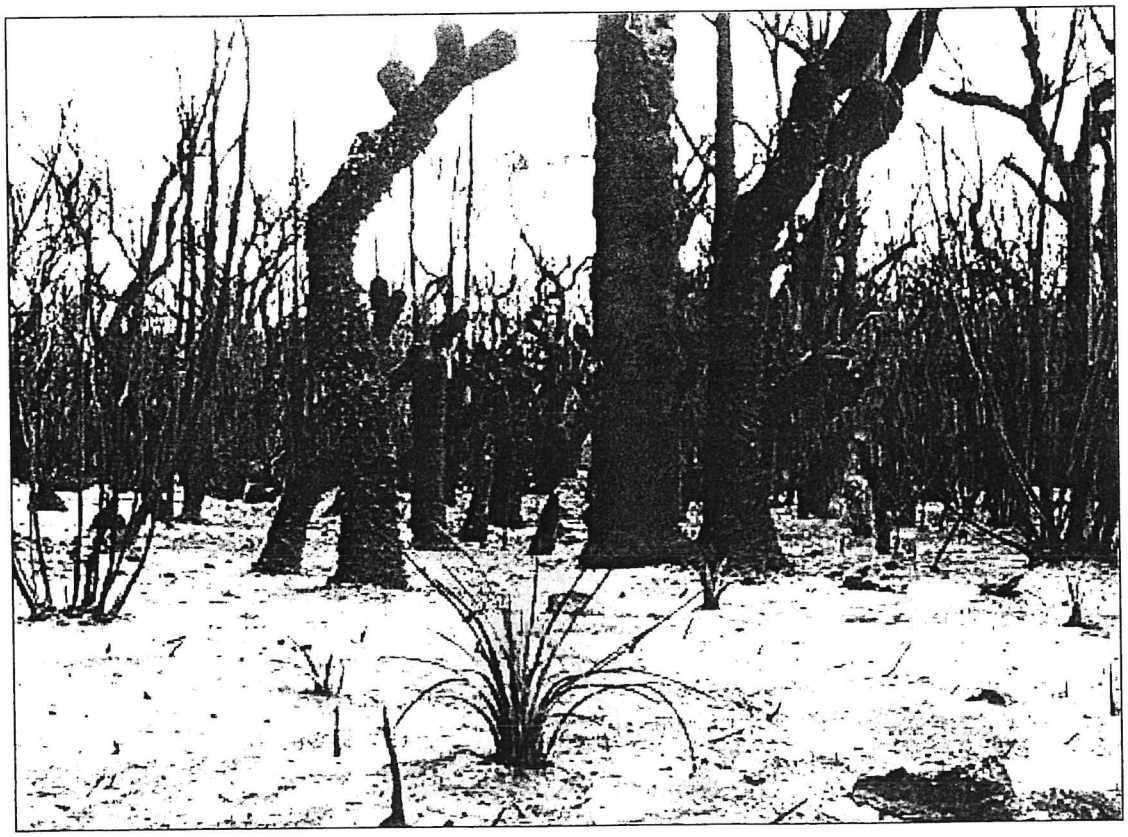
Nuyts Wilderness Wildfire Impact Report

7-11 March 2001, Walpole, Western Australia



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13 June 2001

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1 Introduction

At approximately mid-day 7 March 2001, following a morning electrical storm, smoke was reported rising from within the eastern end of the Nuyts Wilderness. At 12.28pm a report from the CALM fire spotter aircraft to the Walpole Office of the Department of Conservation and Land Management confirmed that the smoke was from a wildfire that was located approximately 150 metres to the west of Circus Beach Track and 250 metres to the north of Circus Beach. The fire was in an area that could only be accessed by boat and then by foot, and could only be attacked with hand tools assisted by aerial water bombers. By mid morning the following day, the fire fighters mounting the direct attack on this fire, were regarded as being at considerable risk and so were withdrawn. A second option to contain the fire was implemented. The fire was finally contained in the early hours of the morning of 11 March. By the time the fire had been contained it had burnt through 2,700 hectares of the Nuyts Wilderness. Pockets of unburnt vegetation within the area of the fire continued to burn spasmodically over the next few days. The cost of containing this fire is believed to be almost $300,000.

2 The Nuyts Wilderness

2.1 Description

The Nuyts Wilderness is located on the Nuyts Peninsula at the western extremity of the Walpole Nornalup National Park. The wilderness is surrounded by water on more than 75% of its perimeter. The Nuyts Wilderness shares its eastern and north-eastern boundaries with the Nornalup Inlet, its southern boundary with the Southern Ocean, the northern boundary with the Deep River and its western boundary is confluent with the eastern boundary of the D'Entrecasteaux National Park.

The area is characterised by extensive areas of consolidated sand dunes, with characteristic calcareous sands, interspersed with seasonally inundated, low lying, and perched damp-lands, and hills composed of sandy laterite over granite bedrock. The area is transected by many gullies and creek-lines. Some of the creeks are perennial, and some, seasonal in nature. The creeks have their source both in water catchment on elevated areas of shallow soils over granite bedrock and from springs that arise in the consolidated dunes. Three lakes occur in the Nuyts Wilderness.

2.2 Biodiversity

The diversity in topography, soil types and water availability, results in a significant diversity in plant communities and associated fauna. Heath is widespread on the consolidated dune country, while the hills are dominated by medium to tall forests of karri, red tingle and marri. Yellow tingle and jarrah are also represented but are less common. On the lower slopes of the hills medium height forest of marri and jarrah, and in places stunted red tingle is prevalent. In the transitional areas from the base of the hills, the intermediate height forest follows an ecotonal transition to low marri or jarrah forest, which trends to scrubby jarrah woodland and to coastal heath.

