, we haven't yet learnt our lesson. *Prosopis* makes excellent charcoal, for which there is still great demand in big cities like Lima. It takes many hundreds of years for a tree to reach full size, but only a few hours to fell it with a chainsaw. Today, the few remaining large trees of the south coast are being rapidly and tragically converted into barbecue fuel. The likely consequences of this for the ecology and also for the agriculture of the south coast can be seen in the abandoned basins of the lower Ica Valley. Change is not necessarily sudden, but beyond a certain point, even *Prosopis*' stubborn persistence gives ground to wind erosion and river floods, and valuable agricultural lands are lost.