



Quantification of Dew and Fog Water Inputs for Swiss Grasslands

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Dew and fog occur rather frequently in ecosystems all over the world. Yet, little is known about the quantity of water input of dew and fog events and its influence on plant water relations in temperate ecosystems.

Dew forms when the plant temperature drops below the dew-point temperature. As a consequence, gaseous water vapour from the air condenses on the leaves. This occurs predominantly at nights with clear skies, where thermal energy from the earth surface is easily lost to the atmosphere. Under similar conditions, it is also likely that radiation fog forms close to the Earth surface. Fog droplets form on condensation nuclei in the atmosphere and are then deposited to plants.

These two phenomena both provide water to ecosystems, we thus hypothesize that during summer fair weather and drought periods, nocturnal dew and fog formation have a measurable and non-negligible quantitative effect on the water status of plants in Swiss grasslands.

This is due to the fact that plants cannot only take up water via their roots, but also directly via the leaves, referred to as foliar water uptake. Overnight dew and fog formation lead to notable leaf wetness duration, which, in turn, leaves enough time for foliar water uptake. Furthermore, there may be other physiological effects, such as enhanced cooling through leaf-wetting during the early morning hours of hot summer days.

Within the framework of this project, we plan to quantify how much dew and fog water is provided to grassland leaves under today's climate conditions in Switzerland. For that purpose, existing long-term meteorological field sites will be supplemented with lysimeters, visibility and leaf moisture sensors at 10 locations with different climatic conditions and elevations throughout Switzerland.

Self-made lysimeters are developed and constructed to measure even small weight gains on plant leaves that are caused by dew and fog water inputs. At each field site, 3 lysimeters will be installed to have triplicated data. Visibility sensors allow to determine if water inputs stem from solely dew or from dew and fog in combination (fog: visibility < 1000 m). The leaf moisture sensors give a redundant measurement whether leaves really are wet. The observed data will be set into relation with meteorological data to establish a functional relationship that allows for explicit spatial estimations of dew formation and fog deposition. In a further step, this functional relationship will be used in combination with very latest climate scenarios for Switzerland in pursuit of estimating the effect in the future, where prolonged drought periods during summer fair weather tend to increase.

Overall, the outcome of the project will be expected to be useful for grassland management decisions, with impacts on grassland productivity and resilience today and in the future.