

## Conference Proceedings – Speaker Transcript

### The management of restored grassy ground cover sites: Fire as a tool in maintaining diversity and influencing vegetation structure

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What a wonderful and challenging morning it's been. People have mentioned the range of ideas raised today and I think this is very positive. We need to hear all these different points of view. The use of fire is such a complex issue that we're dealing with, not just fire, but restoration itself, the nature of our vegetation, our culture, our past and particularly now our future. Today we're living in a country which is so dramatically altered, with 60% of the Australian footprint now under private ownership for agriculture. That is 60% of the footprint of this country essentially used for growing crops and domesticated animals. So what a transformation that is. Then you throw in the footprint of our cities. You're probably talking another 5%. So we're really talking about an altered landscape, with 22 million people and all sorts of infrastructure on it. So the issue of using fire to restore our native vegetation can't be anything but complicated.

So why do we burn? Essentially, if we're just going to cut through to the core of it, we burn to protect the 22 million people that live on this continent and we burn to protect their assets. That's the primary reason that we're doing this. Now, there are many other reasons that we try and embed into that use of fire, but protecting people and their assets is first. That's the take home message if we are honest. That's why we're doing it.

So while I currently work out of western Sydney now on Cumberland Plain restoration, for two decades I worked on grassland and grassy woodland restoration in Victoria. In Victoria there is also a lot of discussion of fire and where and when it should be used. Often it's on rural roadsides, where essentially (particularly in the western districts) there's a whole series of strategic firebreaks that are lovely wide three plus chain roads. Essentially these road systems were designed and used as strategic firebreaks. These are routinely burnt by the volunteer CFA down there. In reality most of those roadsides are sadly covered or dominated by *phalaris* and other sorts of introduced grasses. And with this as a potential fuel load, the CFA manage the biomass on these roads for to provide a strategic firebreak in times when bush fires sweep across the landscape. The roads are essentially burnt when the CFA crews can afford the time and resources to get off the farm which is often just before or after they harvest their wheat. Often just before Christmas. Essentially, if there happens to be native ground flora vegetation on the roads, and sometimes there is some of the best ground flora remnants left in Victoria on those road sites, it's just lucky that that burning process, which is I stress essentially about maintaining strategic firebreaks and asset protection, the burning also manages to assist in the preserving of the native species. So, again, it's just good luck that these native species are hanging in on those road sides which

haven't been tilled up for farming. We also haven't put animals on these roadsides to a large degree for some time (as travelling stock routes). Some are still used as travelling stock routes, but it's much rarer these days. Again, the ecological sort of concern about the use and timing of burns in respect to native species came down the track. But it's fair to say many of the best roadside remnants have persisted in part due to the coincidence of burning practices.

We know that these native ground layer communities are wonderfully resilient, and tolerant to that fire disturbance event. In this slide I'm just really pointing out the ground layer here, so those herbs, lilies, orchards are coming up post fire. This image is at one site out near Stawell, in Western Victoria (slides 6-8). Over a period of about three weeks this area that had been bare following the fire is transformed into this wildflower meadow - so fire can be quite transformative.

So why do we in GA and in particular our Grassy Groundcover Restoration Project use burns? The Grassy Groundcover Restoration Project is a project that I've headed since 2004. It was established to investigate the feasibility of restoration of grasslands and grassy woodlands in the agricultural footprint of Australia. Often we talk up here in Sydney about the wonderful bushland that is still somewhat common along the east coast and great divide, and in some ways this can be misleading in terms of what is occurring in terms of native vegetation in other parts of the country. To my way of thinking essentially Australia's divided into pretty much two parts; that is areas that humans can make use of, such as the places we farm, our arable land or where we build our cities and buildings such as places with nice views. Many of the sites we build cities occur on land that is not ideal for farming (such as sandstone country) so often there is still native vegetation left (this is the case in Sydney). Sadly, I think our country is pretty much a split like that. And my group is mostly working in these arable landscapes where we humans want to actively make use of such as to grow crops and meat or to dig big holes to mine coal or gas or rare earth metals that are essential for the existence of all this wonderful technology and equipment that surrounds us here in this city and this room today. So, while it's easy to point the finger at culprits in terms of impacts on our native biodiversity in this arable and city footprint we're all involved in the use of the products. But there is a really important role we humans to think about how we can go back into those altered landscapes and see if we can restore some of the vast amount of native biodiversity that's been pushed out of that huge footprint of Australia, and the world as well. It's the same story right across the globe.