A number of rare and priority species of flora exist in the area. Declared rare flora species *Banksia verticillata, Mezeilla trifida* and *Diuris drummondii* have been recorded in the Nuyts Wilderness. Priority species *Gonocarpus pusillis, Chamaexeros longicaulis, Chamelaucium floriferum ssp floriferum, Chamelaucium floriferum ssp diffusim, Dryandra sessilis var cordata, Jansonia formosa* and *Melaleuca ringens* have also been recorded. *Eucalyptus jacksonii* (red tingle), a Walpole endemic tree species of limited distribution, is also well represented. A number of populations of animals of particular interest have also been noted. Ringtail possums, honey possums, pygmy possums, echidna and extensive populations of mainland quokka, quenda and bush rats were known to occur in the area. The densely vegetated creek-lines, gullies and sedge-lands had provided refuge habitat for one of the larger known mainland populations of quokka.

A translocation of the endangered Western Bristle Bird into the eastern portion of the wilderness had been carried out over the previous eighteen months. Eight western bristle-birds had been released in spring 1999 and a further seven released in spring 2000. The translocation appeared to have been successful, with the birds having demonstrated an excellent survival rate when the last intensive monitoring was conducted in late spring 2000.

2.3 Fire History

Between 1856 and the early 1940's the cattlemen who held leases in the area, applied a regime of frequent mosaic burning to the areas of heath land. This was a practice that they adopted from the Murran group of the Nyoongar people who had ownership of the land. Much of the area was burnt by wildfire in 1937. After the mid 1940's this burning regime lapsed into a less frequent, and more, broad-scale burning, until the area was zoned as wilderness in 1978. The Management Plan assigned to this new wilderness included a regime of No Planned Burn. Fire had been successfully excluded from the majority of the area since 1978. A small area on the north and north eastern perimeter was burnt in 1977/78. Two relatively small areas had been burnt by wildfires in 1993/94. A wind driven buffer had been burnt to the east of the Nuyts walk trail in spring 1995, and another to the west of the walk trail early spring 1998. The intersection of these buffers was the line along which the fire was finally contained and these buffers clearly contributed to that outcome. A significant portion of the area however, had not experienced fire for 40 years and in some cases longer. The vegetation in much of the longer unburnt areas was in various states of senescence, with dead vegetation coexisting with living plants. This was true for much of the heath-land, scrubland and the forested areas, and was to have a significant influence on the behaviour of the fire, and its resultant impact.

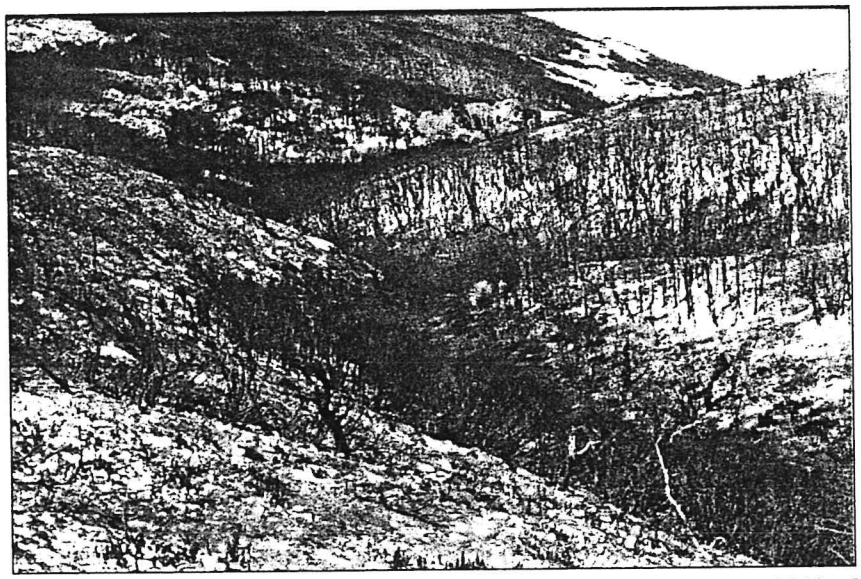
The seven months preceding the fire had been one of the driest periods on record. As a result, at the time the fire occurred the soil dryness index was extremely high and the surface moisture content very low. The high soil dryness index coupled with high fuel levels and the senescent state of much of the vegetation was to produce a fire that was both difficult to control, and to have a high environmental impact. The mild weather conditions that existed throughout the period of the fire however, had a moderating influence.

3 Fire 22

3.1 General

An aerial inspection of the area on Sunday 11 March revealed that there had been an almost total removal of the scrub layer. Between the Circus Beach Track and the Nuyts walk trail almost no vegetation remained unburnt at ground level. This area had experienced almost total removal of the scrub layer in the heath-lands, wetlands, forested areas, valleys, gullies and creek-lines. Only a narrow corridor of scrub remained along the coastal fringe and that continued to bum.

The first ground inspection of the area was made on Monday 13 March. Significant ash beds were found to be present even in areas of denser heath. In some areas, these ash beds were still hot two days after the fire had passed through, and some surface soil sterilisation is to be expected. It is likely that in these areas that *Leguminous* species will be the most common germinants. The ground search confirmed the near total removal of the scrub layer and humus layer from forests, creek-lines and gullies.



