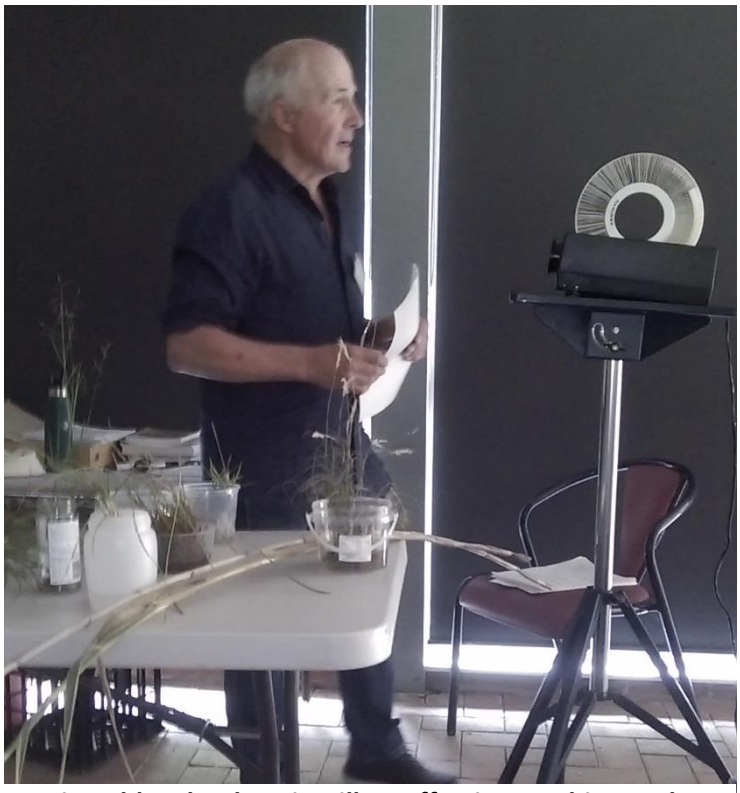
Last Meeting…. report by John Knight

Grasses: Diversity, Photosynthesis and Climate Change

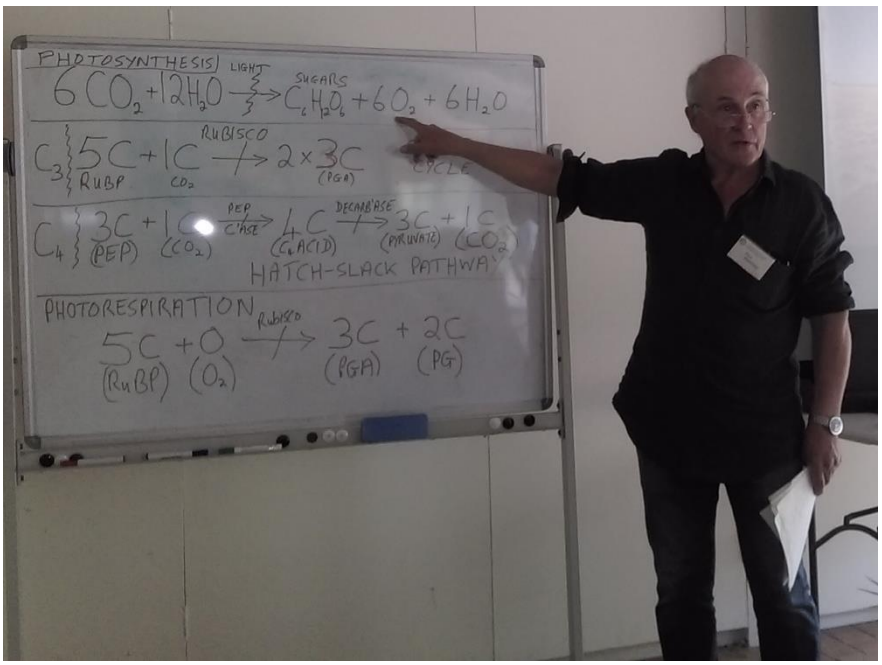
We knew this was going to be a different type of experience when Paul arrived and set up his slide projector.
Most had probably not seen one of these for some years, as the ubiquitous PowerPoint has dominated presentation formats.
Paul began by offering insight to his working background, which evolved to the research on photosynthesis in grasses at a time when there was a lot to be discovered.

Paul began by explaining how perennial grasses are classified as either C3 or C4, and that all grasses contain the more primitive way of capturing carbon dioxide during photosynthesis. The additional C4 pathway evolved in grass species in tropical areas.

Fixation of carbon in C3 plants involves a 3-carbon molecule, but C4 grasses initially produce a 4-carbon molecule which then mysteriously enter the 3-carbon cycle.



