

**REPORT OF AN INVESTIGATION INTO THE
ORIGIN OF BUSHFIRES
ON 15 NOVEMBER 2002
IN THE SHEEPWASH AND REDMOND AREAS
ADJOINING THE HAY RIVER,
SOUTH-WESTERN AUSTRALIA**

Prepared by Lachlan McCaw
Department of Conservation and Land Management
Science Division
Manjimup, 6258, Western Australia
14 March 2003

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Executive Summary

On 15 November 2002 the lower south-west of Western Australia experienced an event of extreme forest fire danger brought about by a combination of high temperature, low humidity and strong winds. A number of fire outbreaks occurred in the area between Walpole and Albany during the period of extreme fire danger in the morning and early afternoon of that day. Significant fires occurred on lands managed by the Department of Conservation and Land Management (DCLM) in the Frankland and Albany administrative districts.

This report has been prepared to address a series of issues associated with fire outbreaks in the Sheepwash and Redmond forest blocks on 15 November 2002, specifically:

- to provide a description of the weather conditions and other predisposing factors associated with the fires;
- to examine possible causes of ignition for each fire outbreak;
- to document observations of fire behaviour made during the main period of activity, or deduced from post-fire inspection and interview;
- to document information relating to aspects of damage to buildings and bluegum plantations on private property.

The findings of the investigation in relation to the origin of the main fire outbreaks are summarised below:

1. Frankland District Fire 5 in Sheepwash block south of Centre Break Rd

Possible causes of the fire outbreak at Centre Break Rd include:

- re-ignition from smouldering logs or stumps inside the boundary of a prescribed burn in Sheepwash forest block undertaken by DCLM in early November,
- lightning-caused ignition of unburnt patches of fuel within the burn, or
- arson.

It is possible that, under the extreme fire danger conditions during the morning of 15 November, smouldering logs or stumps re-ignited unburnt areas of fuel within the burn boundary. The first-arriving personnel at the fire observed active fire behaviour both north and south of the road and reported that pockets were continuing to burn actively north of the road until after 1100 hrs. The Investigation Team were able to find a number of locations where fire had re-burnt through the previously edge-burnt vegetation on the northern side of the road, particularly where there was a dense layer

of understorey shrubs that had been scorched but not fully consumed during the edge-burning operations earlier in the spring.

It is also possible that lightning strikes within the boundary of the prescribed burn area during the morning of 15 November ignited previously unburnt patches of fuel. Reports from several observers suggest that lightning storms were active in the area of Sheepwash block that day.

The Investigation Team did not find any evidence to indicate that arson was involved in the fire outbreak at Centre Break Rd.

2. Albany District Fire 2 in Redmond block

Lightning ignited a fire north of West Redmond Rd and east of Davy Rd between 0700 and 0800 hrs. This fire was first detected by a local resident driving along the West Redmond Rd shortly after 0800 hrs who returned to the family property to get fire-fighting equipment and notify fire authorities and DCLM. Efforts to contain the fire north of West Redmond Rd and east of Davy Road continued throughout the morning, with resources arriving from a number of volunteer bushfire brigades and from DCLM. Shortly after midday Fire 2 and Fire 5 joined together into a single fire that subsequently spread extensively to the east following the arrival of a westerly change during the early afternoon.

3. Fires in the Spencer Rd area

The fire which burnt private property and bluegum plantation in the Spencer Rd area originated within the boundary of the Sheepwash block, but the Investigation Team were unable to confirm the cause of ignition. Possible ignition sources include:

- smouldering logs or other woody material that had been ignited during prescribed burning operations earlier in the week;
- lightning strikes within the boundary of WLP_110 which resulted in a fire run under the extreme weather conditions on the morning of 15 November;

Lightning strikes had been observed in the Spencer Rd area between 0700 and 0800 hrs that day.

4. Other fires investigated

Loc. 1519

A fire on Loc. 1519 reported at 1307 hrs by the DCLM spotter aircraft is most likely to have originated from spotting associated with fire activity on the western side of the Hay River within Sheepwash block. At the time of the report winds were still in the north-west. On the previous day the spotter aircraft had reported fire activity within the burn to the north-west of this location.

Loc. 52

The cause of a fire on Loc. 52 which subsequently also burnt Loc. 53 is unclear. However it is most unlikely that this fire originated from any prescribed burning activity undertaken by DCLM.

Loc. 1899

The most likely cause of ignition of a building on Loc. 1899 was from firebrands of bark and eucalypt leaves originating from the fire west of the Hay River. This would have required burning material to be transported a distance of at least 800 m across green paddocks. The considerable age of the house, the style of construction, and the fact that it was unoccupied at the time would have contributed to its vulnerability to attack by burning fragments of bark and leaves.