Picture 1 *This picture typifies the post fire condition of more than 99% of the refuge and browsing habitat for small to medium size fauna in the area burnt by the wildfire.*

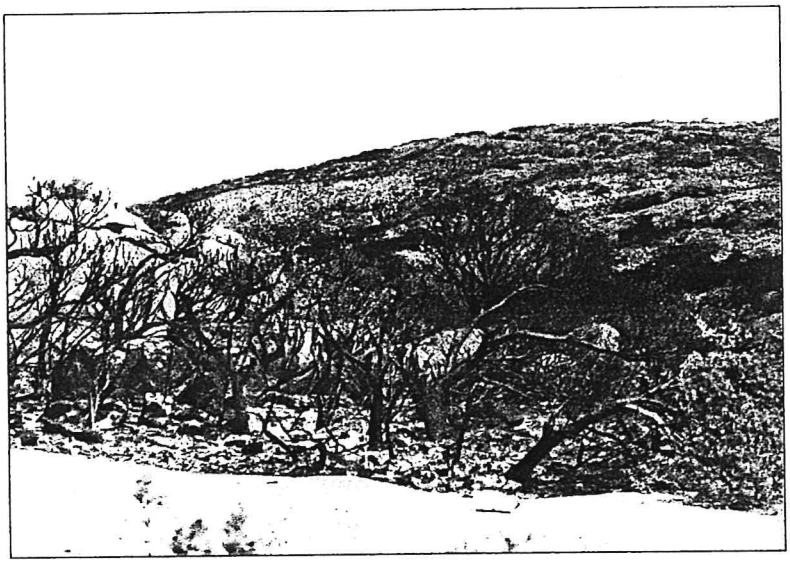
3.2 Flora

A number of species of declared rare and priority flora were known from within the area burnt by the fire. The size and health of these populations had been recorded along with the soil type, plant community with which they were associated and any obvious threats to that population. Some species of rare and priority flora may have been previously present, but due to the long unburnt nature of much of the area may have only been represented in the seed bank at the time of the fire.

3.2.1 Declared Rare Flora

3.2.1.1 *Banksia verticillata*

Declared rare flora species *Banksia verticillata* is killed outright if burnt or experiences total canopy scorch by fire. The first post fire survey of the Mt. Hopkins *Banksia verticillata* population was conducted on 12 March. This population was quite extensive, several thousand plants being present before the fire. At the time of the survey it was estimated that approximately 85% of the plants, had been killed outright, and 10% to 12% found to have suffered significant scorch. A subsequent inspection revealed that many of the scorched plants had died. It is estimated that between 92% and 95% of this species have died as a result of the fire.



Picture 2 *Declared rare flora* Banksia verticillata. *Between 92% and 95% of* the plants in *this population died as a result of the fire.*

The significant ash beds that exist in the wake of the fire are likely to provide the basis for a good regeneration of this *Banksia*. The survival of regenerated seedlings will be dependent upon adequate spring and summer rainfall in spring 2000 and summer 2000/2001. The extremely high percentage of plant deaths as a result of the fire has placed this population at some risk. Large portions of this population are now dead and in the event of failed regeneration there is a significant risk of these areas being dominated by *Gastrolobium biloba,* which regenerates well post fire. In this eventuality it is possible that the *Banksia* may become permanently displaced from a significant part of its previous habitat. The Department of Conservation and Land Management has collected seed from this *Banksia verticillata* population and the seed has been placed into storage to be used in the event of failed, natural post fire regeneration.

3.2.1.2 *Diuris drummondii*

Declared rare flora species *Diuris drummondii* has been observed to respond well to fire and to flower well in the spring following fire. Numbers seen flowering, appear to decline in years subsequent to the fire.

3.2.1.3 *Mezeilla trifida*

Declared rare species *Mezeilla trifida,* only occurs in open, seasonally inundated sites and is in most cases, unlikely to be appreciably affected by fire. Two populations of this species exist within the area burnt by the fire. One of these populations occurs in an area that fire fighters successfully protected. The second of these populations was severely affected by the fire with only two of the original several hundred plants being found when the site was inspected on 30 April. The temporary post fire increase in the level of the water table is unlikely to have any long term detrimental effect on this semi aquatic species.

3.2.1.4 *Gonocarpus pusillis*

Priority species *Gonocarpus pusillis* is a short-lived, fire (disturbance) regenerated perennial (personal observation). It is generally absent, or present in very low numbers in areas unburnt for more than four years. The plant has been observed to become common in areas of its occurrence during the three years following fire. Numbers appear to reduce significantly in the fourth year and the plant then becomes very uncommon, or is absent until the next fire event. It is reasonable to assume that the *Gonocarpus* will follow this previously observed pattern.

3.2.1.5 Chamelaucium floriferum ssp floriferum

Priority species *Chamelaucium floriferum ssp floriferum* is an obligate seeder and has been observed to regenerate well post fire, to have a fast initial growth rate and to flower in the second spring post fire. (Ref. 1: CALM Report. Dec. 2000). An unburnt 0.3 ha of this species has been located in an area that was observed to be burning 36 hours after the fire was contained. Moderately heavy rain was falling at the time of observation and was almost certainly responsible for protecting this small area of the *Chamelaucium.*

3.2.1.6 Chamaexeros longicaulis

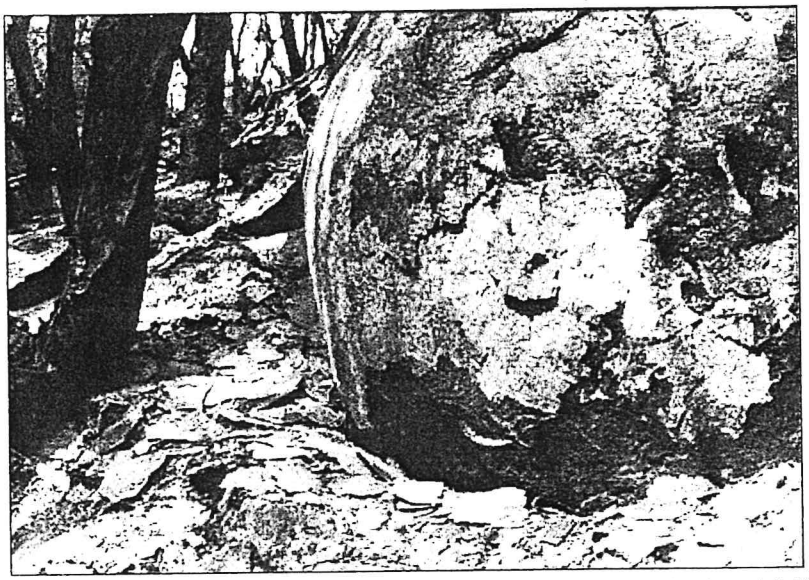
Priority species *Chamaexeros longicaulis,* a Walpole endemic species, was observed to be resprouting in the Nuyts Wilderness on 12 May, nine weeks post fire. During the course of the survey associated with this report many previously unknown populations have been found and its distribution in the Nuyts Wilderness appears to be quite extensive. The populations of this species appear to be secure.