Proving old technology is still an effective teaching tool, Paul begins his dissertation on the anatomy of grasses



C3 grasses are generally adapted to cool seasons, and are therefore more common in southern Australia, although they might grow in either wet or dry environments. These grasses are also tolerant of frosty conditions. Generally, they are less bulky than C4 types, although research has shown that the food value is often higher.

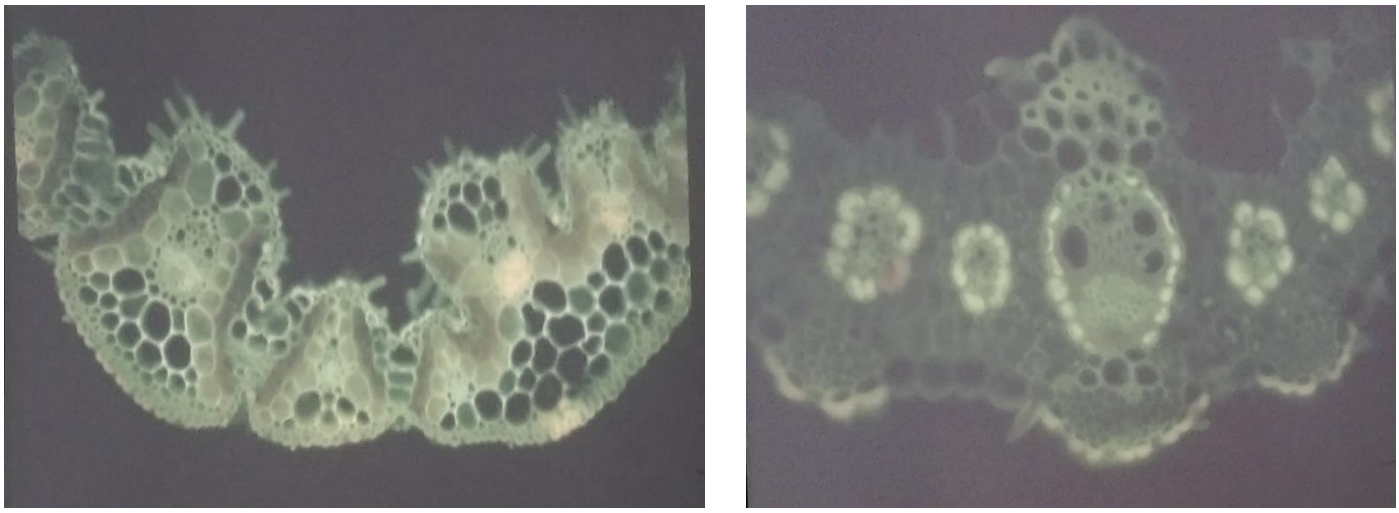
Students of the sciences will appreciate Paul's use of a whiteboard to show the differences between the photosynthesis process of C3 and C4 grasses. The rest of the audience required a more detailed but less confronting explanation, which was forthcoming, and appreciated.

C4 grasses are more adapted to warm or hot seasons, having evolved in more tropical areas. A warming climate favours the spread of C4 grasses, and we now see these grasses beginning to outcompete C3 grasses much further south than in previous decades. Whilst not tolerating frosts very well, no doubt in time generational change will favour their continued movement south, displacing many species which fail to compete successfully.

