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# A Fire at Treetops? - Fire Management and Nature Conservation

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*Fire management is one of the most contentious and difficult vegetation management issues. The example of “Treetop Sanctuary” in the Lockyer Valley shows that current rural fire management practices often have a very poor scientific basis and as a result are having serious negative impacts on biodiversity. The significant vegetation of “Treetop Sanctuary” is profiled, fire management practices in the Lockyer Valley and their negatives discussed, and solutions to the problems outlined.*

## Introduction

“Treetop Sanctuary” is a 150 acre (62.5 hectare) property located in the southern Lockyer Valley, approximately 100 km west of Brisbane, South-East Queensland. The western end of the property, where there is road access, is on a flat-topped plateau with an altitude of approximately 500 metres. The eastern end of the property drops away into a steep-sided sandstone gorge. The plateau area and gentle slopes leading towards the rim of the gorge feature tall open woodland, dominated by eucalypt and acacia species, with dry rainforest in the remaining gully line and gorge areas. Approximately 60% of the property is tall open woodland. The geology of the property is predominantly Heifer Creek Sandstone, rising to Walloon Coal Measures on the plateau area. On adjacent properties there are large basalt caps, rising to 700 metres, overlying the Walloon Coal Measures. The area is in the foothills of the Great Dividing Range, which is located approximately 10 km to the south.

The owners of Treetop Sanctuary, Peter Keys and Leanne Jackson-Keys, have established a small-scale health retreat/environmental tourism enterprise on the plateau part of the property. By establishing a health retreat/environmental tourism enterprise, the landholders are able to make an income through retaining, rather than clearing or modifying, the significant natural vegetation on their property. “Boutique” guest accommodation is in cabins in six renovated historic train carriages. Other facilities include a seminar room, dining room, kitchen, and health therapy rooms. Walking tracks lead to rainforest areas, lookouts over the gorge, and other features. A Fire Management Plan has been prepared for the property (Cox, 1998).

## Nature conservation values

“Treetop Sanctuary” has very high nature conservation values:

- A large number of rare and threatened species, including a newly described species.
- A large number of flora species normally found in sandstone vegetation communities further inland.

- Areas of endangered dry rainforest ecosystem.
- Forms part of a larger area of highly significant continuous bushland.

### Flora

So far only large-scale vegetation survey work has been carried out in the Heifer Creek area. However, the survey work, carried out by Mr. Paul Grimshaw of the Queensland Department of Environment and Heritage, has revealed very high nature conservation significance (Table 1), including a newly described species, *Boronia splendida* (Duretto, 1999). It is likely that finer-scale surveys will yield further significant finds.

**Table 1 - Endangered, vulnerable and rare species - Treetop Sanctuary**

Species	Common name	Details
<i>Boronia splendida</i>	Splendid Boronia	Pending Vulnerable (V) species
<i>Acacia blakei</i> ssp. <i>diphylla</i>		Listed as Vulnerable (V) in NSW
<i>Bertya opposens</i>		Rare (R) species

*Boronia splendida* is a woody shrub growing up to 2.5 m on well-drained sandy soils. It covers an extensive area of the property and ranges from just to the east of the Treetop Sanctuary buildings down on to the slopes of the gorge. It is by far the dominant understorey species, and is in abundance throughout the property. Although found over a wide area, known populations of *Boronia splendida* are geographically isolated, small in size, and threatened by clearance and fire. It is expected that *Boronia splendida* will be given a conservation status of Vulnerable under the *Queensland Nature Conservation Act 1992*. Aside from its biodiversity value, *Boronia splendida* is also likely to have commercial value. The potential for commercial production as a garden plant or as a cultivated cut-flower plant is currently being investigated. It is likely to be ideal for these purposes, with its attractive fragrant foliage and spring pink flowering. It also has potential for yielding essential oils.

The Heifer Creek area, where Treetop Sanctuary is located, also features populations of several plant species that are normally found a considerable distance further west and north-west (Table 2).

