



## **Stable isotopes of hydrogen and oxygen in ecohydrology: is the thrill gone?**

Daniele Penna

University of Florence, Department of Agriculture, Food, Environment and Forestry, Florence-Firenze, Italy  
(daniele.penna@unifi.it)

Achieving a thorough understanding of water mixing and transfer between subsurface compartments and vegetation is essential for addressing key environmental and social problems linked to ecosystem services. Stable isotopes of hydrogen and oxygen have proved to be a robust and flexible tool to quantify different components of the water cycle and investigate ecohydrological dynamics in terrestrial ecosystems, and are being increasingly used worldwide.

However, there are some issues that inhibit the application of isotopes in ecohydrological studies in a standardized way and that raise critical questions. For instance, to which extent we can include the isotopic variability associated with the heterogeneity of natural systems in our conceptual models? How much do mixing and fractionation processes affect our understanding of water exchange among different compartments based on isotope evidence? Are we sampling the water pool we mean to characterize?

In this talk, I will report recent thoughts by the ecohydrological community about the mechanistic complexities and methodological problems that currently limit the application of stable water isotopes in ecohydrology. I will show how we can turn these constraints and knowledge gaps into opportunities for new isotope-based interdisciplinary ecohydrological research. I will support this reasoning with examples from ongoing projects dealing with isotopic variability in small catchments, in river systems, in agricultural sites and at the global scale, also focusing on examples of new comparison of extraction methodologies and definition of mixing models. There are several challenges ahead that are worth tackling and that keep the isotope thrill in ecohydrology alive!

Keywords: stable isotopes; water mixing and transfer; ecohydrology; research opportunities.