Examining the ecological impacts of persistent volcanic degassing at Masaya, Nicaragua, using multi-temporal MODIS NDVI and ground-based data

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Masaya volcano is located within the most densely populated area in Nicaragua and has been in a persistent state of passive degassing since entering its current phase in 1993. The volcanic emissions are predominantly blown in a west to southwest direction by regular trade winds during the dry season, which runs approximately from December through April. Continued long-term exposure to these volcanic emissions is known to result in a range of human and environmental impacts.

At Masaya changes in the sulphur dioxide gas flux have most frequently been documented during the dry season using field campaigns of FLYSPEC measurements and/or diffusion tubes. Dry deposition of volcanic sulphur, chloride and fluoride has been determined using sulphation plates. Previous satellite-based assessments of vegetation have mostly been limited to two-date change detection but compositional analyses of soils and plants show uptake into the local ecosystems. Although proximity and spatial distribution are known to influence vegetation response, little is known about the impact on vegetation of temporal variations in gas flux and/or direction, particularly during the wet season, from May to November.

Therefore this study presents a time-series of more than 200 Moderate Resolution Imaging Spectrometer (MODIS) Normalised Difference Vegetation Index (NDVI) 250 m 16 day composite data from 2002-2012. Results from the satellite-based data are compared and contrasted with the available ground-based measurements of gas flux and deposition alongside vegetation surveys of species richness and abundance, as well as plant morphological responses.

Incorporating this increased understanding of the annual and long-term vegetation responses to the volcanic plume will inform risk reductions strategies related to human health, land use and agricultural productivity.