



## **“We used to grow more crops here; now we can only grow pineapples and dragon fruit”: impacts of persistent volcanic emissions on agriculture in Nicaragua**

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Masaya volcano in Nicaragua poses a low threat from ash or lava eruptions, but instead it is a long-term source of persistent gas emissions. The gas emissions have negative effects on plant health, with a well-defined vegetation kill zone close to the active vent. However, there are certain crops that appear to be highly resilient to the volcanogenic pollution, and potentially benefit from it through unknown mechanisms.

We have carried out interviews with the local communities close to the Masaya volcano and researched historical archives in Nicaragua and the United States. There is a substantial evidence for the impact of persistent volcanic emissions in agriculture. The impact of Masaya’s volcanic emissions has been issue of considerable concern for Nicaraguan governments for many years: in the late 1920s a special tax was levied on coffee exports in order to pay for schemes to stop the volcano’s emissions. In the late 1940s the coffee growers’ association estimated that the loss of coffee plants had cost at least \$10 million dollars. The impact on the economy was such that President Anastasio Somoza Garcia advocated dropping a bomb into the Masaya volcano in order to seal it up. Documents from Nicaragua’s National Archive also demonstrate that the current problems faced by the local communities have deep historical roots: documents from the Somoza-era Interior Ministry refer to the poverty of these communities, a result of two key burdens: first, inadequate access to water, and second, the impact of the volcano’s emissions.

However, we also found evidence of local initiatives to combat the negative effect of volcanic emissions in agriculture. In the 1970s farmers living close to the volcano began collecting wild-growing pitahaya (dragon fruit) samples from close to the volcano’s crater. These plants, and their descendants, were particularly well-suited to local conditions, and helped to develop the local pitahaya industry. Similarly, farmers began experimenting in the 1990s with ‘living filters’ [filtros vegetales], using espadillo plant [Yucca Gigantea, or ‘Spineless Yucca’ in English] to protect coffee plants from volcanic emissions.

Some of the local pitahaya and pineapple farmers indicate that these crops grow better in the volcano-impacted area than outside of it, for example, less or no fertiliser has been used. The biological and agricultural mechanisms for this are currently unknown. We believe this is an important area for research, and could potentially help make other types of crops more resilient.