3.2.1.7 Dryandra sessilis var cordata

Priority species *Dryandra sessilis var cordata* is widespread in the Nuyts Wilderness, both within and also outside the area of the fire. Most of the plants of this species that occurred in the area of the fire were killed by it. This *Dryandra* is a slow growing obligate seeder, and its recovery will be dependent upon the survival rate of seed under conditions of moderate to intense wildfire. Approximately 70% of a small sub population of the *Dryandra* in the area of the back burn is known to have survived the fire.

3.2.1.8 *Melaleuca ringens*

Priority species *Melaleuca ringens* is common on the coastal fringe of the Nuyts Wilderness. This coastal margin was the area least affected by the fire. It is estimated that approximately 85% of this species was burnt. This Melaleuca has canopy-stored seed, which is released after a fire event. In areas where combustion was less complete, regeneration of this species appeared to be prolific three months post fire. However in areas of this population where combustion was more complete, most of the fire resistant seed capsules were also consumed. In these areas regeneration was extremely sparse at the time of inspection.



Picture 3 *Evidence of the intensity and duration of the fire in the vicinity of this granite boulder.*

3.3 Forest and Woodlands

3.3.1 General

Records kept by the Dept. of Conservation and Land Management show that most of the forested area of the Nuyts Wilderness had remained unburnt for forty years. Scrutiny of aerial photographs of the area proved this to be correct. Part of this forested area had not been burnt since 1937.

The impact of the fire on forested areas was high. The degree and nature of the impact was determined largely by the forest structure, dominant tree species, topography, fuel accumulation and the time of day or night at which the fire passed through. Much of the area of forest that burnt downhill, and at night, suffered minimal crown scorch. Crown scorch was noticeably lower in areas that were back-burnt as apposed to those that were burnt by the head fire. The lower impact of the back-burn was particularly noticeable on the tree species that are killed outright if burnt or defoliated by scorch. Swamp banksia, *Banksia seminuda* and Warren River cedar, *Agonis juniperina,* are both fire sensitive species but many of the trees of these species suffered minimal canopy scorch and survived the lower intensity back-burn.

Picture 4 *The completeness of the combustion of an almost impenetrable, pre fire scrub layer in this red tingle forest is evident.*

3.3.2 Crown Damage

The degree of crown scorch and defoliation varies greatly across the forested areas. The level of crown damage was defined to some extent by the type and structure of forest. In the tall and medium height karri and red tingle forest, crown scorch ranged from moderate to severe, and defoliation was not extensive. Some defoliation and a severe level of crown scorch were noted in the eastern portion of the tall forest area.

The extent of crown damage to the medium height marri and jarrah varied from mild scorch to total defoliation. In areas where the fire had burnt through this forest type at night and downhill, crown scorch was minimal. In the greater part of the remainder of this forest type, defoliation was total. In the open jarrah woodland defoliation was almost total.

A number of naturally occurring even-aged juvenile karri stands occur on the margins of the forested area. One of these juvenile stands experienced moderate crown scorch, while scorch was absent from the remaining juvenile stands.

3.4 Impact on Forest Structure

3.4.1 Stem Damage and Tree Fall Count

It was noted that a considerable number of trees had fallen during, and in the days immediately following the fire. In order to assess the change in forest structure as a result of this, it was considered necessary to carry out a count of the fallen, and otherwise severely damaged trees

3.4.1.1 Methodology

A series of 500 metre transects were made through the tall and medium height forest. All recently fallen trees within 50 metres of the transect line were counted. If the stump of a recently fallen tree was within fifty metres of the transect line, it was included in the count. This gave a one-hectare

sample, for each 100 metres of transect. A series of 0.5 ha areas of these forest types were sampled to determine the number of stems per hectare. All stems above 40 cm diameter were included. No trees with stems below this diameter were included in the fallen tree count. No stags (standing dead trees) that had fallen as a result of the fire were included in the count.

3.4.1.2 Tree Fall Count Outcome

A total of ten hectares of tall karri, red tingle forest and five hectares of medium height red tingle marri forest were sampled. Trees killed as a result of cambium death and remained standing obviously could not be identified, and as a consequence the tree fall count must be considered to have understated the impact.

In the area sampled in the tall red tingle, karri forest, the tree fall rate was found to be 1.6 per hectare, or 4.8% of all trees with a stem diameter of greater than 40 cm. A count of all stems that had been burnt through above the butt and below the crown, resulting in permanent, total loss of the crown was also made. Total crown loss from this cause occurred at a rate of 1.8 per hectare representing 5.3% of all trees sampled in this category. Of all forest structures, the tall forest was subject to the greatest impact. In this forest type the fall rate of karri was three times that of red tingle in the area sampled, and this appeared to be consistent across the whole tall forested area.

In the medium height red tingle and marri forest the tree fall count was 2 per hectare representing 2.2% to 2.4%of all trees with a diameter greater than 40 cm. Total permanent crown loss occurred at the rate of 0.4 trees per hectare representing 0.44% to 0.48% of all trees sampled in this category.

An additional 25 hectares of a variety of forest structures were sampled. Tree fall count in each of these samples was between those obtained for the tall karri, red tingle, and the medium height red tingle and marri forest.

It is clear that in most of the tall and medium height forest, that even though defoliation was low, the impact on the forest structure was significant. The rate of tree fall, and permanent crown loss was exceptionally high. This apparently contradictory outcome resulted from the fact that this forested area burnt at night, and from the structure of the under-storey and scrub layers. The area had been transected twelve months before the fire and the structure of the under storey and scrub layer had been noted. As a result of being long unburnt, the under storey had opened up as a consequence of the death of many of the under-storey plants from competition and senescence. These dead under storey plants now formed a significant component of the forest litter. The consequence of a more compact fuel layer was a fire of lower intensity and longer duration. The outcome was a lower level of crown scorch and defoliation and a high incidence of stem damage, with a subsequent high rate of tree fall.