1. Introduction

On 15 November 2002 the lower south-west of Western Australia experienced an event of extreme forest fire danger brought about by a combination of high temperature, low humidity and strong winds. These conditions were associated with the easterly movement of a trough of low pressure that had developed down the west coast of the state over the preceding 2-3 days. The trough was accompanied by unsettled weather conditions including thunderstorms and lightning.

A number of fire outbreaks occurred in the area between Walpole and Albany during the period of extreme fire danger in the morning and early afternoon of 15 November. Significant fires occurred on lands managed by the Department of Conservation and Land Management (DCLM) in the Frankland and Albany administrative districts. These included (refer to Figure 1):

- a fire that began on departmental land in Redmond block and extended to the south and east affecting farmland, young plantations of bluegum (*Eucalyptus globulus*) and further patches of State forest between the West Redmond Road and Hunwick Road. This fire was identified as Albany Fire 2.
- a fire that began near Centre Break Road and ran southwards through Sheepwash block and across the Hay River into Redmond block, identified as Frankland Fire 5. This fire joined with Albany Fire 2 in the vicinity of the West Redmond Road shortly after midday. Following a change to west-south-westerly winds during the early afternoon, the eastern flank of the combined fire extended on a front of about 9 km and burnt into private properties adjoining the Hay River where it was eventually halted by green (uncured) pasture. However, the fire threw a shower of embers eastwards from the river which ignited remnant bushland, several buildings and structures, fences and a large number of log heaps widely scattered through farm paddocks;
- a cluster of fires that burnt pasture and bushland on private property in the vicinity of Spencer Road and along the Hay River at the northern extremity of Sheepwash block. These fires also spread into plantations of bluegum. This group of fires were managed as part of Fire 5.

Sectors of the fire west of the Hay River and in the Spencer Rd area were managed from Frankland office, while those east of the river were managed from the Albany office. Volunteer bush fire brigades from the Shires of Albany, Denmark and Plantagenet provided extensive support during the initial attack and subsequent mop-up of both fires.

Personnel from DCLM also attended a fire on private property Location 52 adjoining the north-western boundary of Sheepwash block near the Denmark Mt Barker Rd. This fire had started on 15 November, but was not contained until DCLM fire-fighters visited the property on the following day. This fire did not originate from, or impact upon Departmental lands. The cause of this fire remains unclear.

On the same day, fire also escaped from a prescribed burn being conducted in Sharpe block north of Walpole and subsequently burnt much of Mitchell and Crossing blocks. The fire in Mitchell and Crossing blocks was also managed from the Department's Frankland District Office and was identified as Fire 6. As the cause of

this fire was clearly evident, no further investigation was undertaken.

Officers from DCLM commenced an investigation into the origin of Fire 5 on the morning of Saturday 16 November, with the initial aim of determining whether this fire had originated as an escape from prescribed burning operations recently undertaken in Sheepwash block to the north of Centre Break Rd. Lachlan McCaw and John Neal from the Science Division's fire research team were assigned to this task. Following an initial briefing from Incident Controller Greg Mair at the Frankland District office, the investigation team made a field inspection of the Sheepwash area. Further field inspections were undertaken in the Sheepwash area on 17 and 19 November, and in the Redmond area on 20 November. Jim Gould, Leader of the Bushfire Research and Management Group from CSIRO Forestry and Forest Products was in Western Australia on a working visit and accompanied the investigation team on 16, 17 and 21 November.

This report has been prepared to address a series of issues associated with the fire outbreaks in the Sheepwash and Redmond areas on 15 November 2002, specifically:

- to provide a description of the weather conditions and other predisposing factors associated with the fires;
- to examine possible causes of ignition for each fire outbreak;
- to document observations of fire behaviour made during the main period of activity, or deduced from post-fire inspection and interview;
- to document information relating to aspects of damage to buildings and bluegum plantations on private property.

A detailed inventory of damage to private property and public land managed by DCLM and other agencies is beyond the scope of this report. However, immediately following the fire Departmental officers from Walpole and Albany made contact with affected private property owners and compiled a preliminary list of losses attributed to the fire.

2. Weather conditions and predisposing factors

Weather observations from Rocky Gully South and Albany Airport have been used to represent conditions in the area of the fire outbreaks. Rocky Gully is located about 100 km north-west of Albany and 55 km from the Southern Ocean, and is within the Stirling Inland weather forecast district. Albany Airport is about 7 km north-west of the city centre and 9 km from the ocean, and is within the Stirling Coastal forecast district.

2.1 Seasonal dryness and pasture curing

Rainfall for the eastern half of the Frankland District was average in the 3 month period from July to September 2002 (Anon. 2002). Monthly rainfall during September was average for Albany Airport and slightly above average for Rocky Gully, and both stations recorded average rainfall during October (Table 1). Further rainfall was recorded at Albany Airport on November 1st (21.8 mm), 2nd (1.8 mm), 3rd (0.2 mm) and 12th (0.2 mm) (Anon. 2002).