So why are we doing it here in our Grassy Ground cover sites? Essentially we still have to reduce biomass. There is still the problem or issue of asset protection, whether it's an exotic grass sward or a native grass sward. Interestingly we now have evidence to suggest though that the native grass swards are less combustible and so are less of a wild fire risk to people because they often represent less biomass build-up compared to a *phalaris* road site, for example. So there's a benefit in the use of native species compared to many exotic grasses on roadsides for we humans. In our grassland management we are also we're attempting to inhibit grass growth because they over time become the dominants, just like trees can in other communities. We also try to restrict the regrowth of trees where that is an issue so that things remain open woodlands rather than closed forest. So in a lot of the grassy systems we operate, trees are there. They've just been managed out, either actively through clearing then grazing, or fire or burning.

If you take away grazing or burning the trees will re-grow. We also burn to rejuvenate the grassy vegetation. A lot of this layer just becomes rank or moribund over time. It's simple horticulture. If you

leave some things long enough they will just become rank. Now, in the past these grassy systems would have been grazed, whether it was stock with the advent of European agriculture or by kangaroos and other herbivores or Aboriginal fire in the pre-European Australian landscape. This ground flora was constantly grazed or burnt, and through that process - rejuvenated. In the absence of disturbance, such as we often see in the current situation, then fire can be used as a tool to rejuvenate plant growth which may lead to better fodder or increased seeding and things like that. Opening the grass canopy also allows for the small forbs and such to come into play. Burning can help create canopy gaps and in a cost-effective way. It's pretty good. You can burn a large area or footprint in a fairly short period of time. It's relatively easy once you get the processes and all your ducks lined up. At other times it can be a pain in the bum. I mean, you all know how hard it is to get permits at some times, and then wait for the right conditions for burning to take place at others.

We have a few images showing this biomass reduction concept (slide 10-15). There we've got a grassy sward. We've cut a break around it. We've then done a burn through it to get the vegetation opened up. As you can see, it has opened that up beautifully. Then we get those gaps in the grass sward occurring and the seed can drop into those gaps. So then over time you get this opportunity for more recruitment and seedling occupying those gaps. I'd add that you need to continue to use fire to control biomass as is needed because those gaps will close up again if the grasses get away. That notion that management might not need to be ongoing with then unintended changes to the vegetation occurring is somewhat prevalent on the Cumberland Plain, where what may have once been open grassy Cumberland Plain woodland. In this instance where someone takes away a burning practice or they take away grazing, then relatively quickly (say in a decade or so) all of a sudden if conditions are suitable massive tree regeneration occurs and suddenly an open grassy woodland becomes something else – more a closed forest of sorts. Now, maybe that's fine if it's what the managers of that landscape or society wants. But often it's not what is desired, and here burning can help.

Rejuvenating vegetation (slide 17). We can use fire to rejuvenate vegetation. Both grasses and the sub-dominant species. In these systems grasses are the primary structural component of that ground layer. But the species diversity is in that forb or herb layer, consisting of things like lilies, daisies, orchids, mosses and various other things. Fire can put a cap on the growth of grasses, restricting their dominance, particularly kangaroo grass. This allows the sub dominant species to survive and persevere. Aboriginal Australians were absolute masters of doing this. In all those discussions about the Murrumbidgee (Yam Daisy) fields and things like that. These were done by just doing that – restricting certain species (such as the grasses) and allowing the herbs to dominate. We use these same principles allowing those things to happen, and opening those gaps so that once again you can restore sites. All these sites I've been showing you have been those were we restored grasslands or grassy woodland on ex-agricultural land. This image (slide 20) for example shows a nationally threatened species – a Hoary Sunray. The site is one that's been restored from scratch and then we've used fire as a management tool. We're using fire to open up the grasses so the rare species can recruit and spread.

Some of the issues with fire (slide 21). There's 22 million or there about people living in Australia. And in truth it's particularly hard to burn when there are this many people about. There is also a lot of things we value very highly within the landscape. Things worth billions and billions of dollars all over the place, such as infrastructure, roads, rail, power lines, cities, people's houses. Now days we have huge urban borders with combustible vegetation right up to the interface of houses. These vegetated areas have to be managed, whether they're exotic or whether they're native. And this in itself has become something of a huge issue for society. Even in rural areas these issues are relevant. Again, something as simple as

fences on a farm. Take an average farm of say 1000 to 2000 ha. These could have up to 50,000 dollars' worth of fences on them. That makes it really tricky to burn, and especially to get burning wrong. You don't want a burn to get away and take out this sort of infrastructure (let alone the farm house). That's why we're a bit nutty and paranoid about the use of fire. And it's a reason why it's much harder to do now than it was 200 years ago before Europeans arrived.