Apart from logs and scattered patches of more substantial under-storey, the fuel and live vegetation in the forested areas has been almost totally consumed and an ash bed depth of 20 cm, and at times more, was common throughout these areas. The scrub layer throughout the tall forest had previously been dominated by *Lepidosperma gladiatum,* a resprouting rhizomatous rush. Most of this rush has failed to resprout since the fire, and

the removal of much of this dense scrub layer may provide the opportunity for good regeneration of under-storey, and of tall forest tree species in gaps created by tree fall during the fire. Seed fall from red tingle since the fire had been patchy, as appears to be typical for this species. However, in areas where seed fall did occur, red tingle seedling density of up to fifty per square metre was observed at fourteen weeks post fire. Yellow tingle seedlings were far less numerous at the time of observation.

Picture 5 *Associates indicate the forest litter depth present before the fire. The total combustion of this dense layer caused stem damage to many red tingle and karri trees with resultant tree fall.*

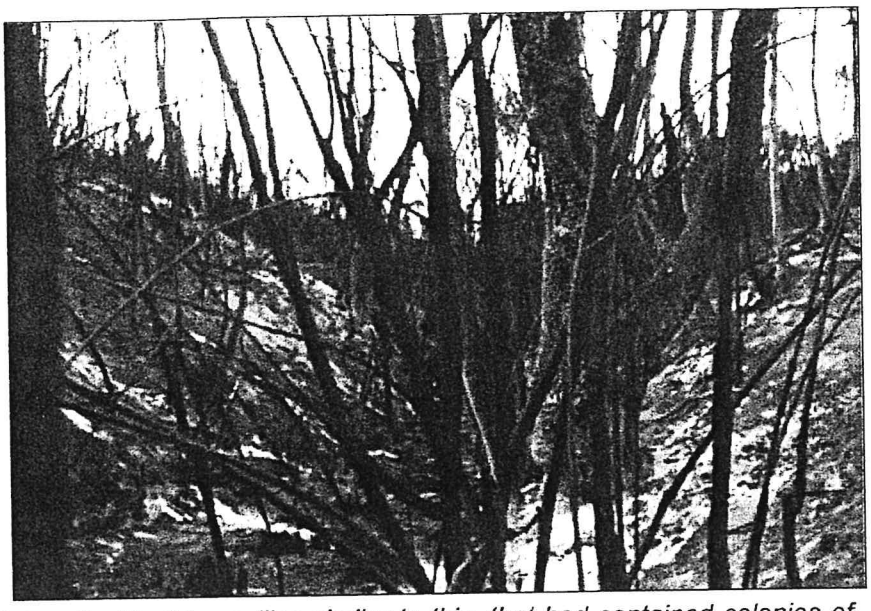
3.5 Fauna

The removal of refuge, grazing, foraging and browsing habitat for all species of mammalian fauna within the area of the fire, has been almost universal. Of more than 50 kilometres of creek-lines and gullies that served as refuge habitat for quokka, bush rats and quenda, probably little more than 250 metres remains unburnt. The survival rate of these species within the area of the fire is unlikely to have been more than 1%. It is clear that total quokka refuge habitat has been reduced to a tiny remnant of the area that existed before the wildfire.

Quokka were washed up along ten to twelve kilometres of coastline to the east of the area of the fire for more than a week following the fire. It is evident that these animals had been driven over the cliffs and into the ocean by the fire. It is not known how many animals died in this way but it was clearly in the hundreds. There is no record of an event such as this having occurred previously. Another wave of deaths of these animals was observed approximately eight weeks post fire. While the cause of these deaths is not known it may be related to the consumption of inappropriate vegetation in the absence of a normal food supply, or possibly disease related.

During five days of survey only one surviving lizard was seen, although snakes appear to have fared a little better with one snake being seen and a number of snake tracks observed. The snake tracks were mainly observed near the perimeter of the burnt area. The areas of suitable habitat for many

lizard species, granite outcrops, had in most cases been as clean burnt as the heath-lands, gullies and damp-lands.



Picture 6 *All of the gullies similar to this, that had contained colonies of quokka before the wildfire, were almost completely gutted by it..*

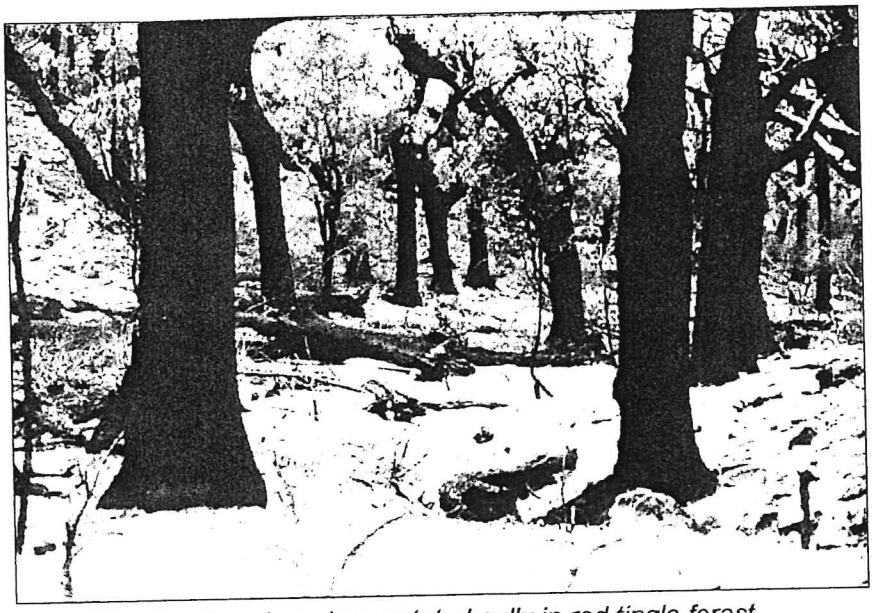
Most of the known habitat for ringtail possums was subject to extremely intense fire. Destruction of the tea tree and defoliation of the marri trees that had provide nesting sites for these animals is complete. Several intensive searches for these animals, both with spotlight at night, and searching for sign in daylight, has found only burnt animals and no sign to indicate surviving animals.