Within a species, there are typically wide genetic variations that are the result of adaptation by the species to local conditions across the range of the species. The genetic variation will sometimes be so great that some populations of the species actually constitute a subspecies, or possibly even a new species altogether. An example is the koala fern *Caustis blakei*, which grows in South-East Queensland coastal Wallum heath areas. There are also populations of koala fern in the Helidon Hills, an upland sandstone area across the north of the Lockyer Valley. The koala fern populations in the Helidon Hills are genetically distinct enough to actually be a subspecies, *Caustis blakei* subsp. *macrantha*. Although the species itself is common, the Helidon Hills subspecies has a very restricted range and habitat which has resulted in its pending listing as a vulnerable (V) species.

**Table 2 - Other significant species, Heifer Creek area**

Species	Common Name	Details
<i>Eucalyptus bakeri</i>	Baker's mallee	Very disjunct eastern population. Species is normally found on western Darling Downs.
<i>Eucalyptus melanoleuca</i>	Yarraman ironbark	Very disjunct south-eastern population. Species is normally found from Yarraman to North Burnett. Listed as Rare on the <i>Queensland Nature Conservation Act 1992</i> .
<i>Allocasuarina inophloia</i>	Thready-bark casuarina	Disjunct eastern population. Species is normally found on Darling Downs. Second disjunct population in the Helidon Hills.
<i>Eucalyptus sideroxylon</i>		Disjunct eastern population. Species is normally found west of the Great Dividing Range. Located on Treetop Sanctuary. Would probably have also been on adjacent properties prior to clearance.
<i>Triodia</i> sp.	Spinifex, porcupine grass	Very disjunct eastern population. Species is normally found in western Queensland.

The genetic distinctiveness of the Helidon Hills koala fern was only recently identified, the result of studies carried out by the University of Queensland Gatton College. Studies have not yet been carried out on the disjunct populations of *Eucalyptus bakeri*, *Eucalyptus melanoleuca*, *Allocasuarina inophloia*, *Eucalyptus sideroxylon*, and *Triodia* sp., but when they are, distinct subspecies may be revealed. These subspecies could then be expected to be listed as endangered (E) or vulnerable (V). Even if these populations are not distinct enough to be subspecies, they still have conservation value, because species adapted to a wide range of situations stand a much better chance of long-term survival.

Aside from their conservation value, genetically distinct populations of a species can also have notable commercial value. The widest range of natural genetics in plant species that are grown for commercial production purposes means the greatest potential for developing new plant breeds and therefore new market opportunities. The Helidon Hills koala fern is adapted to a different set of conditions than the coastal koala fern, and for this reason is likely to be useful for the breeding of commercial varieties if koala fern is brought into cultivation. For example, in recognition of the potential commercial value of genetic variations amongst natural populations of *Macadamia* species, the Australian macadamia industry currently has a major project to identify and protect natural macadamias. *Eucalyptus bakeri* is being grown as a cut flower species in the Roma district, where it is found naturally. Attempts to grow healthy plants closer to the coast have so far failed. However, it may be possible to overcome this problem through breeding with the genetics of the Lockyer Valley population.

### *Fauna*

So far only general fauna observations have been carried out in the area, but have revealed high bird diversity and presence of several wallaby species including the Brush-tailed Rock Wallaby *Petrogale penicillata* which is listed as Vulnerable (V) on the *Queensland Nature Conservation Act 1992*.

## *Ecosystems*

The plateau area of Treetop Sanctuary and the gentle slopes leading towards the rim of the gorge feature tall open woodland, dominated by eucalypt and acacia species, with dry rainforest in the remaining gully line and gorge areas. Approximately 60% of the property is tall open woodland. The dry rainforest has been identified as Regional Ecosystem 12.9/10.15 - Semi-evergreen Vine Thicket (SEVT), which currently has a conservation status of “Of-Concern”.

