

MANAGING A NATURE REFUGE ON A FIERY CROSSROAD

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Property owners "Belgamba"

Abstract

Management of a Nature Refuge on a plateau in eastern Central Queensland within a region of mixed land use is inextricably linked with fire. Practical experience has led to an understanding of fire behaviour and the adoption of a range of fire management techniques to optimise nature conservation outcomes. Ultimately, environmental success cannot be achieved in isolation but is dependent upon the responsible use of fire by the local community.

Introduction

Belgamba and the adjoining Bouldercombe Gorge Resources Reserve are situated 25 km south of Rockhampton - locally called the beef capital of Australia. They are located on a deeply dissected plateau which is the junction of the Dee and Razorback Ranges and the source of three catchments, Dee River, Gavial Ck., and Plumtree Ck. The neighbouring grazing properties based on the surrounding plains country to the south, east and north have their back paddocks running steeply up to the edge of the plateau; ideal entry points for wildfire. Conversely, the property to the west has been chronically overgrazed for at least 25 years, and while this is not good land management, and soil erosion is rife, it is an ideal firebreak. Most of the surrounding plains have been cleared for grazing and agriculture. The majority of blocks are small hobby farms with a few larger grazing properties.

We acquired Belgamba, a 540 hectare property, in 1990. Our intention was to save it from the effects of environmentally damaging grazing practices and restore it to its former glory. We were not aware that fire would affect all aspects of land management, would take far more time, effort and expense than we ever imagined, and would come to dominate our lives. This is our "Australian Story" of learning about, adapting to, and managing fire in range country over a period of 16 years.

Vegetation and Climate

While most of the plateau is open forest and woodland, there are significant patches of dry rainforest. Their distribution is largely controlled by the frequency and intensity of fires. We know that Aboriginal firing practices created much of the landscape but removal of the traditional owners has resulted in a loss of collective memory of these practices. The open forest (Regional Ecosystem 11.11.3) has an understorey of *Macrozamia*, *Xanthorrhoea* and *Cycas* and a variety of grasses. The Microphyll Vine Forest (RE 11.11.5) commonly called dry rainforest or vine scrub is the version of rainforest that is able to survive in low rainfall areas of coastal Queensland. It is characterised by a closed canopy but with a low height (5 - 10 m), and a preponderance of vines and spiky plants. Dry rainforest is botanically rich with a degree of local endemism and is an important contributor to biodiversity in the landscape. Dry rainforest communities are fire-sensitive when young but fire-retardant when mature, and therefore can act as a natural firebreak. These fire retardant properties are due to the absence of grass, and the low combustibility of the timber and foliage.

Situated in the dry-tropics, fires can occur at any time of the year, although the peak period is from August to October when the dry westerly winds are active. We have seen an extension of this wildfire season into November and December partly as a result of a marked decline in summer rainfall.

Recent Fire History

From 1980 to 1990 the previous owner of Belgamba started fires annually in the ungrazed sections of the property and left them to burn into the country below. When we bought the property, his advice to us was "What Belgamba needs is a Good Hot Burn every year". These sentiments about fire in general still exist in the broader community. In the last 16 years there have been a total of 23 fires either on the plateau or in the very near vicinity which have had a significant influence on our activities at Belgamba. Of these, two were major invasive wildfires that extensively burnt Belgamba, ten were other wildfires, and eleven were prescribed burns. Of the ten other wildfires, five would have entered Belgamba if action had not been taken either by us or by others. The other five were extinguished before reaching Belgamba by natural events such as rain. All ten wildfires caused considerable effort and inconvenience. Some were active for up to three weeks in the surrounding countryside and during these times it was not possible to spend any length of time away from the property.