Echidna were known to have occurred in the area, although no sightings had been reported for at least five years. Neither echidnas, nor echidna sign has been observed since the fire, it would appear to be logical to conclude that none of these animals that were present at the time of the fire would have survived.

A narrow corridor of unburnt vegetation extends along the coastal fringe for 1250 metres westward from Circus Beach. This corridor generally varies in width from 30 metres to 60 metres, is slightly wider in a few places, and is discontinuous at several points. Scattered thickets of *Chorolaena quercifolia, Melaleuca ringens* and *Melaleuca aff incana* that occur periodically along much of the length of this corridor, provide suitable refuge habitat for quokka, quenda and bush rats.

The presence of occasional scats and tracks of these animals in the adjacent burnt areas, confirms that although extremely low in number, a remnant of these animals has survived in this corridor. This corridor may provide the means by which these remnant populations can expand into adjacent areas where sub populations had existed before the fire. This is unlikely to begin until the discontinuous areas within this corridor are sufficiently re-vegetated. From the western end of this corridor, for a further 3.5 kilometres to the west, no similar corridor of vegetation has survived. A number of isolated, vestigial,

remnant sub populations still occur, along with sites of now apparently locally extinct sub-populations of quokka.



Picture 7 *Previously a densely vegetated gully in red tingle forest.*

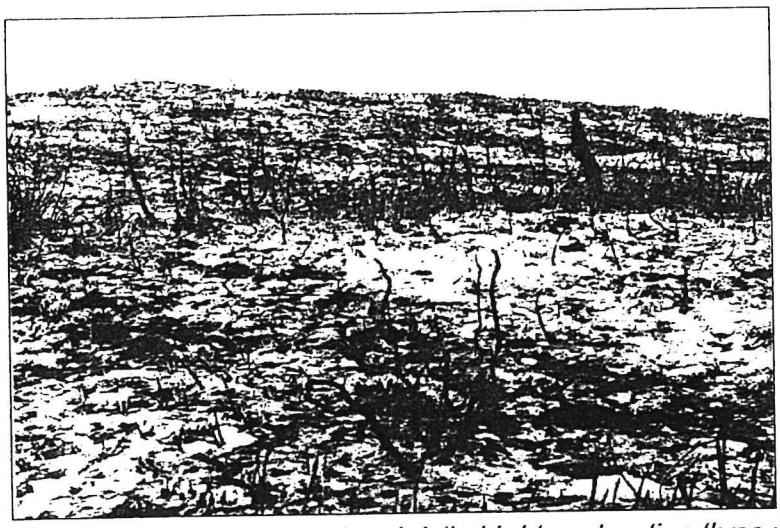
Almost none of the bush rat holes examined post fire had been freshly excavated. Hundreds of these holes were examined before any showing signs of being inhabited were found. In almost every case those holes that had been excavated after the fire (indicating surviving animals) had been constructed under mounds of earth. This thicker layer of earth had obviously provided better insulation from the intense and prolonged heat that this fire had produced. Even in a severe fire event, bush rats have been observed to demonstrate a good survival rate. Rapid decline in bush rat numbers then follows as a result of predation. The fact that only a vestige of these animals survived this fire is indicative of a fire intensity, and or long residence time that is exceptional for this environment.

The extremely small size of animals such as pygmy possums and honey possums, and the nature of their habitat, makes them extremely susceptible to fire. These animals are very dependent on a mosaic of unburnt habitat if rapid repopulation is to occur. No unburnt areas of suitable habitat remain. Re-colonisation of this area can only take place as animals invade from the unburnt western part of the Nuyts Wilderness, and from a small, unburnt area at the eastern extremity of the wilderness.

3.5.1 Western Bristle Bird

The western bristle bird is one of Western Australia's most endangered species of bird. Fifteen western bristle birds had been translocated into the eastern part of the Nuyts Wilderness during the eighteen months before the fire. During late spring 2000, bristle birds were reported calling from the west of the Nuyts Walk Trail, approximately three kilometres to the N W of the release point. These birds were heard calling from within a wind driven buffer that had been burnt to the west of that walk trail in October 1998. As the walk trail formed the western boundary of containment of the wildfire, the area to the west of the trail, remained unburnt by the wildfire. Post fire monitoring

along the walk trail, indicates that birds that had adopted territory within the wind driven buffer, have survived. Monitoring of the area to the east of the walk trail suggests that all bristle birds within the area of the fire were killed by it.



Picture 8 *The site of the western bristle bird translocation three weeks after the fire.*

3.5.2 Predation

Baits for foxes were laid by CALM immediately after the fire and have continued to be laid periodically over the last three months. This intensive program is expected to continue until the area is sufficiently re-vegetated to provide refuge for critical weight range animals. CALM assisted volunteers have implemented a cat-trapping program. Even in the absence of feral predators, predation by native predators (eg. raptors) could have a significant impact on these vulnerable remnant populations of small to medium size animals.

