February 2014 in our Catchment

What a contrast! Thursday the temperature edged towards 40°C and the relative humidity slid under 40%: Friday night it rained! And it kept raining… the best bit is that so much of the rain went into the parched soils. Martin Butterfield, who lives on Whiskers Creek at Carwoola, has captured the whole process wonderfully.

Do enjoy his blog at http://franmart.blogspot.com.au/2014/02/apres-le-deluge.html

The BOM reports that we got 66mm over the three days at Wickerslack Lane.

Your Results

Parameter	Where it comes from	How it affects things	Local events
Electrical Conductivity	The ground water and soil determine the EC	Limey soils are naturally more conductive, more dissolved CO_2; waterlogging also increases mineral content.	While some of the newly flowing creeks had lower than usual readings, sites where there was no flow yet, or were sampled before the rain showed very elevated EC: look at Jerrabomberra Ck at Fernleigh Park, before the rain (1020 $\mu S.cm^{-1}$). With the road works, Woolshed Ck is very high 1830 $\mu S.cm^{-1}$
Turbidity	This is how much light can penetrate the water.	Silt and dissolved humus change turbidity	Anything between 35 and 400NTUs appears to be normal this time!
Oxygen Saturation	Oxygen gets into water through flow, wave action and plants growing.	More than 120% saturation causes embolisms in animals, big or small; below 60% and it is hard for things to breathe.	The hot weather appears to have had a lethal effect on the capacity of many sites to hold oxygen…and it doesn't improve instantly. The Queanbeyan above town had too much DO after the rain (a flood effect, but not much flood) while the Molonglo above *Foxlow* was still shallow and oxygen starved. Many of the ponds were little better.
Phosphorus	Phosphorus is found in small amounts in disturbed soil; the other source is fertilizer.	Every cell needs P to carry its Oxygen: excess leads to rapid growth of planktonic algae.	Did someone add something to Sullivan's Ck? Andy at Mitchell observes 'saw an empty bag of fertilizer in the creek'. The Dawes Rd inlet to Norgrove Park also had elevated P.
Nitrate (NO_3^-)	Animal droppings and fixation by cyanobacteria and root nodule organisms	With P excess promotes plant growth	High in the upper reaches of Jerrabomberra Ck.
Ferals	Introduced fish	Gambusia and European Carp outcompete the locals	There are still pigs in Googong Ck near the pipeline dam.

There are still many places that are doing it tough for water. Kelly's Swamp at Jerrabomberra wetlands hasn't filled much. All along the Molonglo there is still only a trickle … nothing at Burbong Bridge, two pipes on Yass Rd, and nothing in Yandyguinula Ck at Rossi Rd. Hopefully many of the tributaries will be filling now!

Soils need their Crusts!

Here we are again watching the bush and hoping there are no fires round here. For most of us, before last weekend (14–16 February) the last significant rain fell on the 5th of December last year. Since then Canberra has had at least 18 days where the daytime temperature has been 35°C or greater. Perhaps more significantly the 3:00pm relative humidity has been less than 40% on at least 56 days since that last rain, and has dropped as low as 6% one afternoon in January. We have also had some windy days in there! Our soils have very likely lost all their moisture and our vegetation is very dried out.

While there is a degree to which hot, dry summers are the natural state of affairs in rangeland on the western side of the Great Dividing Range, in years when we have a drop in summer rainfall our urbanised lifestyle contributes to the severity of the situation.

Built up areas are dominated by water repellent surfaces. That also means that below that water repellent surface there is a covered layer of what was once soil…and is now deliberately dried out. That leaves that small portion of garden and lawn to collect or lose all the available water for the whole area. We are all too keen on order and regimentation. So we mow that lawn, even in the height of summer. We weed and tidy the flowerbeds. We rake the pebble paths and remove the leaf litter. When the downpours come most of the water rushes past as overground flow, and ends up in the drains all because of our neatness. Then we complain about our water bills.

Public open space also falls foul of our desire to husband and control. The fear of fire combines with our sense of order. We mow the grassland. We prune the trees, mow round them and collect the debris. We abolish the understory…except in the rose beds, and they must be tidy and weed free. It perplexes me when I locate one of the mowing crew or at least his dust cloud: if it is that dusty, what is left of the soil crust that would hold in any moisture or absorb any small passing shower?