Our Early Years at Belgamba - 1990 to 1994

When we purchased Belgamba we intended to repair the previous environmental damage. From 1880 onwards

large quantities of timber had been removed, principally for the nearby Mount Morgan gold mine. As a result, the forest had a high proportion of immature trees and a general lack of large hollow trees. Lantana (*Lantana camara*) was very dense in all disturbed areas and rainforest edges. It had replaced the riparian vegetation and was also present on slopes and plateaus. After fencing out the cattle, we started removing the lantana and in three years had cleared 80% of it. Once we had put so much effort into lantana removal and control, we did not want Belgamba to be managed as a grazing property again; so in 1993 we approached the State Government to see if a Nature Refuge could be declared over the area. This is a voluntary conservation agreement, binding on title in perpetuity. Belgamba Nature Refuge was gazetted in 1997.

One consequence of our de-stocking and lantana removal was that after a few years we had a large body of native and introduced grasses, which was increasing our fire risk. We had equipped ourselves with a fire-fighting pump and knapsack sprays, but our firebreaks were of a poor standard. Our general lack of fire experience meant that we had difficulty in visualising an adequate response to a wildfire. We feared that some areas of recovering creeks and dry rainforest would be devastated by wildfire, and in 1994 this is exactly what happened

First Major Invasive wildfire

1994 was the year of terrible bushfires in eastern Australia, and in October of that year a wildfire burnt through much of the district. It was started on a dry 38 degree day, without a permit, by an 80 year old local landholder on a nearby property. The fire burnt slowly down into the Upper Ulam Valley south of us on Wednesday 5 October confined to the far side of a large area of dry rainforest, so that by Friday night it was constricted to a 100 metre length of dry creek bank between a road and the dry rainforest. We walked down to this site with knapsack sprays early on Saturday and extinguished burning logs on the unburnt edge. However, being called away to other fires in the district we did not check the status of this fire again on Saturday and by Sunday it had flared up again. Despite frantic efforts on Sunday morning it could not be contained with the result that it only took an hour to roar up the slope to our boundary, and two days to burn through the whole property. The rural and Mount Morgan town fire brigades were in attendance to protect buildings. Their back-burning efforts, while protecting the houses, intensified the fire in the hills surrounding the buildings. The extremely dry conditions meant that this was a very hot fire and great damage was done both to large mature trees in the open forest and to small patches of dry rainforest. Big hollow logs were still burning in the hills four weeks after the fire.

Observations and Lessons Learned

1. We almost succeeded in stopping the fire in the Upper Ulam Valley when it was quiet and manageable. Our failure was due to a lack of follow up patrols. In our range country there is often a time in the life of a fire when it can be approached safely and extinguished. We learned from this fire how important it is to take advantage of such opportunities.
2. By not having an adequate firebreak on our boundary at the top of the slope where the fire entered our property, we were not able to burn down to the approaching uphill fire. Our other internal and boundary roads were also not in a good enough condition to use as firebreaks.
3. We observed that a fire that took three days to descend 200m in altitude to the valley floor, took just one hour to come back up a slope of 300m altitude.
4. A narrow walking track to a lookout was sufficient to stop the fire and leave a large unburnt area between the track and a creek. This could only have occurred during the coolness of the night.
5. Fire-sensitive areas needing time to recover, such as creeks and regenerating dry rainforest, were put back many years. Our program to senesce native grasses, such as River Grass (*Chionachne cyathopoda*), which had expanded beyond their normal range, was back to square one. Also a large number of habitat trees were destroyed because of their propensity to burn.
6. The native vegetation did not survive where Guinea Grass (*Megathrysis maximus*) and Green Panic (*Panicum maximum* var. *trichoglume*) were growing in creeks and adjacent to dry rainforest.
7. We were unable to control the fire on the property because we could not leave our house and buildings as they did not have sufficient buffer area around them.
8. The fire entered Belgamba via a block of Unallocated State Land where the owner was not available to help. (It later became a Reserve controlled by Queensland Parks and Wildlife Service (QPWS))

Fire Management Strategy

The fire of 1994 taught us that if we were to achieve our environmental objectives, management of fire would have to be a top priority. In particular we thought we could adopt the principle of “We will decide what fires come on to our property and the manner in which they come” This would be achieved by