### **Fire regimes and nature conservation**

*Boronia* species are extremely fire sensitive. Fire is needed for seed germination, and the frequency of fire needs to be regular enough to germinate seedlings while the soil seed store is still viable. However, if fires are too frequent the soil seed store will be exhausted at a faster rate than it is being replenished from the seed set by mature plants. For *Boronia*, there is an optimum fire frequency - too frequent or too infrequent burning of an area will result in the decline and eventual extinction of the *Boronia* from that area. On Treetop Sanctuary *Boronia splendida* is currently thriving, where there has not been a fire for around 20 years, but appears to be absent from other properties in the area where burning is carried out annually. *Boronia splendida* has been observed to regenerate readily following clearance, demonstrating the existence of a viable soil seed store. (With many species, it is not the heat of the fire that stimulates seedling germination, but chemical compounds in the smoke. The same compounds can also be released from the soil following disturbance, and this is why clearance can stimulate germination of *Boronia splendida*). These factors indicate that a fire frequency of around 20 years is likely to be required by *Boronia splendida*, and that the local practice of annual burns constitutes a serious threat to the survival of the species. This conclusion is supported by the known fire requirements of other *Boronia* species, however further research will be required to more accurately confirm the required fire frequency.

If the fire regimes for the area around Treetop Sanctuary are not to continue posing a serious threat to nature conservation values, then they must account for the presence of *Boronia splendida* and the other significant flora, fauna and ecosystems in the area.

The presence of wallaby species, for example, warrants a very carefully planned fire regime. A widespread and reasonably intense fire would probably force these animals into small pockets where they would either die out through competition with other individuals, or would have to adjust their diet according to the food available. Similarly the timing of a fire is critical to minimise the effects on breeding and available food for young. To minimise the detrimental effects of fire on fauna, animal habitat usage needs to be appreciated. This requires knowledge of the breeding, feeding and refuging habitats of each species.

Fire is also posing a significant threat to the “Of-Concern” dry rainforest remnants in the Lockyer Valley. Fires impact on remnant margins, and will often burn into a remnant for a considerable distance due to the presence of invasive exotic species. Introduced pasture species, in particular green panic grass *Panicum maximum*, are invading intact and semi-intact dry rainforest remnants in the Lockyer Valley, displacing native species and greatly increasing the susceptibility to fire incursion.

## The fire management plan for Treetop Sanctuary

To date, fire management planning in the Lockyer Valley has concentrated on hazard reduction for the protection of human life and property and on the maintenance of grazing pastures, but with little or no regard for nature conservation values. As a result, the significant biological diversity of the region is being placed at risk.

Whilst it is clear that fire has an extremely important role to play in the maintenance of natural systems, our understanding of the exact fire requirements of the vegetation on Treetop Sanctuary is limited. What we do know from the presence of *Boronia splendida* is that fire needs to be very infrequent, meaning that any hazard reduction burning on Treetop Sanctuary should be subject to the uttermost caution. *Boronia splendida*, whilst likely to be dependent on fire for its regeneration in the long term, is extremely abundant and so is likely to represent a key species in the ecosystem. An irresponsible fire regime could result in the local extinction of this species and the invasion of unwelcome non-native plant species. This would be an economic disaster as well as an environmental disaster. The property is used as a health retreat and for environmental tourism, and as such the landholders' income is dependent on the long term conservation of the significant natural values of the property. *Boronia splendida* also has potential as a cultivated garden plant, cut-flower plant, or essential-oil plant, and this potential would be lost if it was destroyed.

Because of the need to conserve natural values as well as protect human life and property and maintain pastures, fire management planning must include *hazard protection* as well as hazard reduction and pasture burning.

### *A wildfire dependant ecosystem*

There has been no significant fire on Treetop Sanctuary for at least 20 years and a large quantity of fallen timber and leaf litter has accumulated on the forest floor, increasing the risk of a serious wildfire. Many landholders in the area around Treetop Sanctuary are burning annually or every few years to reduce the accumulated fuel load, with some also burning to promote the growth of fresh grazing pasture. This hazard reduction and pasture maintenance burning is typically justified by the belief that “the Aborigines burnt this every year”, reinforced by the observation that “this country was all open 20 years ago”.

It is widely believed that before European settlement, Aborigines burnt the bushland of the Lockyer as frequently as every year. However, this cannot be correct, because many of the Lockyer Valley vegetation types and species would simply not be present if fire had been used as frequently as every year or even as frequently as every five years. *Boronia splendida* is just one example of a Lockyer Valley bushland species whose survival depends on infrequent fire. The Helidon Hills, in the north of the Lockyer Valley, has several ecosystems with a large number of fire sensitive species, as do some other bushland areas in the southern Lockyer. Such ecosystems are more likely to be the product of widely-spaced random wildfire events rather than any deliberate burning regime.

