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Quantification of Dew and Fog Water Inputs for Swiss Grasslands

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Dew and fog occur rather frequently in temperate ecosystems. Yet, little is known about the quantity of water input of dew and fog events to grassland ecosystems and its influence on plant water relations. The goal of this project is to quantify dew and fog water yields for Swiss grasslands over a representative spatial and elevational scale and to assess its effect on plant water relations now and in the future.

Dew and radiation fog form under similar conditions, when thermal energy is lost from the soil surface to the atmosphere. As a consequence, gaseous water vapour from the air condenses on the leaves, or fog droplets form on condensation nuclei in the atmospheric air 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 (FWU). We will investigate the role of this effect during intensive field campaigns. Furthermore, there may be other physiological effects of dew and fog, such as enhanced cooling through leaf-wetting during the early morning hours of hot summer days.

To quantify the amount of dew and fog water that is provided to grassland leaves under today's climate conditions in Switzerland, existing long-term meteorological field sites will be supplemented with lysimeters, visibility and leaf moisture sensors at ten locations with different climatic conditions and elevations throughout Switzerland.
Self-made high-precision 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, three lysimeters will be installed as replications. Visibility sensors (MiniOFS, Sweden) 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 (LWS, Decagon, USA) give a redundant measurement whether leaves really are wet.
The observed data will be set into relation with meteorological measurements 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 the most recent climate scenarios for Switzerland (CH2018) in pursuit of estimating the effect in the future, where prolonged drought periods during summer fair weather conditions tend to increase.
Overall, the outcome of the project is expected to be useful for grassland management decisions, with impacts on grassland productivity and resilience today and in the future.