Pastures south of the Muir Highway (Manjimup-Mt Barker road) were still green on 15 November, with the first signs of curing becoming evident in the area north from Spencer Road to the Muir Highway. A Drought Factor of 7 has been used to determine the McArthur Forest Fire Danger Index (FFDI). The Drought Factor indicates the relative dryness of forest fuels on a scale from zero, when no fuel is available to burn, to 10 which represents the maximum level of fuel dryness following an extended period of drought.

TABLE 1. Rainfall observations (mm) for Rocky Gully and Albany Airport, September –November 2002.

	Rocky Gully		Albany Airport	
	Observed	Mean	Observed	Mean
September	83	69	72	77
October	54	57	64	64
November 1-14	<i>Data not available</i>	-	24	-

2.2 Forecast and actual conditions on 15 November

The synoptic chart for 15 November 2002 showed a trough located down the west coast, with a low embedded in the trough near Cape Leeuwin (Figure 2). An approaching cold front in the Indian Ocean triggered easterly movement of the trough during the early hours of the morning. This pattern is typically associated with a northerly air flow, followed by an abrupt change to west-south-west winds as the cold front arrives.

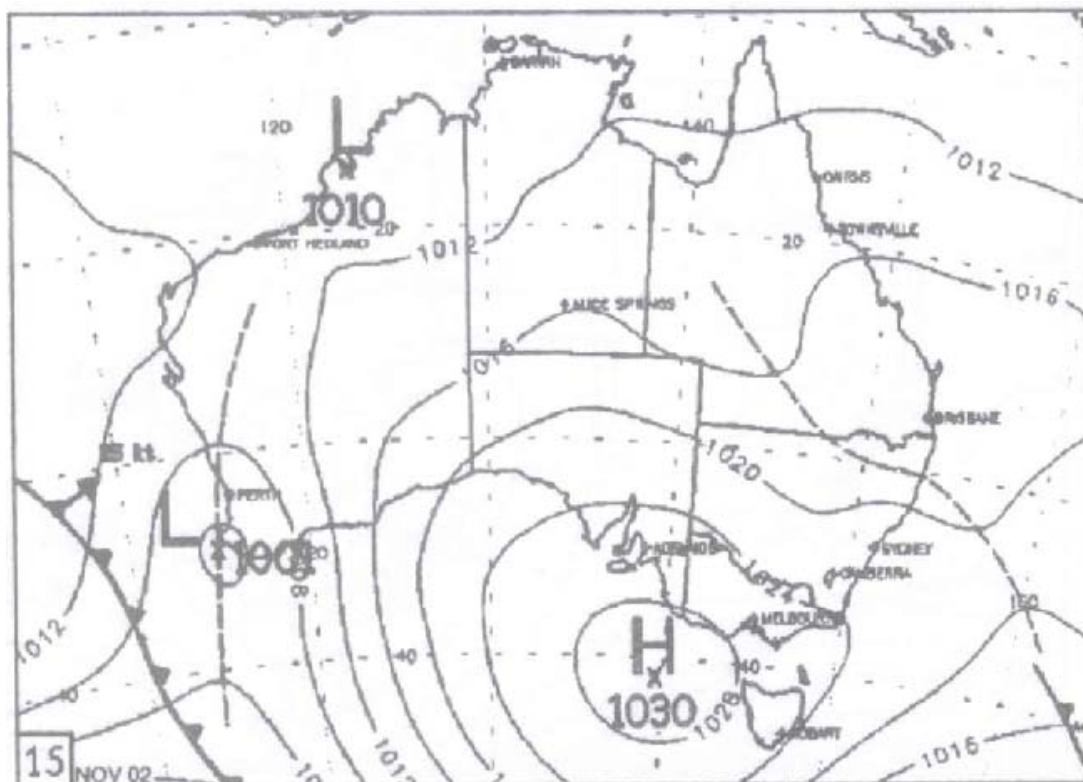


Figure 2. Synoptic chart for 15 November 2002 (Source: Bureau of Meteorology)

The Bureau of Meteorology provide fire weather forecasts for the Stirling Inland and Coastal Districts, and also provide a point forecast for Rocky Gully as part of the fire weather service to DCLM. Forecasts issued for 15 November are shown in Table 2.

Weather conditions observed at Rocky Gully corresponded closely with the 0745 hrs forecast, except that during the morning dew points were substantially lower than expected, indicating the presence of a dry air mass (Table 3). Wind gusts of up to 68 km/h from the NNW were recorded at Rocky Gully. Fire danger at Rocky Gully peaked at around midday, with a Jarrah forest rate of spread index of 660 m/h (Extreme) based on a moisture content of 5 per cent for surface litter fuel. The McArthur FFDI peaked at 34 (Very High) between 1000 and 1100 hrs.