Aborigines burnt bushland areas to assist with the availability of food resources, hence the description “fire-stick farming”. The Lockyer catchment features wide and very fertile creek valleys and alluvial plains, now recognised as some of the world's most fertile agricultural land. Prior to European settlement these lowland areas typically featured forest redgum

(*Eucalyptus tereticornis*) open woodland with a grassy understorey and would have had an abundance of food resources, in particular kangaroos and wallabies. The Aboriginals apparently lived a semi-sedentary lifestyle on the lowland flats and plains, only venturing into the uplands on hunting and food gathering forays or to travel on various pathways to other areas (Ann Wallin & Assoc, 1998).

The Aboriginals probably burnt the lowland flats and plains to promote the presence of fresh green grass to attract the kangaroos and wallabies, and there is historical evidence to support this. For example, Murphy's Creek in the north-west of the Lockyer is reported to have been known to Aboriginal people as *Tamamareen* meaning "where the fishing nets were burnt in a grass fire" (Ann Wallin & Associates, 1998). However, they would have had little or no need to burn the far less fertile Lockyer uplands. Fire would actually have posed a significant threat to the upland dry rainforest areas, which featured food and medicinal resources, and for this reason fire may have even been deliberately avoided in the uplands.

There is evidence to support the view that different tribal groups had very different fire management practices. Just over a small range to the south of Treetop Sanctuary is the West Haldon district, which was apparently a different tribal area with dramatically different fire management practices. The local history book *On the Point of a Spur* (Campanaris 1986) highlights the differences between the two areas:

Unlike the impenetrable scrub country that surrounded the Mt. Whitestone district in the early 1840's, the West Haldon district bordering the south-west Lockyer was open country. May Cork writes:

It is worth recording that a description of the district in the early 1860's differs considerably from a description of it at present. At the date mentioned the country was sparsely timbered and well grassed. Soon however, a remarkable change took place and such country became overgrown with small brush, and the number of trees increased enormously.

Most certainly, the change in vegetation cover at West Haldon from a sparse sclerophyll forest to a densely timbered one was due to the removal of the Keinjan tribesman from the area by 1860, who previously practised extensive burning of their hunting grounds.

### *Cycles of change*

Because it is dependant on a 20-plus year fire cycle, the vegetation on Treetop Sanctuary goes through observable changes. When there has not been a fire for more than 20 years, the dominant midstorey of *Acacia* reaches maturity and dies, meaning that the midstorey becomes quite open or even completely open. Following a fire, there is rapid regeneration of the understorey, midstorey, and also of new overstorey plants, which quickly creates a very dense and impenetrable undergrowth. The progression to a more open stage is currently observable on Treetop Sanctuary, with much of the *Acacia* midstorey dying over the past 5 years. It is the open stage that local landholders have observed when saying that "this country was all open 20 years ago", not realising that it is just a stage within a cycle. While local landholders remember the open stage of the cycle, the surveyor who carried out the original survey of the Treetop Sanctuary property over 100 years ago struck the dense undergrowth

stage, reflected in his “very dense undergrowth” and “very heavily timbered” comments for the woodland parts of the Treetop Sanctuary property.

At some point *Boronia splendida* would also be expected to reach maturity and die which would open up the understorey and midstorey even further, but there is not yet any sign of this occurring. Many of the *Boronia* plants have now reached 2.5 metres in height, the mature plant size, but there is no evidence of the commencement of decline. The other known populations of the *Boronia* in the Heifer Creek area last received major fires at the same time as the Treetop Sanctuary population, apparently at a time of very serious wildfires throughout the region, and show no observable difference to the Treetop Sanctuary area population.

#### *Hazard reduction burning*

It may be possible to replicate the natural fire cycles of the Treetop Sanctuary area through controlled hazard reduction burning. The reduction of fuel load would reduce the risk to human life and property from wildfire events, and would also reduce the possibility of the whole property being burnt out by a single wildfire. If the entire property was burnt out it would obviously be unattractive to visitors, which would be a negative for the health retreat/environmental tourism operations on the property. Vegetation cover would, however, quickly return.

