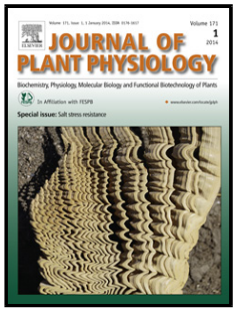

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From aquaporin to ecosystem: Plants in the water cycle ⋆

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Abstract.

Vascular plants are major intermediaries in the global water cycle, and are highly adapted to both facilitate and resist water fluxes, such as during root uptake, translocation in the xylem, and transpiration by leaves. Here, we summarize the contributions to a Special Issue on water in the *Journal of Plant Physiology*, which cluster around the theme of control and facilitation of water movement in plants. We conclude with an editorial view of the need for plant physiologists to consider larger cultural issues surrounding water use, especially in terms of the increasing agricultural demand for water to produce animal feed, with its associated trophic nutritive losses and environmental damage.

Life as we know it would not be possible without water. It is by far the most abundant molecule in living cells, and the medium in which all biochemical activity takes place. In the case of terrestrial plants, water is additionally required for the generation of cell turgor, turgor-driven growth, nastic movements, anatomical and morphological patterns, solute flow, and the stabilization of temperature (Damm et al., 2018). Plants are an intrinsic, and massive, part of the global water cycle, with transpirational water flux exceeding evaporation on land by as much as ten to one. As part of this cycle, they possess numerous pathways through which the movement of water can be conducted, and, conversely, many means by which it can be restricted.

In this Special Issue of the *Journal of Plant Physiology*, we present a group of reviews and original papers that span a wide range of research areas, but cluster, with one exception, around a common theme: facilitation of, and control over, water movement in plants. Such facilitation and control occur at many scales, from that of aquaporin proteins, reviewed here in terms of their function under hypoxic conditions by Tan et al. (2018), to that perceived via remote sensing, as discussed by Damm et al. (2018), who emphasize the importance of combining observation with mechanistic models of vegetation-driven water movements. Between these micro- and macro- levels of observation, we present three ground-breaking studies on the transfer of water from soil to atmosphere via plants, at organ and organism levels of structure and function (Meunier et al., 2018; Sundgren et al., 2018; Plavcová et al., 2018).