Fire weather conditions observed at Albany Airport were more severe than at Rocky Gully. Dew points were below 2.5°C during the morning, the maximum temperature reached 37°C and mean wind speeds were up to 57 km/h with gusts to 72 km/h (Table 3). The balloon sonde released from the Airport at 0700 hrs recorded NNW winds at 90 to 94 km/h between 2000 and 3000 feet, reducing to about 60 km/h at 7000 feet. Fire danger at Albany peaked at around midday with a Jarrah forest rate of spread index of 1600 m/h (Extreme) based on a 5 per cent moisture content, and a McArthur FFDI of 70 (Extreme).

Fire weather forecasts issued for the Stirling Coastal and Inland districts accurately predicted the maximum temperature and minimum relative humidity for the day but substantially under-estimated the mean wind speed and gust strength. The more advanced condition of grass curing in the Stirling Inland district resulted in a forecast Extreme grassland fire danger, compared to only High fire danger in the Stirling Coastal district.

TABLE 2. Fire weather forecasts issued by the Bureau of Meteorology for 15 November 2002. All times are Western Standard Time.

	Rocky Gully	Stirling Inland	Stirling Coastal
Time of issue	0745 hrs	0730 hrs	0730 hrs
Maximum temp (°C)	36	38	36
Dew point (°C)	14	not shown	not shown
Minimum RH (%)	27	10	15
Lightning activity level	1	not shown	not shown
Winds (km/h)			
1100 hrs	N@30	N@25	N@25
1300 hrs	NW@35	NW@30	WNW@30
1500 hrs	WNW@35	NW@30	WSW@30
1700 hrs	W@30		
overnight	SW@20		
Comments	Humid change. Risk of a morning thunderstorm. Gusts to 60 km/h possible.	Risk of a thunderstorm. Gusts to 45 km/h pm.	Risk of a thunderstorm. Gusts to 45 km/h pm.
Grassland fire danger	Not issued	Extreme	High

TABLE 3. Weather observations from Rocky Gully and Albany Airport automatic weather stations on 15 November 2002. Data provided by the Bureau of Meteorology, Perth. Wind speed represents the mean speed recorded over a 10 minute period prior to the observation time, and the wind gust represents the strongest gust over the same period.

	Rocky Gully							Albany Airport					
Time (WST)	Temp (°C)	RH (%)	Dew point (°C)	Wind speed (km/h)	Wind direction (deg.)	Wind gust (km/h)		Temp (°C)	RH (%)	Dew point (°C)	Wind speed (km/h)	Wind direction (deg.)	Wind gust (km/h)
0600	21	33	4.3	28	60	39		25	18	-1.0	26	10	42
0700	23	31	4.6	13	20	17		26	18	0.1	22	10	31
0800	26	27	5.5	24	30	33		27	16	-0.5	33	10	48
0900	30	22	6.3	33	10	57		29	19	3.1	21	10	28
1000	33	20	6.9	39	350	57		33	14	2.0	52	360	70
1100	34	22	9.5	39	340	68		35	13	1.8	46	350	65
1200	33	24	9.7	41	330	68		36	12	2.5	57	330	72
1300	29	41	14.7	44	270	54		37	12	2.2	50	320	67
1400	22	63	14.4	41	250	55		20	74	15.6	35	240	50
1500	20	59	11.9	30	260	46		19	71	13.5	35	250	61
1600	19	59	11.1	37	250	50		18	60	10.4	41	250	63
1700	19	58	10.2	31	260	41		19	62	11.3	28	260	48
1800	18	57	8.9	37	260	50		18	62	10.7	21	250	35

Wind direction morning shifted from NE early in the morning through to NW by midday, and a WSW change arrived at both Rocky Gully and Albany Airport before 1400 hrs. The change resulted in a rapid fall in temperature and a rise in relative humidity and dew point as a moist on-shore air mass penetrated inland. Winds remained strong and gusty during the remainder of the afternoon.

2.3 Lightning

Fire weather forecasts indicated the possibility of thunderstorms and lightning associated with the trough.

Lightning is known to have ignited Albany Fire 2 in Redmond block north of West Redmond Rd and east of Davy Rd between 0700 and 0800 hrs on 15 November. This sighting was confirmed by Mr Peter and Mrs Peg Buxton who own Loc. 6636 which adjoins the southern end of Davy Rd (Appendix 1). They responded to the fire using equipment from their property and sought assistance from volunteer Bush Fire brigades and the DCLM office in Albany.