The difficulty with controlled hazard reduction burning is that very little accurate information is known about the life cycle of *Boronia splendida*. To address this situation, the Treetop Sanctuary Fire Management Plan recommends scientific study of *Boronia splendida*, including the trial burning of small habitat plots with subsequent observation and monitoring. The Fire Management Plan recommends that, apart from the trial burning, no other burning of *Boronia splendida* habitat should be carried out until informed decisions can be made.

#### *Hazard protection*

If no hazard reduction burning is carried out, then another way must be found to protect human life and property. This can be achieved through hazard protection, which works on the “rule of 3B’s”: Buildings - Buffer - Bushland. A buffer zone is used to provide a line of defence between buildings and bushland. The buffer zone needs to be kept completely clear of understorey, midstorey, and any fuel load. Fuel load removal in the buffer zone can be achieved through manual removal (picking up branches, raking leaves) or by controlled burning. The overstorey (trees) should also be removed from the buffer zone if local conditions indicate a high risk of crown fires, that is, fires that travel rapidly through the tree tops rather than at ground level. A fireline is constructed along the boundary between the buffer zone and the bushland. This facilitates easy access for back burning in case of an approaching wildfire, and also provides a firebreak for controlled burning operations within the buffer zone. A second fireline can also be constructed between the buildings and the buffer zone. Additional firelines should also be constructed within the bushland areas if possible, as has been done at Treetop Sanctuary, to provide additional lines of defence. Firelines and buffer zones should also be constructed to assist in preventing wildfires moving to or from adjacent properties.

In addition to the Treetop Sanctuary Fire Management Plan, the hazard protection approach has also been used in the Helidon Hills Fire Management Plan (Gardner, 1998). The 35,000

hectare Helidon Hills lies across the north of the Lockyer Valley, and is mostly continuous bushland.

### *Impediments to successful hazard protection*

Key impediments to the successful implementation of the Treetop Sanctuary Fire Management Plan are:

- Many of the local landholders are unaware of the significant species and ecosystems in their area.
- The local Rural Fire Brigades and local landholders are typically unaware of how to manage fire for biodiversity conservation.

A consortium of South-East Queensland Councils has submitted a Natural Heritage Trust (NHT) application to carry out a “bushfire and biodiversity” project that will go a considerable way towards addressing these issues. The project will extensively research the fire requirements of different vegetation communities and will educate and inform Rural Fire Brigades, Councils, and landholders about these fire requirements.

The implementation of the Helidon Hills Fire Management Plan has the advantage of being part of a larger project, the NHT funded WESROC (Western Subregional Organisation of Councils) Sustainable Management of the Helidon Hills Project (Boyes et al, 1998). The project includes education and awareness raising in regard to conservation values and appropriate fire management practices, and will also be facilitating fire management plans for individual properties as part of a large-scale property management planning process.

The WESROC Sustainable Management of the Helidon Hills Project has been able to successfully integrate adjacent land use and management approaches that are often seen as incompatible, for example environmental tourism and grazing. A similar project for the Treetop Sanctuary area would be expected to result in similar benefits.

