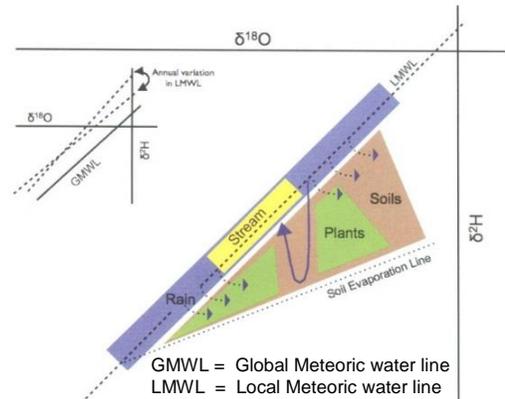


Where do trees get their water from and does this change during drought in the B2-TRF?

Background and Rationale: Where trees get their water from has been a long-standing debate in the hydrological community. The best tool available to determine the answer to the above question are stable isotope measurements. Hydrogen and oxygen of water (H_2O) both have stable isotopes that can be used as tracers of the water (like a dye). In 2010, Jeff McDonnell's group (then at the University of Oregon) found that trees in a humid forested watershed basin in the USA Pacific Northwest were using water from the soil and not the streamflow, even when they were growing right next to a stream. The figure below illustrates this in cartoon form. Experiments in Mexico, elsewhere in Oregon, and a tropical site in Puerto Rico, also found that the plants drew water from the soil, which had an isotopic composition distinct from stream water.

This summer we will test whether the isotope composition of the soil and trees are different from the stream –sub-soil drainage- in the B2 rainforest. This rainforest will provide another wet site (like Puerto Rico) with little change in rainfall across the year, but focused on different plant species and soil depths. The rainforest inside Biosphere 2, most importantly, allows us the ability to test how plants might adjust their water uptake strategies through a controlled drought.

After the start of the drought we will put Deuterium labeled water at the bottom of the soil then determine which trees take up this deep water and when, if at all, they will take this labeled deep soil water up into their stems.



Questions to be explored include: how different are the $\delta^{18}O$ and δ^2H from soil water sampled from with suction lysimetry (available water) and cryogenic extraction (strongly held water, only available to plant roots) and how do they compare to plant water and sub-soil drainage water? Is the plant water isotope composition different across the 7 canopy species, or do different plant species use different water sources? Do these differences change (or not) through a 6-week drought, or does the water use strategy change with drought for different tree species?

For more information, please contact Dr. Jeffrey J. McDonnell (jeffrey.mcdonnell@usask.ca), Jaivime Evaristo (jaivime.evaristo@usask.ca) or Dr. Joost van Haren (jvanhare@email.arizona.edu).



B2 rainforest photos showing the above (profile, left) and below (soil pit, below) ground environmental monitoring and sampling capabilities. Right: deep soil labeling pipes and subsoil drainage trough.

