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Fog as an unconventional water resource for securing food production in Eastern Andes

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The rural region of “Valles Cruceños”, located in South-Eastern Bolivia experiences recurrent droughts and an increasing pressure on water and land resources driven by the interconnected effects of climate change and the expansion of neighboring and rapidly growing city of Santa Cruz de la Sierra. Despite the relative scarcity of rainfall, orographic fog events are recurrent all year round. Under these climate conditions, water can be easily harvested by fog using simple fog collectors consisting of a vertical plastic meshes supported by two posts, which are set up perpendicularly to the predominant wind direction. The access to sustainable water supply improves farmers’ resilience to dry spells, while promoting food security and livelihood thanks to water harvesting technique of fog collection.

The work describes a first assessment of fog collection in the eastern Andean escarpment of Bolivia based on a 12-month analysis made through 1-m² fog collectors placed in 10 different locations. Results showed that, on an annual basis, an average of 6.3 l/m²/d can be obtained from most productive areas, with peaks up to 9.4 l/m²/d. Starting from experimental data collected in 2018, a linear model based on Multiple Linear Regression (MLR) analysis was built for extrapolating longer time series of fog volumes collected, using global climate reanalysis data products as explanatory variables. Synthetic time series from 2016 to 2018 were used to design a fog water irrigation system for a standard theoretical field with four local popular crops (maize, green beans, potatoes and tomatoes) to be grown throughout the dry season.

This paper represents the first study on fog collection in Bolivia, showing how fog can represent an unconventional water resource capable of securing food production and improving family and community livelihood. Moreover, while a large part of the scientific literature focuses on advection fog, mostly occurring in the Pacific Coast of South America, this is one of the first consistent studies on the productive use of orographic fog in inland locations.