Ecosystem services associated with water: the role of the liverwort Frullania tamarisci along an elevation gradient in Terceira Island (Azores) for one year

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Abstract

Water is essential to life, and vital to all processes related with the metabolic functioning of plants. Bryophytes depended almost exclusively on external water supply due to their simple morphological features and absence of true vascular tissues. Thus, they tend to mimic the environmental conditions of different areas and seasons, being good indicators of ecological processes. Moreover, bryophytes are able to intercept rain and dew (liquid water) and use fog (water vapour), and transport water both externally, by capillary forces, and internally, in different cells (specialized or not). Thus, bryophytes play an important role in water-flow regulation through their unique water holding ability. Notwithstanding this role, almost no data exists on the quantification of the water inputs into the system. In this study we aimed to know how the Field Water Content (FWC) of a common liverwort species (*Frullania tamarisci*) varies along the year, in three native vegetation stands, at different altitudes in Terceira Island, and how do climate variables (temperature, precipitation, relative humidity, vapour pressure deficit) affect its Relative Water Content (RWC) along the four seasons. In order to quantify the species' hydration status at three different elevation native vegetation stands (40 m, 600 m and 900 m), five samples of approximately 20 shoots were monthly collected in the field, kept in waterproof containers, and later that day weighted in the laboratory, to get FWC. The same samples were then fully hydrated, weighted, oven dried and weighted, to get RWC. As expected, FWC increases along the elevation gradient, reaching 9 g/g during at the highest elevation and about half of that value in the lowest location, during the wettest seasons (winter and spring). RWC values show that the plants keep hydrated for the whole year, albeit never reaching their full capacity, with a yearly average of ca. 40%. Understanding how much native bryophytes, acquire, store, and release water into the system contributes to the knowledge of native vegetation resilience in the face of climate change and, especially, potential impacts on the availability and quality of water - a major ecosystem service performed by plants.

Keywords: bryophytes, ecophysiology, ecosystem services, liverworts, water holding ability

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