- conducting prescribed mosaic burns in the open forest, taking care not to destroy large habitat trees,

- excluding fire from creeks, and from dry rainforest where edges are regenerating
- setting up and maintaining a network of fire control lines both on the boundary and internally,
- maintaining our own fully equipped fire unit on a four wheel drive vehicle,
- poisoning introduced fire-accelerant grasses within creeks, on dry rainforest edges and close to firebreaks
- utilising opportunistic fire-fighting
- maintaining a large area of mown parkland around buildings
- ensuring that owners of neighbouring land, whether private or state, know that they have fire on their land and encouraging them to take timely action to prevent their fires coming to us. This includes working with them outside Belgamba when required.

Second Major Invasive Wildfire

Our fire strategy was successful for the ten years following the 1994 fire, and we were extremely pleased with the progress of environmental rehabilitation on Belgamba. However the recovering areas still needed more time.

On Friday 12 November 2004 the landholder of an adjoining property in the Upper Ulam Valley to our south lit a pile of logs, but without consulting us as is required under the permit conditions. The temperature was above 35 degrees. The fire escaped and burnt up the slope and into our property that afternoon. We were unaware that this had happened and no advice was given to that effect either by the landholder or the local fire warden. The next day we were away from the property and when we returned at 5pm the only message on our answer phone was from a different neighbour asking where the fire was. The fire had 24 hours to establish itself on Belgamba before we even knew about it. During the next two days we received help from the local Rural Fire Brigade, a crew from QPWS, and our two employees. We only succeeded in saving one third of our property, but were able to prevent it from entering two separate parts of the Reserve, where it could have spread to the residential areas of Struck Oil and Bouldercombe. This fire set back our environmental recovery program in fire-sensitive areas. However in general this was not a destructive fire compared with 1994. We lost very few large trees, and much of the area burnt as though it had been a prescribed burn.

Implementing the Fire Management Strategy

Fire control lines

A network of 4WD tracks mainly running along ridgelines was put in by mining exploration companies and these are maintained by us as firebreaks. It took some time to develop the best method for treating these tracks to make them effective firebreaks. The use of a bulldozer to clean up firebreaks disturbs the soil and brings up large rocks in hilly country. Slashing leaves stubble that is too high. We have since found the only effective method is to apply the herbicide glyphosate. Once firebreaks have been prepared in this way, the use of a high capacity leaf-blower is very effective in creating a bare-earth strip from which to burn back during a prescribed burn or prior to the approach of a wildfire.

Opportunistic Fire Fighting

It is possible to control fires, often in areas without vehicle access, by taking advantage of favourable conditions such as the coolness of the very early morning, eg:

We have combined with QPWS early in the morning to back-burn from a hastily rake-hoed line in the Reserve and succeeded in stopping a wildfire that had seemed impossible to control on the previous day. On another occasion there was an opportunity to extinguish a fire early in the morning when it had just entered the grassy downhill slopes of the Reserve. Three QPWS rangers helped us put it out in a few hours, preventing it from spreading to a much wider area. We are fortunate in being able to call on QPWS because they are prepared to work in mountainous areas away from vehicles. This does not mean that safety standards need to be compromised.

Working on our own we were able to stop the November 2004 fire from burning the remaining third of our property by drip lighting from an internal road. Starting at 4 am, we back burned towards the approaching fire front, sometimes only metres away, as it burnt up a hill with a heavy fuel load in places. In November 2005 we went to inspect a fire early in the morning that had started the previous day. It had put itself out amongst the long grass and grasstrees (*Xanthorrhoea johnsonii*) on a gentle downhill slope apart from a few smouldering logs lying close to the edge of the unburnt country. By walking off-road with knapsack sprays and extinguishing the fires in those logs we prevented them from re-igniting later that day.