Lightning strikes were observed over Sheepwash block between 0700 and 0730 hrs that morning. Mr Simon Watkin of Walpole was travelling north on the road from Denmark to Mt Barker and observed bolt lightning in the vicinity of Spencer Rd (Appendix 2). At the time of the lightning he was about 20 km south of the estimated ground contact point, but on reaching Spencer Rd noticed smoke and heat haze developing from behind a ridge to the east side of the Denmark-Mt Barker road. The ridge prevented Mr Watkin from having a direct view of the fire.

Mr Duncan Small also observed lightning activity over Sheepwash block at 0700 hrs while milking cows at the Denmark Agricultural College (Appendix 1). He described the strikes as being north-east of Denmark and probably north of Powley Rd (5 km north of the town).

Data recorded by the GPATS lightning detection system were obtained from the company's office in Ultimo, NSW. This data is in the form of digital records indicating the time, latitude/longitude, and polarity of lightning discharges recorded by ground-based sensors. Examination of the data confirmed that extensive lightning activity occurred in the area west of Albany during the period 0800-1000 hrs on the morning of 15 November with most of the recorded discharges were south of latitude 35°S and over the Southern Ocean. One discharge was recorded from 34°45'24.5"S 117°56'11.4"E which is very close to the latitude of Spencer Rd but some 33 km further to the east of the area where fires occurred. The GPATS data support the visual observations of the Buxtons, Simon Watkin and Duncan Small that lightning storms were indeed associated with the low pressure trough.

3. Description of prescribed burn WLP_110 undertaken in Sheepwash block prior to 15 November 2002

Frankland District undertook prescribed burning in the northern half of Sheepwash block during spring 2002. The burn was designated WLP_110 and had a boundary defined by the Denmark Mt Barker Rd. on the west, the private property interface and Spencer Rd on the north, tracks adjoining private plantation and the Hay River on the

east, and Centre Break Rd on the south. The area included within the boundary of the prescribed burn was about 7800 ha. Details of the sequence of activities associated with the prescribed burn have been obtained from the District fire diary and burn prescription records, and are summarised below.

Parts of the northern and western boundary adjoining private property were edged on 31 May and 1 June 2002 under late autumn conditions. Edging involves igniting fire at a number of points along the boundary of an area to be burnt and then allowing these individual fires to join together and remove leaf litter and understorey fuel from the zone adjacent to the track or road that acts as the boundary. Typically, the aim is to remove the fuel for a distance of between 30 m and 100 m from the track. This reduces the chances of fire escaping across the boundary during subsequent ignition operations in the core of the block. Edging is normally done early in spring or late in autumn when fires can be readily controlled and will go out overnight because conditions are cool and moist. Edges are patrolled and mopped-up to extinguish burning logs and stumps within 20 m of the road, and to fell or extinguish burning trees within 100 m of the road.

Burning operations in spring commenced on 30 October when the depth of edging adjacent to private property was extended, and new edging commenced on the remaining boundaries. On the same day, open forest and heathland vegetation within the core of the block was ignited with a helicopter under mild weather conditions, achieving about a 10 per cent burn-out of the area that was lit.

Over the next nine days, further edging was done along the Denmark Mt Barker Rd, and along the boundary adjoining private property Locs. 55, 72 and 498. As fuels became drier over this period, fires began to run during the day.

On 10 November aerial ignition took place across the southern two-thirds of the burn achieving an 80 per cent burn-out of the area lit.

Between 11 and 14 November work continued to mop-up and patrol edges on all boundaries and to burn out any pockets within 200 m of the boundary that had not already been burnt during previous ignitions.

On 14 November, the day prior to the extreme weather conditions, the DCLM spotter aircraft reported smoke sightings from several locations within the boundary of the prescribed burn. These included:

- two smokes immediately north of Centre Break Rd,
- one smoke in the south-east corner of the burn located west of the Hay River and adjacent to Loc. 1519,
- one smoke located more than 2 km inside the burn on the eastern side of the enclave of private property (Locs. 2286 and 498) accessed from the Denmark Mt Barker Rd,
- two smokes south of Spencer Rd and west of Loc. 85.

One of the smokes on Centre Break Rd was considered to warrant further attention and was subsequently field checked by DCLM personnel. The other five smokes did not require attention or were already being attended to by ground crews (Appendix 3).

4. Description and probable origin of fire outbreaks at Centre Break Rd

4.1 Initial fire reports

The first report of fire activity outside of the boundary of WLP_110 was made at 1035 hrs by Mr Dene Cullen, the driver of DCLM heavy duty fire appliance F40. His initial report, which was transmitted by radio and recorded in the fire diary at the DCLM Frankland District Office, put the fire 600 m up (presumed to be east) on Centre Break Rd and burning very actively. At this point the fire outbreak became identified as Frankland Fire 5.