So, what are these soil crusts? Are they important? How do they work? Can we plant them?

What are these soil crusts? Eldridge and Tozer (1997) put it rather well: *They are formed by an intimate relationship between a rich assortment of lichens, bryophytes (mosses and liverworts), cyanobacteria (blue-green algae), green algae and fungi and the uppermost layer of the soil.* This rich assortment varies from place to place in its components at the species level, but even in tilled soil (like your rose bed or vegie patch) the organisms are there and ready to form the crust.

Are they important? People tend to forget they are there, but Tongway and Ludwig (2011) make the point with a couple of photos early in their important book on landscape restoration: '… *an 11mm input event wets a sandy loam to a depth of about 12mm …*' In functional systems there are grass tussocks and forbs and shrubs and trees that have root systems that enhance that penetration, but the soil crust has to be there to help the rain in.

Biological soil crusts interact with the weather at a much finer scale than we usually encounter.

How do they work? When we look at a **bird lime lichen** we see the general blob shape and the changes of colour. If we were at raindrop size we'd see the ups and downs of the uneven surface. This

very irregularity helps the lichen protect the soil from wind and rain damage, and slow down the runoff of the now spread out water droplet. The fungal hyphae (the long, skinny groups of cells, with partly open cross-walls, that fungi make) can dry out and wet up very quickly, so that at least some of that first raindrop is pulled into the tissue of the lichen. As they get wetter and wetter the hyphae swell and the spaces between them shorten and widen. The rain goes through deeper and deeper into the lichen. The algal packets sitting in the hyphal network swell and spring to life…that takes water. The underside fungal hyphae, set in the soil, behave like the upper surface, and the water percolates between them and into the soil below. Soil spaces fill with water and the water travels on, further and further into the soil.

The fence allows the soil crust to survive on one side, away from the foot traffic

Bird lime lichen and crust-forming cyanobacteria are structurally simple in comparison to their fellow organisms in the soil crust. Many lichens are highly dissected sheets with curling edges and root-like stays called rhizines penetrating the soil; others have both surface hugging and branching erect structures. Tube forming cyanobacteria may produce sponge-like fibrous crusts. Liverworts either spread across the ground like the sheet-like lichen or form carpets like their moss cousins. The fungi only come to the surface to fruit (mushrooms and puff balls) but their hyphae weave between the crumbs of the soil and the leaf litter and make up much of its bulk. This complexity means even more water can be captured and stored.

Can we plant them? Soil crusts are very easily disturbed. In high rainfall, high soil moisture environments the disturbance may be short lived, but in rangelands, grassy woodland and other areas where soil moisture is frequently changing reestablishment takes a long time. On the other hand Snot (*Nostoc commune*) that rubbery stuff that appears on bare ground after rain, and quite a few of the common mosses do happily colonise broken ground. You cannot sow a biological soil crust, but you can give one the encouragement to get started. Simply restricting stock and other traffic and not mowing or cleaning up an area will allow a crust to develop. So, when restoring areas give some thought to leaving the leaf litter there (whatever the fire risk) and fencing the plantings.

References:

Eldridge, D and Tozer, ME (1997) *A practical guide to Soil Lichens and Bryophytes of Australia's Dry Country* Department of Land and Water Conservation, Sydney.

Tongway, DJ and Ludwig, JA (2011) *Restoring Disturbed Landscapes Putting principles into Practice* Society for Ecological Restoration International Island Press, Washington.

Calendar

2nd March	Ant Walk, Mt Majura, 4:00–5:30 pm	Meet Helms Place, Hackett. Ring 62488955 to register
15th March	Wamboin-Bywong Wildlife Habitat Challenges & Solutions 9:00–3:30	Bywong Community Hall RSVP 12th March 0422 279 946
22nd March	Burra-Royalla Wildlife Habitat Challenges & Solutions 9:00–3:30	Burra Hall RSVP 19th March 0422 279 946
15th and 16th March	Sampling time	Your site

Stephen Skinner

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The operation of the Molonglo Catchment Group is assisted by the Australian Government's Caring for our Country and the ACT Government. Some administrative assistance is provided by the Australian Government's GVESHO program.