### **Conclusion**

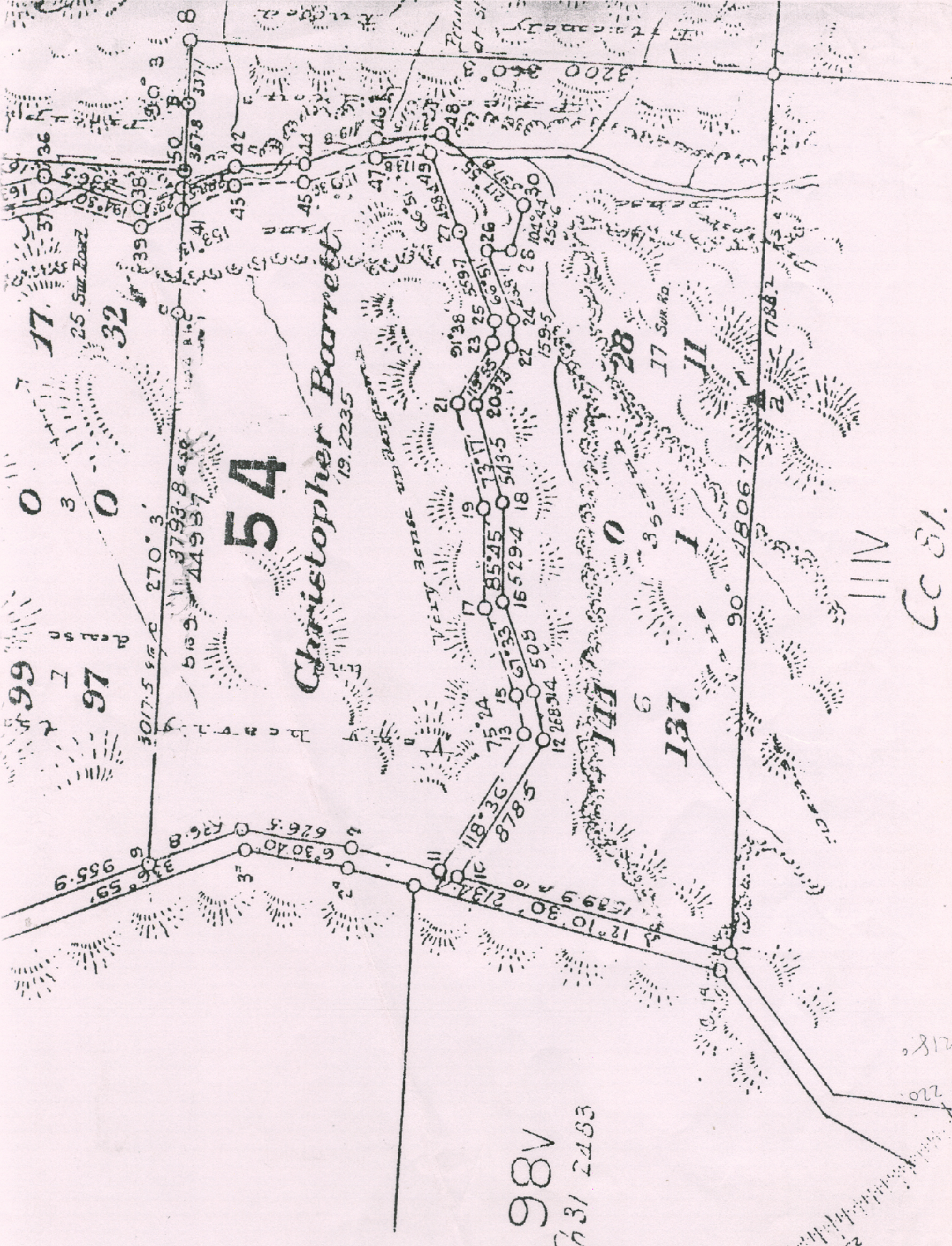
The example of “Treetop Sanctuary” shows that current fire management practices often have a very poor scientific basis and as a result are having serious negative impacts on biodiversity. Burning is carried out every few years or even annually to reduce fuel accumulations and maintain grazing pasture, at the expense of significant flora and fauna which cannot survive such frequent burning. A solution is to incorporate hazard protection with hazard reduction and pasture burning, but there are impediments to the success of this approach. Many landholders are unaware of the significant native species and ecosystems in their local area, and Rural Fire Brigades and local landholders are typically unaware of how to manage fire to conserve these species and ecosystems. A consortium of South-East Queensland Councils has submitted a Natural Heritage Trust (NHT) application to carry out a “bushfire and biodiversity” project that will go a considerable way towards addressing these impediments. The achievement of optimum outcomes, however, is likely to result only from carrying out coordinated fire management planning across the landscape through projects like the WESROC Sustainable Management of the Helidon Hills Project.



## References

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1886 survey map of Treetop Sanctuary property. The map was accompanied by a list of the tree species used for the numbered blazes marking the road easement through the property, and a number of these trees still exist.