4 Conclusion

The impact of this fire on 2,700 ha of high conservation value area, can only be described as severe. The broad-scale removal of scrub and humus layers and consequential loss of habitat, the extremely high animal mortality, high tree fall rate and potential long-term impact on some species of flora are not minor issues. Only favourable weather conditions and the containment of the fire to 2,700 ha prevented a much greater environmental impact

In the Southern Forests, the total combustion or defoliation of all vegetation in creek systems and gullies is not a normal outcome of either wildfire, or prescribed burn. Exceptions to this are areas that are long unburnt, and creek-lines where the dominant vegetation is tea tree, *Agonis sp*. The almost total removal of the humus layer in moist gullies, under weather conditions as mild as those that prevailed at the time of this fire, can not be considered to be a normal outcome either. Almost all of the creek-lines lines and gullies in this area were moist at the time of the fire, and many had standing or running water in them. While some of the vegetation on the more elevated areas was

drought stressed as a result of the seasonal conditions, this did not apply to the vegetation in these sites (ie. gullies and creek-lines lines). The almost total combustion of the vegetation in these creek-lines lines was clearly not simply a function of the dry season that had preceded this event, and should not be attributed to it.

The extremely high soil dryness index that existed at the time of the fire was a major factor in the removal of the humus layer from the forested, and more open woodland areas. This was not the case however in the gullies and creek lines where the soil moisture level was high. In these areas the total combustion of this humus layer can only be attributed to the high fuel levels and senescent nature of much of the vegetation that existed in these sites and the areas adjacent to them.

The high rate of mortality of animals within an area of such diversity, with limited options for re-colonisation is a matter for serious consideration. The Nuyts Wilderness is essentially a peninsula and repopulation by terrestrial fauna, can only take place from the west. Remnant populations of some of these species still occur within the burnt area, and in the unburnt eastern extremity of the peninsula. Infiltration of some species could also be expected to occur from this unburnt eastern extremity, which was protected by CALM and volunteer fire fighters.

An appreciation of the intensity, duration and consequential impact of this fire can be gained by observations made on one of the resprouting species, *Xanthorrhoea gracilis,* that occurs in scattered populations throughout the less dense marri jarrah forested parts of the Nuyts Wilderness. In much of the marri jarrah forest, leaf tip scorch on post fire emergent leaves of *Xanthorrhoea gracilis* of 50mm to 100mm was found to be common. (Specimens collected). Leaf tip scorch of this species has been used as an index of soil temperature gradient. Scorch lengths of up to 50 mm have been recorded after intense fire in the northern jarrah forest. (Ref. 2: *Koch J. M. and Bell D. T. 1980.)* The much greater leaf tip scorch length of 50 mm to 100 mm in areas within the Nuyts Wilderness wildfire indicates a fire of great intensity, long residence time, or both. Where *Xanthorrhoea gracilis* occurs within the area burnt by the fire, there appears to be a direct correlation between leaf tip scorch length of this species, ash bed depth and scarcity of germinants, strongly suggesting surface soil sterilisation.

Fifteen weeks after the fire, the impact of soil sterilisation appears to be evident. Apart from heat tolerant *Leguminous* species and species with canopy stored seed, germinants were absent from most of the broad area of the forest, heath and scrubland. Along tracks and pads however, where litter and humus had been compacted and did not burn, germinants of these species were common and in some cases prolific. These species had historically, been common throughout the area, particularly in the two to three years post fire. In addition to this were lignotubers of *Jacksonia horrida, Leucopogon sp.* and *Hibbertia sp.* that had failed to resprout and had apparently been killed as a result of high soil temperatures.

5 Recommendations

5.1 Post Fire Monitoring

The fire has provided opportunities for monitoring in an area of high biodiversity. The opportunity to gather information on the re-population and re-colonisation of some animal species after severe disturbance could be of great value. Monitoring of post fire recovery of declared rare species of flora and some less well known priority listed species should be given high priority. A list of some species worthy of consideration for monitoring follows.

- *Banksia verticillata:* Post fire monitoring of this species until such time as the population appears secure. Monitoring of competition from and potential displacement by *Gastrolobium biloba*.

- *Mezeilla trifida:* Monitoring of the post fire recovery of the fire-affected population. The fire response of this species is unknown.

- *Diuris drummondii:* Monitoring to determine the size of the population and flowering pattern for three or more years post fire.

- *Jansonia formosa:* The population of this species was reported by Churchill in 1957, and has not been seen since. As it belongs to the family *Papilionaceae* it can be expected to regenerate well post fire. Location of this population could be of value.

- *Eucalyptus jacksonii:* (red tingle) Post fire seed fall of red tingle was patchy. However in areas where seed fall has occurred, germination rates are high, up to 50 seedlings per square metre. Monitoring of the survival rate of these seedlings could provide valuable information that could be useful in the future management of this restricted species.

- Small to medium size mammals: Animal numbers in many sub-populations are at a critical level. Monitoring of numbers in some of these populations until they appear secure would be of long-term value. A greater understanding of the response of these animals to severe habitat and population reduction could be of use in future management. Monitoring of re-colonisation of apparently extinct sub populations could be of similar value.

- Western bristle birds: It appears that three western bristle birds are still alive in the western buffer adjacent to the area burnt by the wildfire. Monitoring of the movements of these birds as the vegetation in the burnt area recovers may provide a better understanding of the behaviour of this species in these circumstances.

Invertebrates: A number of relict Gondwanan invertebrate taxa are known to occur in the Walpole Nornalup National Park. Some of these invertebrates have only been found in long unburnt red tingle forest and some have only been found in recently burnt red tingle forest. (Ref. 3: Van Heurk P. F. Burbridge T. Wheeler I.) No long unburnt forest of this type now exists in the Nuyts

Wilderness. Consideration may be given to monitoring for those relictual species unique to recently burnt red tingle forest.

5.2 Future Fire Management

The current management plan for the Nuyts Wilderness expires in 2002. This management plan was implemented after a series of workshops that provided a venue for consultation with the N.P.N.C.A., the Walpole Nornalup National Parks Association and the public. The current plan includes a regime of No Planned Burn. A regime of No Planned Burn was considered to be appropriate for an area that had been zoned as a wilderness and contained a number of fire sensitive species.