Dene subsequently provided more information about his observations made on arrival at the fire (Appendix 1), including that:

- fire had crossed Centre Break Rd and was spreading southwards;
- there was fire burning on the northern side of the road;
- the fire had crossed near a section of the burn edge where small patches of residual litter and scrub fuel had been burnt out the day before to provide a continuous burnt edge;
- fire had also crossed at several places further east on Centre Break Road.
- there was no evidence at the site of the fire to indicate that anyone had been since DCLM personnel had departed the day before. The presence of items such as recently discarded cans, bottles or rubbish might have indicated human activity in the area, and raised the suspicion of arson.

The DCLM spotter aircraft reported at 1055 hrs that the fire burning south of Centre Break Rd was about 70 ha in area and burning in a SSE direction, with the head-fire about 800m south of the road. Over the next hour the spotter reported that fire had become active at several locations within the boundary of WLP_110, either in unburnt fuel or re-burning through areas that had already been burnt at low intensity but retained sufficient fuel to support a fire under hot, windy conditions.

Mr Ray Flanagan of DCLM Frankland District arrived at the fire about 1100 hrs (Appendix 1), approaching from the west to east along Centre Break Rd. Ray drove through the fire, noting the approximate location of the east and west flanks and estimating the fire to be about 1.2 km wide. He observed that the fire was burning vigorously on both sides of the road, apart from a 200 m section about halfway between the two flanks which was not alight and had not crossed south of the road. Ray organised his accompanying crews and bulldozer to begin constructing a track along the west flank of the fire, but they withdrew when a pocket of fire activity north of Centre Break Rd threatened to cut-off their access to the west. Fire-line construction was then re-commenced from a more secure location a hundred or so metres further west.

4.2 Probable cause of ignition

Possible causes of the fire outbreak at Centre Break Rd include:

- re-ignition from smouldering logs or stumps inside the boundary of the burn,
- lightning-caused ignition of unburnt patches of fuel within the burn, or
- arson.

It is possible that, under the extreme fire danger conditions during the morning of 15 November, smouldering logs or stumps re-ignited unburnt areas of fuel within the burn boundary. The first-arriving personnel at the fire observed active fire behaviour both north and south of the road and reported that pockets were continuing to burn actively north of the road until after 1100 hrs. During a field inspection on 16 November fire investigators were able to find a number of locations where fire had re-burnt through the previously edge-burnt vegetation on the northern side of the road, particularly where there was a dense layer of understorey shrubs that had been scorched but not fully consumed during the edge-burning operations earlier in the spring (Figures 3-6).

It is also possible that lightning strikes within the perimeter of WLP_110 during the morning of 15 November ignited previously unburnt patches of fuel. Reports from Simon Watkin and Duncan Small suggest that lightning storms were active in the area of Sheepwash block that day. However, the chances of finding evidence to directly confirm this possibility are remote.

The Investigation Team did not find any evidence to indicate that arson was involved in the fire outbreak at Centre Break Rd.

4.3 Fire spread under northerly winds

The fire spread in a SSE direction on the eastern side of the Mitchell River and then crossed the Hay River north of where the two rivers join. At 1230 hrs the head-fire was reported to be about 0.5 km north of the West Redmond Rd. Between 1055 hrs and 1230 hrs the head-fire travelled about 9.5 km, making the average forward rate of spread 6.3 km/h. The path of the head-fire was across gently undulating terrain, declining in elevation from 140 m to 60 m above sea level. Initially the fire spread in 6-year-old fuel, then into 12-year-old fuel as it crossed the eastern boundary of Sheepwash block, and subsequently into 19-year-old fuel south of the Hay River. At the peak of fire activity the intensity of the head-fire was probably in the range 30 to 40 MW/m.

The head-fire reached West Redmond Rd soon after 1230 hrs. Examination of the pattern of crown defoliation and leaf freeze suggests that the centre of the head-fire hit the road about 100 m west of the house on Loc. 6636 (Figure 7). Coordinates for the centre of the head-fire were fixed with a GPS at 34° 54' 24.3" 117° 32'04.4" (WGS 84 datum). The eastern side of the head-fire appears to have hit the road near the large dam in the north-east corner of Loc 6636, directly adjacent to Great Southern Plantations Reed bluegum plantation (34° 54' 24.9" 117° 32'18.3")

Spot fires were reported in two compartments of Redmond block south of West Redmond Rd at 1230 hrs (central compartment) and 1245 hrs (western compartment). Based on the position of the head-fire reported at 1230 hrs, spotting was occurring at least 2.5 km and possibly up to 5 km ahead of the main fire front.