Prescribed burns

We have conducted prescribed mosaic burns in parts of the open forest and woodland to- (a) maintain ecosystem health, (b) provide a refuge in non-burnt areas for wildlife, and (c) endeavour to reduce the effects of a wildfire should one occur within the following year. In most cases we have received assistance from QPWS. Our procedure for managing each burn has been to prepare fire control lines, sometimes including temporary cross-country firebreaks, many months beforehand to facilitate fire control. QPWS provide additional labour on the day of the burn. We then patrol the edge of the burnt area for many days afterwards until the area is safe. Using these methods none of our prescribed burns have ever escaped.

In the earlier years our prescribed burns were conducted in the winter months because they were easier to control. Since then we have taken on board scientific advice from former CSIRO entomologist Don Sands that insects overwintering in foliage are destroyed. We now recognise that there are better times of the year for burning.

During the last two years wildfires have burnt the majority of the surrounding range country within at least a 20 km radius. This has impacted on our plans. We are now less inclined to conduct prescribed burns given that our unburnt country is part of a diminishing refuge for the more fire sensitive plants and animals, e.g. Painted Button Quail (*Turnix varia*), Rufous Bettong (*Aepyprymnus rufescens*), and Mountain Oak *Allocasuarina torulosa* - the only food source for the Glossy Black-Cockatoo (*Calyptorhynchus lathami*) classified as Vulnerable.

Patrolling

We patrol every fire on or near Belgamba, whether wildfire or prescribed burn, until we are satisfied that it is safe, and then once more just to be sure. In addition we endeavour to save any habitat tree that appears to be in trouble whether near the edge or within a burnt area. We ensure that every smouldering tree or log that is a threat to the unburnt edge is extinguished. This can involve using water, chain-sawing, dragging logs away from the edge, and in special cases, packing the base of smouldering hollow trees with soil to cut off the air supply. We try to patrol every fire at least once at night as this is the best time to see glowing embers which may be invisible by day. Many hollow old dry ironbarks, whether standing or on the ground, can burn with very little smoke.

Riparian Strips and Dry Rainforest Edges

In the first few years after burning, de-stocking, or weed removal, there is an explosion in the growth of grass. This is when the fuel load is a major risk factor, particularly with introduced grasses such as Green Panic and Guinea Grass. As time goes by without fire dry rainforest patches and riparian strips start to recover re-developing a canopy which ultimately suppresses the grass. All this takes a long time without fire. We poison the introduced grass and endeavour to burn away from, rather than towards, these areas.

Communicating with neighbours

We have established communication with our near neighbours in relation to bushfires, and have worked together with them when required, although it is not possible to have such a relationship with all the non-adjointing landholders who can still be the cause of wildfires.

Fuel Load and Hazard Reduction

The terms Fuel Load and Hazard Reduction are often misunderstood by the general public and politicians. There is a simplistic belief that the latter will fix the former, with little regard to the long term effects of such action. These words are general terms for complex issues. All attributes of Fuel i.e. *type, quantity, size, arrangement* and *moisture content* play a role in determining the intensity of a fire, and their effects vary with each fire. Other non-fuel factors such as- *terrain, time of day, vegetation type* and *weather conditions* also impact on fire behaviour. We have found that the *quantity of fuel* on its own can be surprisingly unimportant in our range country in governing the behaviour of a fire when considering the interaction of all the other factors listed above.

Fuel Size and Arrangement

In our open forests and woodlands there is a rapid growth of grass during the first year after a fire. The grass grows to a certain height and grows no higher. The longer an area remains unburnt after a fire, the greater the build up of branches, leaf litter and dead grass. Even though the actual quantity of fuel measured in kg/square metre may increase over the years, this additional fuel is on the ground and burns slowly, up to many hours after the initial fire front. However the main contributor to the intensity of a fire front, namely the fine and openly arranged standing grass, does not increase after the first year or two following a fire. Therefore we have observed that factors such as *fuel size* and *arrangement* have been more important than *quantity of fuel* ("fuel load"). After the 2004 fire, we noticed that those areas which had not burnt for 10 years suffered no greater intensity of heat than those areas

which were burnt 5 years ago. The most scorched areas were where the fire front had run uphill during the day. The number of years that had elapsed since previous fires appeared almost irrelevant.