Can these goals be achieved by other means? (Slide 27) Well, at times we have to look to other means to do achieve these various goals because sometimes burning is just not the most effective, safe or efficient management tool. For example, grazing by cattle or sheep can be used at times to remove grassy biomass. So sometimes where we've got a really good farmer working with us at a restoration site we can use a technique called crash grazing at particular times. Essentially, if you've got a lot of annuals plant species in a landscape, you can use crash grazing in spring to stop the seed being formed from dropping, because at this time that annual vegetation is attractive to the stock as feed. Following this you take the stock off the paddock and this allows the perennial native component of that landscape which hasn't yet flowered and formed its seed to go through its flowering and seed cycle. This over time improves the native component. And there's different ways of applying this technique, such as shorter, long-term, deferred, rotational or cell grazing.

Conversely, and I've seen it lots of times, the much more widespread practice of just leaving a herd, sheep or cattle on a landscape for long periods as set stocking. And this can really have a negative effect on the native grasses or the herb layer. The use of slashing or mowing and baling the cut grasses is another technique. Essentially another way to remove biomass. It's the equivalent of kangaroos or other native herbivores eating it, except just a bloody great big tractor full of diesel, taking it away, or off to where it can be baled. But there are drawbacks of course. Some include that by moving equipment around the landscape we are transferring weeds, and compacting soils. Now, these things are also happening with stock as well, by the way. So these are the issue that you just have to weigh up when considered alternatives to fire. It's just complicated.

So here's a site in western Victoria near a cemetery (slide 30). It's a beautiful grassland. Sites like this are often managed on an alternating basis. So one year they'll use a burn and another year they'll just slash and remove vegetation. This slide is where you can see they're slashed into a *Themeda* area and essentially treated it like a native lawn. Here's a site (slide 31-32) where we've restored a really nice *Wallaby Grass* grassland. At this point we've come in, and just taken that grass and other biomass off as bales to open it up. And then removed the cut bales. Here's another site near Geelong (slide 33-35). You can see that it's on a farm, and we have restored a large area of grassland right next to a crop of wheat. Again, when we think it's appropriate we will come in and cut and bale that off. If you cut at a particular time, such as early spring or even autumn, the material is useful as fodder. Conversely if you take it a little later in late spring or summer when the plants have flowered and there is seed set, this will be held in the bales and you can spread that out as a 'seed hay'. This seed hay can then be of use as a material to recreate grassland elsewhere.

So, coming to our Grassy Groundcover Restoration burns. I'm just indicating now some of the burns we've done. It's always a process for us of weighing up all these multitude of factors I've been mentioning. Do we slash? Do we burn? Do we use cattle? Is there a combination thereof? How often does the vegetation requiring burning? You can see how wonderfully complex these sort of plant communities are. And essentially that is maintained through active management. That's the key word. It isn't necessarily about burning. It's about active management. Neil, in particular, spoke earlier about

that, the need to be there on site and managing. It's not something you can put into a calendar and forget. Good management is about constantly looking at the landscape and managing it intimately.

In terms of when we need to manage biomass, some of the things we have sort of refined down so they are prompts for action. For example when we find at a site that we've got greater than 70% vegetation cover of the ground surface and we've also got dry material held above 150 mm, we know we have two key cues there. At 70% cover and dry material above the ground we know we've got enough combustible material to carry a flame. That's that simple mechanistic assessment that indicates we can actually get a burn to go. It also indicates that that the gaps in the vegetation are starting to close up – which for us is an issue. As the grasses re-grow in response to the available resources, forbs will again come under more and more pressure from grass dominance. In this instance, the burn or whatever technique we use has a practical and an ecological outcome.

Here's just a few slides of some of our burns. We've probably done over 100 of these at sites over the last several years. In this slide you can see a dense sward of *danthonia* (slide 39-43). We've got in the Snake Gully CFA fire crew there and it's an autumn burn. You can see in the background that same pole. Look at all the herbs in that foreground months after the fire. They were all embedded in that dense grass material. It just needed to be opened up. Another site at Hamilton (slide 44-50), and the Buckley Swamp CFA crew came in. Again, we're working with the CFA crews for their skill and expertise. Again this is a late autumn burn. You can see that yellow sort of circle up the back just as a reference point. This slide shows the site in spring that year. We've got a whole bunch of people going through looking at the beautiful wildflowers.