Southerly spread of Fire 5 was restricted by the presence of green pasture on Loc. 6636, and by the sparse fuels in the 3 year-old Reed bluegum plantation. Bluegums on the northern boundary of the plantation were severely scorched by radiant heat from the head-fire, and from fires that ignited in the corridor of native vegetation

along the road (Figure 8). Large numbers of firebrands were also deposited within the plantation and associated patches of remnant native forest. Within the plantation, fires resulting from spotting activity generally burnt with low intensity in sparse surface fuels that consisted mostly of clover and scattered eucalypt leaves. In contrast, patches of remnant native forest burnt at high intensity with trees up to 20 m tall defoliated by crown fire. Firebrands also ignited a number of log heaps in paddocks containing green pasture (Figure 9), and an area of swampy vegetation on the boundary between eastern side of the Reed plantation and Loc. 6638 about 1 km south of the West Redmond Rd.

4.4 Fire spread following the westerly change

Arrival of the westerly change between 1300 hrs and 1400 hrs turned the eastern flank of Fire 5 into an extended head-fire some 9 km in width. At the southern end in Redmond block, the fire joined with the lightning-caused fire that had already burnt a substantial area east of Davy Rd during the morning. The eastern side of the combined fire subsequently extended out to the edge of Redmond block where it encountered green pasture and young bluegum plantations west of Verne Rd. The remainder of the eastern side of the Fire 5 spread under the influence of strong WSW winds until it encountered green pastures in cleared private property along the Hay River. Within the Reed plantation, the westerly change drove fire from patches of remnant native forest into adjoining bluegums with sufficient intensity to defoliate the first four rows of trees before dropping back to the litter layer on the ground (Figure 10). Fire penetrated 100 m or so into the plantation before becoming fragmented in the light surface fuels.

5. Albany Fire 2

This fire appears to have started from a lightning strike between 0700 and 0800 hrs in the section of Redmond block north of the West Redmond Rd and east of Davy Road. Mr Anthony Buxton was driving along the West Redmond Rd on his way to Albany shortly after 0800 hrs and noticed the fire which at that stage was roughly circular in shape and less than a few hundred square metres in area. He returned to the family property to get fire-fighting equipment and notify fire authorities and DCLM, then returned to the fire which had by then began to spread in a south-easterly direction. Efforts to contain the fire north of West Redmond Rd and east of Davy Road continued throughout the morning, with resources arriving from a number of volunteer bushfire brigades and from DCLM.

The DCLM Frankland spotter made a report on the fire at 1105 hrs, estimating the fire to be about 25 ha in size and still north of West Redmond Rd at this time. The spotter reported that the fire was heading south-south-east.

Private property Loc 6638 was directly south of the fire and contained areas of slash fuel resulting from harvesting operations in shelterbelts of bluegum, separated by areas of uncured pasture up to several hundred metres across. The areas of slash fuel caught alight during the morning and burnt at very high intensity (Figure 11). Spotting from Fire 2 is the most likely cause of ignition in the two cells of slash fuel immediately south of West Redmond Rd. The origin of spot-fires that ignited the

more southerly cells of slash on this property is less certain, and there is a possibility that these were ignited by firebrands that originated from Fire 5.

When the wind changed to the west-south-west during the early afternoon fire activity in the eastern-most of the slash cells on Loc 6638 caused crown scorch to edge trees in the north-west corner of a bluegum plantation on Loc.6639. This plantation is owned by Integrated Tree Cropping.

6. Fire outbreaks at Spencer Rd

Fire activity in the Spencer Rd area at the northern end of WLP_110 was initially reported by the DCLM spotter aircraft at 1146 hrs. The report indicated that an area of about 7 ha of forest within the recent prescribed burn was alight and that the headfire was spreading south-east towards the boundary between DCLM land, private property Loc. 85 and the Crystal Brook bluegum plantation managed by Great Southern Plantations. Between 1148 and 1200 hrs the spotter subsequently reported a number of spot fires within the plantation and associated patches of remnant native forest. Following the westerly change the main fire front burnt north across Spencer Rd. through Loc. 85 and several other private properties. A number of spot fires started east of the Hay River in pasture and bluegum plantation. An initial assessment of known damage to private property and plantations in the area was compiled during the first week after the fire by Greg Hodgson of the Forests Products Commission, working at the request of the Incident Controller.

The Investigation Team undertook a detailed field inspection of the area within WLP_110 south of Spencer Rd. and west of Loc. 85 where fire activity had been initially reported by the spotter aircraft (Figure 12). We identified a distinct path where a head-fire had run with a north-west wind from within the prescribed burn out towards the boundary. In places this run re-burnt through the sparse litter layer that had accumulated since the edging was done in late autumn 2002 (Figure 13). The Investigation Team followed the head-fire path back to the north-west limit to the point where young fuel resulting from the autumn 2002 edging were encountered. Investigators did not find any burning trees or fallen logs that had obviously acted as a source of ignition for the fire run, although this could be difficult to locate in such a large burnt area.