Moisture Content

There are times when the fuel on the ground does not burn. In November 2004 we were surprised to find a 10 year accumulation of leaf litter virtually intact after a fast moving grass fire had passed over the area. We realised that the 60mm of rain in the previous month had increased the moisture content and decreased its propensity to burn. In this case the *moisture content* was more important than the *quantity of fuel*.

Terrain and Time of Day

When planning prescribed burns or working out how to respond to a particular wildfire, we have learned to appreciate that we have physical properties to work with at Belgamba. These are hilly terrain, and the natural firebreaks formed by large patches of dry rainforest and creeks with sufficient riparian vegetation. If a fire is burning downhill overnight there is every chance that by morning it will have reduced in intensity sufficient for it to be contained before the following day's heat. We also have observed how even on a hot afternoon, and in an area full of grasstrees, a fire will slow down considerably once it moves horizontally or downhill, compared with the speed with which it has raced up hill. In these cases *terrain* and *time of day* are more important than the *quantity of fuel*, and in the latter case *terrain* is more important than *time of day*.

Hazard Reduction

The myth of Hazard Reduction is related to misunderstandings over Fuel Load. As described above, there is rapid grass growth in the period following a fire and an area can burn again quite easily within a year, or even 6 months in some places. If we were to use Hazard Reduction as the tool to protect Belgamba from wildfire it would have to be conducted annually. However such a "scorched earth" policy would favour the fire-tolerant grass species and would cause enormous change to the forest ecosystem. This has already happened in the district where forested ecosystems are being permanently destroyed by the repeated use of fire. At Mt Barmoya northwest of Yeppoon, repeated hot burning up the northern slope has replaced some areas of a densely forested mountainside with Guinea Grass. The justification for burning eucalypt woodland and open forest country should be based on overall environmental benefit, not just on reducing "Fuel Load". Likewise, experience tells us that areas do not need to be burnt solely because a certain number of years have elapsed since the last fire.

When considering Hazard Reduction around buildings and small properties, we are pleased that recent information from the Rural Fire Service is now advising landholders to use mechanical means such as slashing rather than fire.

Fire and Lantana

A good news story from the second major fire is about a subject close to our hearts. Sixteen years experience with lantana removal has taught us that in our country fire is usually ineffective in killing large lantana. In 2002 while removing primary lantana in one creek catchment we noticed that the roots were particularly large, having formed underground plates that required a crowbar to take out completely. In addition, the cut-stump and poisoning method was far less effective with at least 50% of those treated re-sprouting as opposed to 5% elsewhere. We were at a loss to understand what was different about this catchment until we remembered that this was the area that had been subject to annual hot burns during the ten years prior to our purchase. This led us to understand that while fire appears to kill lantana, the roots will remain alive for up to two or three years and the lantana *will* re-sprout. We have validated this by digging out both living and "dead" lantana and have found that in almost all cases the "dead" lantana has a network of living roots. Repeated fires only make lantana roots more determined to survive by forming large underground plates. By contrast the 2004 fire killed seedling lantana in areas where we had recently cleared primary lantana, thus saving us considerable time and effort in controlling regrowth. As a result, we present the "Herbert Theory of successful lantana eradication" which reverses the popular notion that fire should be used to destroy large lantana. In country similar to ours, we advocate that the process should be – first, the removal of primary lantana by hand or poison, and second, a year later, the use of fire to kill the seedlings while they are young. This also takes advantage of the rampant grass that emerges after the large lantana is removed. However, don't try this tactic in the dry rainforest, where fire is taboo.