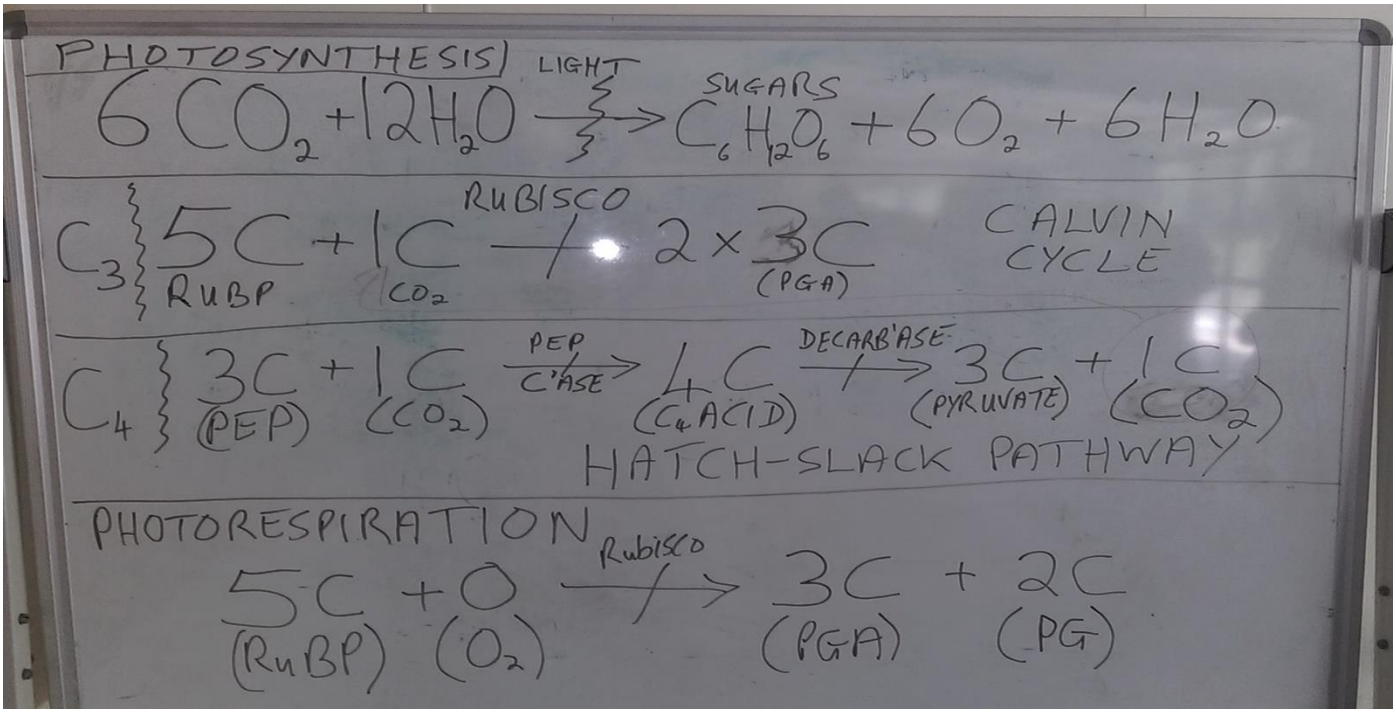
Native grasslands in our region contain a mix of perennial grasses, including ***Themeda triandra***, Kangaroo Grass, ***Austrostipa spp***., Speargrasses, various ***Poa spp***., Tussock Grasses, ***Austrodanthonia spp***., Wallaby Grasses, ***Microlaena stipoides***, Weeping Grass, ***Bothriochloa macra***, Red-leg Grass, ***Cymbopogon refractus***, Barbed-wire Grass, and a mix of herbs and annual plants. The mix of course varies depending on rainfall, aspect, and soil types.

Increasing soil fertility favours weed species at the expense of native species, which have over millennia adapted to the naturally low fertility sites common throughout Australia.

Much of Paul's work was by necessity driven by the need to improve pasture results. As such the use of fertilisers, and increasing available water benefitted the more recently evolved C4 grasses.



These transverse section slides illustrated the different cell structure of grasses, and Paul explained how photosynthesis worked within the cell structure.



Grasses use the C3 pathway to rely on the enzyme **rubisco** to fix carbon atoms from carbon dioxide. Rubisco, Paul told us, is the most common enzyme in the world. C4 grasses instead use the enzyme **PEP carboxylase**, leading to a C4 pathway. By now the "science" is starting to sink in. Then along came **Photorespiration** to muddy the thinking, along with **phosphoglycolate**, and then?

What really stood out though, was that C4 grasses are far more water efficient, and therefore better suited to a drying climate. Research shows that C3 grasses lose around 833 molecules of water for every molecule of carbon dioxide that is fixed, whereas C4 grasses lose only 277. This makes C4 grasses 3 times more efficient in water use.

It is this type of information which made us sit up and take notice.

Although Paul had more to tell us, lunch time had arrived, and Vice-President Geoff presented Paul with a gift bottle of wine, a small token of our appreciation for the enormous amount of detailed research he had put into his preparation. He received long and deserved acclamation from an appreciative audience.

Paul discussing the C4 grass *Joycea pallida*, Red-anther Wallaby Grass

After lunch we ventured to the environs of Deep Creek Dam to have a look at the range of grasses growing naturally. Paul had investigated the area prior to our walk, and had identified 27 different native grasses, although not all of them he recognised.

Delicate flowers of *Cymbopogon refractus*.
Photo Don Wood

The orchid *Spiranthes australis*.
Photo Don Wood

Jackie Miles was a willing ally, and between the two we were able to identify all the grass species, as well as a few forbs, and even the native orchid ***Spiranthes australis***, Ladies Tresses, with its bright pink flowers spiralling around erect stems about 40cm high.

All in all a great meeting, and we thank Paul for his enthusiastic presentations, both “in class” and in the field.