The long unburnt condition of much of the Nuyts Wilderness was a significant contributor to the impact of this fire and was the direct result of both the regime of No Planned Burn, and the suppression of naturally occurring fires that originated in areas external to the Nuyts Wilderness, and would have burnt through that area had they not been suppressed. The Management Plan for the Walpole Nornalup National Park is due for renewal in 2002. It is reasonable to assume that the objective of an area designated as a wilderness should be the promotion and perpetuation of biodiversity. The strategy of No Planned Burn would appear to be antithetical to this objective.

The broad-scale application of fire to an area such as this could not be considered appropriate either. The objective of the perpetuation of biodiversity could be better achieved by the cyclical, strategic burning of areas throughout the heath and scrubland. A number of relatively small, disjunct burns could be conducted within a given year. The fact that the area is bounded by water on three sides would add a significant degree of security if this strategy were to be implemented. Moisture differentials could be utilised to define the boundaries of these areas and to encourage an unburnt mosaic. The perimeters of the burnt areas would to some extent be defined by the state of senescence of vegetation in those areas and the outcome should be a natural pattern of regeneration. Almost all species of indigenous mammalian fauna coexist well with an environment that includes a mosaic of recently burnt and long unburnt vegetation. Such a mosaic provides the combination of refuge, grazing and browsing habitats.

The presence of recently burnt and re-vegetated areas would provide potential for animal refuge and would encourage a greater unburnt mosaic, in the event of wildfire. In such an event, this strategy would also provide areas of lower fire intensity where native animal fire survival behaviour, which is clearly an adaptation to low intensity fire, could be effective. This strategy would also provide an environment where fire-fighting tools such as aerial water bombers could be more effectively utilised, both in fire suppression and in the protection of specific areas of habitat. The objective of this strategy should be the promotion of biodiversity through the mimicking, or at least approximating the historical fire regime that defined the distribution of the species that are an integral component of this part of the conservation estate. If such a strategy is to be considered, its successful implementation would be very much dependent on the recognition that while fuel reduction may be a component of that strategy, it is not the goal, but a tool in the attainment of that goal.

6 References

1. *CALM Report: Chamelaucium floriferum ssp floriferum; Nuyts population. December 2000.*

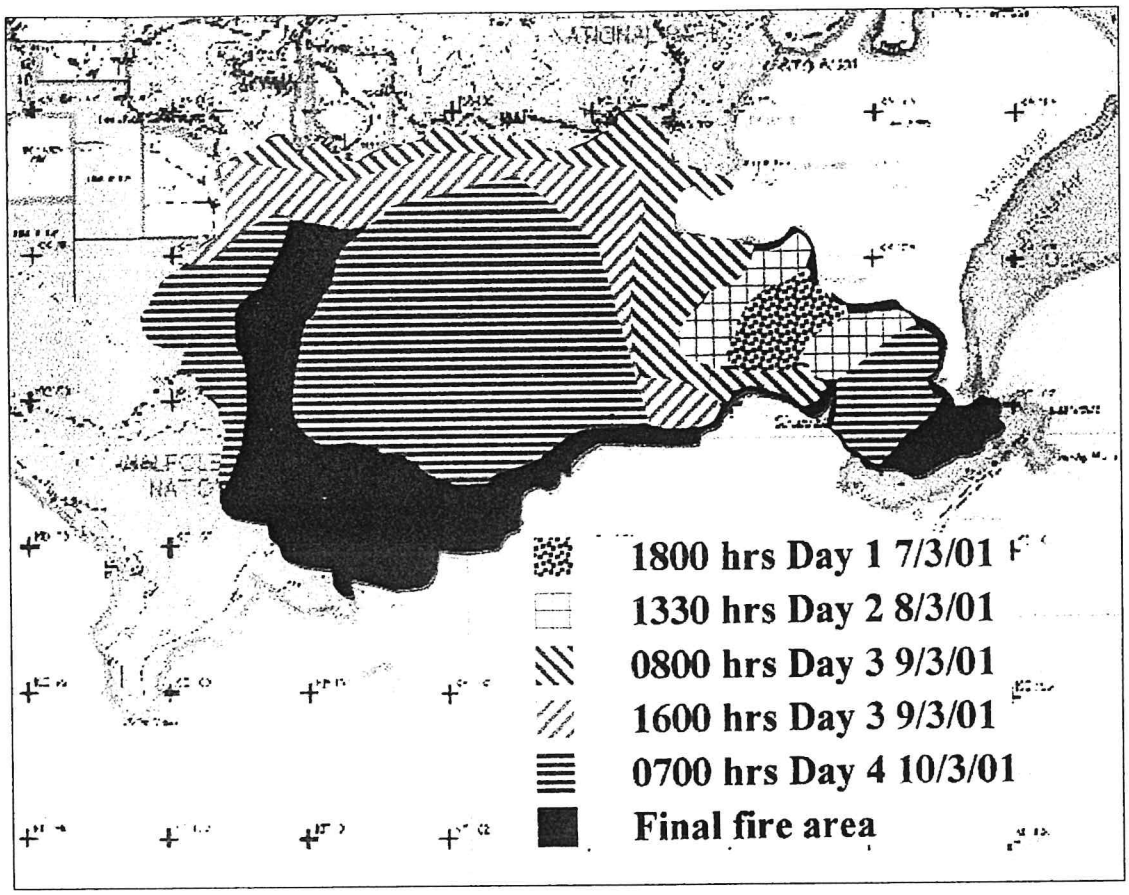
2. *Leaf scorch in Xanthorrhoea gracilis as an index of fire intensity. J. M. Koch and D. T. Bell. Australian Forestry Research 1980 Vol.10. 113-119.*

3. *Invertebrate Biodiversity in the Tingle and Other Forest in the Walpole-Nornalup National; Park in South Western Australia. P 14-17. August 2000.*

7 Attachments

1. Map; Nuyts Wilderness Wildfire Area. Source Dept. of Conservation and Land Management, Walpole Office.

Nuyts Wilderness Wildfire Area



Attachment 1.