One of the lovely things about this cool burn technique is that you can do it so intimately. I've gone through and lifted up rocks and tiles in our sites after these burns all these critters are still in there (slide 51). When it's slow moving or patchy they can hop out of the way or seek shelter. You get this ash on the surface, and then the next day it blows away. You can even burn over the top of moss and it's still left viable underneath it. And all these micro site created by the burns help form niches and habitat. If a site just becomes dominated by grass, if it's not open and complex then you don't have as many niches for all these other trophic levels, which is what we're after in these landscapes.

So in summary. Is burning always best? Well, probably not always, but it is an awesome tool for management of grasslands and grassy woodlands in a whole range of situations. Thank you.

### **Questions from the audience**

**Q** - We've got grasslands that are highly degraded with lots of bulbous weeds, so *sparaxis* and things. They seem to respond very positively to fire and we don't have many other disturbance regimes that we can easily implement in the systems in parks where we can't easily graze. The terrain means we can't easily slash. Any advice in terms of how you've seen fire, in terms of managing weedy systems like that?

**PGR** - It's probably not the answer you want to hear but fire is one of the things that we will use, but there are often complicating factors. So in these really highly degraded landscapes where a lot of the native seed bank and the bud bank has disappeared so it's pretty much an exotic flora. If you're burning that, all you're probably going to do is get weeds coming back through. So, like the guys from Orange, what we've had to do in these situations is bring native seed onto those sites. It's about reintroducing native propagules to our landscape. Someone else touched on nutrients before. A huge change that we've made to the agricultural landscape growing crops, and growing stock is we've reintroduced much

higher levels of nutrients, in particular, phosphorus. That favours the exotic species by and large. By helping them to grow we favour the exotic flora over the native flora which has by and large evolved on low nutrients.

So what we have to do is to try and reduce nutrient levels. And that gives the native seed and plants that develop an opportunity to compete effectively against the weeds that are there or which will just move back in. Then the fire on top of that maintains the native sward. It helps to keep it healthy and robust against invasion. So, as I said, this is just such a complicated story. If you're working in a really degraded system like most of Australia is, the addition of native seed has got to be an issue. Nutrients have also got to be an issue. The management of the biomass, whether it's through fire or anything else, has also got to be part of the issue as well.

**Q** - I think you might have just answered my question a bit. It was about that serrated tussock situation, direct seeding combined with patch burning in North America it's a fairly conventional technique to burn and then sow in small patches. Have you got any comments on that?

**PGR** - Well, only that I agree. I think when we talk about restoration, and I know this is a conference on fire, but we really have to accept that most of this native ground layer vegetation has disappeared. So we have to reintroduce it back into the sites, primarily using seed. Where do we get that seed? That's another issue. But because there's hardly any of these communities left, I'll just throw the notion out there, and if you're game to look at some of the papers I've written, particularly in EMR, you'll see the concept of seed production, or growing native plants crops to produce seed, and then bringing that seed back onto sites is critical. This can be done for example following something like a burn. And then at least you've reintroduced those native propagules back into the system and then you can manage the site so that those natives can over time then become competitive and re-establish themselves.

**Q** - You're working in a winter rainfall area? Is that right or not?

**PGR** - Well, I work from Victoria all the way up to Sydney.

**Q** - Okay, so do you have any comment on seasonal burn? And can you put it in the context of the rainfall?

**PGR** - Look, in Victoria we tend to burn in autumn. I've talked a lot about autumn burns. I had to get used to when I came to Sydney everyone talking about spring burns and I'd think, "What's wrong with this picture?" I think it has something to do with the woodier component up here. But, having said that, to a certain degree, you can burn when you can burn. It's about the conditions at the time; how wet, wind speed, humidity, how much biomass material you've got, things like this. And so, I do know that we've burnt in autumn very successfully out in the Hawkesbury in western Sydney. We did this to manage the high biomass there so that when spring came we didn't have a huge combustible sward of grass which if a fire did come through, it's going to go off. Now, possibly I could also burn it in spring. In Victoria where we worked it was somewhat difficult to burn in spring if the vegetation was perennial - it's too green. Annual systems were different. But essentially I try and restrict biomass where it's needed outside the really highly flammable and combustible period in summer where you've got 40 degree temperatures and big winds. When exactly outside that period comes down to the factors I've spoken about.