Landholder Attitudes and Behaviour, and the Rural Fire Service

It is difficult to achieve all our conservation objectives because our need for the long term absence of fire in sensitive areas is thwarted by the incursion of wildfires. This is where the entire community needs to play a part. Belgamba and the Reserve are at the crossroads of four Rural Fire Brigade areas because our plateau is located at major watershed and shire boundaries. We are therefore in a strategic position to prevent bushfires moving from

one district to another. The significance of this situation is not well understood by these brigades, so that we and QPWS are not always advised or consulted about the progress of bushfires.

In our region the majority of wildfires are started by landholders. We know of no fires started by lightning. As a general rule those landholders who burn out their neighbours and the surrounding bushland, do not have malicious intent, but do so through negligence or ignorance, due to –

- failure to prepare adequate firebreaks,
- lighting up in hazardous conditions,
- lack of preparedness for dealing with a possible breakout
- failure to patrol both during and after the fire

Some landholders even light up many kilometres along a ridgeline and then walk away. A fire started in this way in December 2005 burnt for over a week, caused the local Rural Fire Brigade many days of work, caused QPWS to hire a dozer for a day, put us on high alert, and was only eventually stopped by rain.

Most landholders surrounding our plateau manage for grazing where fire is simply a tool to “get rid of the rubbish” and to promote grass. We and the Reserve are up on a hill and do not exist in their minds. Even if a fire gets away “it’s only a National Park and needs a good burn anyway”. We appreciate that our neighbours’ objectives are different from ours. Our problem is that they do not always contain their fires to within their own boundaries.

Great progress has been made by the Rural Fire Service in getting to the stage where obtaining a permit for fires is now well accepted. However, it appears to be far too easy for people to light up with a permit but with no regard to permit conditions or advice from Fire Wardens. We are not aware of any of those responsible for causing wildfires in our district being prosecuted in the last 16 years. Those who just light up, with or without a permit, and then claim “It just got away, mate” have been getting away with it for years. We need to go a step further and ensure that fires are lit and managed in accordance with the permit conditions. A carrot and stick approach is required. Firstly, education and training, not just for volunteer fire-fighters but also for landholders to encourage them to take responsibility for their own fire management. Secondly, taking action against those landholders who do not comply with their permit conditions. Paradoxically the presence of a Rural Fire Brigade can lead to complacency on the part of some landholders who think that they do not have to prepare for fire themselves as the local brigade will always come and save them. The continuing building of houses on ridge tops in fire-prone areas, with the approval of local Councils, only compounds the problem.

The community has limited knowledge of the impact of fire on ecological processes. Environmental education is not within the scope of the Rural Fire Service. This is where other organisations such as regional Natural Resource Management groups can play a role. However getting the knowledge across may not be easy. For instance a Workshop - “Managing Fire and Native Vegetation on your Property” - organised by the Fitzroy Basin Association recently at Calliope, a small town near Gladstone, was cancelled due to lack of numbers. It may be that the issue of environmental impacts of fire need to be made more relevant to those landholders who are production oriented.

Conclusion

The general lesson is that just buying an environmentally important block of land is not sufficient to “save” it. It will face continuing pressures from threatening forces, and on-going management is a big responsibility. We have had to adapt our strategies to ensure that the vegetation on Belgamba will become as resilient as possible in facing future fire threats. After 16 years at Belgamba we now have a reasonably good understanding of why our bushfires burn the way they do, and how to manage them.

Our initial vision for the rehabilitation of Belgamba has been adjusted to take account of the fact that we are living on a fiery crossroad. While acknowledging that a complete return to pre-European ecosystems is not possible, we believe that we are on the right track with an environmental recovery program that maintains biodiversity and creates less fire prone ecosystems.

Managing bushland for biodiversity within a modified landscape requires not only a combination of practical experience, scientific knowledge, and an understanding of the behaviour of fire in local conditions, but also a more fire-aware community. So not unexpectedly the policy of “*We* will decide what fires come on to our property and the manner in which they come” will not work without the full cooperation of the broader community beyond our borders.