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## Land-use change impacts on soil water balance in Santa Cruz Island, Galapagos

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In the Galapagos archipelago, about 96% of the land area has been declared a Protected National Park in 1959. Of the four inhabited islands, Santa Cruz is the most populated, with 15,393 inhabitants in 2010. The non-protected area in Santa Cruz corresponds to the south-central part of the island and the bay area around Puerto Ayora. Over the period 1961-2018, the agricultural land expanded from 6% to 67% of the non-protected land area. In a field-based study around the settlement of Santa Rosa, we monitored hydrometeorological and soil physical and hydrological properties over the period July 2019-December 2021. Six sites were monitored including two replicates per land cover type: (i) native *Miconia* forest, (ii) agricultural land, and (iii) abandoned farmland with invasive species. The spatiotemporal distribution of rainfall and air temperature over the sites is recorded via one weather station, four rain gauges, air temperature and relative humidity sensors; and the atmospheric input and rainfall were sampled at biweekly basis. After pedological characterization of the six profiles, soil and rock samples were taken per horizon for analysis of elemental chemistry, mineralogy, texture, C/N ratio, and organic matter content. Upslope of the soil profiles, TDR probes measured volumetric soil moisture content, soil electrical conductivity and temperature; and soil water samples were taken using suction lysimeters.

Over the monitoring period, the highest rainfall amounts were measured in January (226 to 265 mm), and the lowest in May (20 to 25 mm). Most of the year, the relative air humidity is close to 100% with values dropping to 60% in March. The lowest air temperatures (15 °C) are measured in August, and the highest (29 °C) in March and April. Solar radiation strongly fluctuates from 80 W/m<sup>2</sup> during the rainiest month to 220 W/m<sup>2</sup> in March. Deeply weathered soils are developed on basaltic parent material and have a depth up to 50 cm. Soils are loose and lack macro-structure. The dry bulk density varies as a function of land cover, with the highest bulk densities of 0.9 g.cm<sup>-3</sup> in abandoned farmlands, intermediate values of 0.7 g.cm<sup>-3</sup> in agricultural land and lowest values of 0.5 g.cm<sup>-3</sup> in forests. Although the air temperature is similar amongst all six sites, there are clear

differences in the soil temperature between agricultural and abandoned farmland, and forest sites. Our data show that soil moisture is systematically higher in the two forest sites compared to the agricultural and abandoned sites.

As such, the field data provide evidence of the impact of forest clearing on soil physical properties and soil-water balance.

#### Keywords

Soil weathering, soil water balance, Galapagos, basaltic soils, Agricultural expansion