The fire run under north-westerly winds appears to have generated considerable spotting that ignited fires downwind in the south-west corner of Loc.85 and probably in the Crystal Brook plantation. The presence of 35 m wide cleared break between the boundary of WLP_110 and the forest on Loc. 85 was insufficient to prevent this spotting (Figure 14). Dry logging slash from recent clearing on the western boundary of Loc. 85 would have provided a very receptive fuel for spot-fires to develop in.

Spot-fires that developed within the plantation generally burnt at low intensity because of light ground fuels (Figure 15). A small area of second rotation plantation on the east side of the Hay River that had coppice shoots several metres tall was burnt, with the fire spreading predominantly in slash fuels remaining after the harvesting operation. There were several places where edge trees in bluegum plantation were severely scorched by radiant heat from fires in adjacent remnant forest.

Greg Hodgson provided information to the Investigation Team (Appendix 4) regarding a conversation that he had with Mr John Fisher who owns property in the Spencer Rd area, including Loc. 85. In this conversation Mr Fisher showed Greg an area where he had seen smoke from burning logs near the boundary of the prescribed burn during the morning of 15 November. Mr Fisher said that he telephoned Frankland District office and expressed concerns about these burning logs to Duty Officer Howard Manning, who had advised that DCLM was already committed to the fire at Centre Break Rd. Mr Fisher had then obtained an earth-moving machine which he used to push the logs further into the DCLM land and away from his property, anticipating that they could potentially cause an escape later when the wind returned to a westerly quadrant. These logs were located about 50 m south of Spencer Rd and had been pushed about 20 m west into the previously prescribed burnt area which retained some understorey fuel and a sparse layer of leaf litter. Assistance for fire suppression from DCLM personnel arrived at around midday in the form of Forest Officer Keith Lillee and a crew from the Manjimup work centre.

Lachlan McCaw of the Investigation Team spoke again with Mr Fisher on 19 February 2003 to confirm details of his observations about the fire. Mr Fisher recalled that the fire activity within the section of Sheepwash block west of Loc. 85 became obvious between 1100 and 1130 hrs, which is consistent with the timing of the smoke report logged by the DCLM spotter aircraft. He also stated that the pushing-in of the logs into the burn boundary had not contributed to the initiation of the fire activity which spotted out of Sheepwash block later in the morning.

The fire which burnt private property and bluegum plantation in the Spencer Rd area originated within the boundary of WLP_110, but the Investigation Team were unable to confirm the source of ignition. Possible ignition sources for this fire include:

- smouldering logs or other woody material that had been ignited during prescribed burning operations earlier in the week. This possibility is supported by two spotter aircraft reports of fire activity west of Loc. 85 on 14 November;
- lightning strikes within the boundary of WLP_110 which resulted in a fire run under the extreme weather conditions on the morning of 15 November. The possibility of lightning is supported by the observations of Mr Simon Watkin who reported lightning activity in the vicinity of Spencer Rd early that morning;

7. Other fires investigated

7.1 Loc. 1519

The DCLM spotter aircraft reported a fire on Loc. 1519 at 1307 hrs. This location adjoins the eastern side of the Hay River just north of Centre Break Rd. The fire was reported to be 0.2 ha in area and burning in a south-easterly direction in Jarrah forest.

The fire on Loc. 1519 is most likely to have originated from spotting associated with fire activity on the western side of the Hay River within WLP_110. At the time the fire was reported winds were still in the north –west. On the previous day the spotter

aircraft had made a smoke report for an area of fire activity within the burn and to the north-west of this location.

7.2 Loc. 52

At 1212 hrs the spotter aircraft reported fire activity from private property Loc. 52 which is situated on the north-west boundary of WLP_110 about 1.5 km east of the Denmark Mt Barker Rd. This property is completely forested, apart from a small clearing around a building and small shed, and a large earth-walled dam. These developments are located approximately in the centre of the property. At the time of report, the fire was about 5 ha in size and the pilot observed that it had an elongated shape with the long axis extending from south-west to north-east (ie. the long axis lay across the prevailing wind direction from the north-west). Fire activity was confined to the eastern side of a track that provided access to the building. The pilot, Andrew Mitton, did not observe any people in attendance at the time, and also noted that the fire was spreading in a south-easterly direction but had not yet reached the adjoining property on the eastern side (Loc. 53) which is also completely forested.

The Investigation Team sought further information about the circumstances of the fire on Loc. 52 but initially were unsuccessful in contacting the owner Mr Graham Cook. On 19 November fire investigators met with Denbarker Volunteer Bush Fire Brigade Mr Gavin Smith and Plantagenet Shire Fire Officer Mr Brad Martin at the property (Appendix 1). Gavin confirmed that he had not issued any permits for burning on the property during the spring period. We followed the track into the property and inspected the buildings and several vehicles parked nearby, none of which had been damaged by the fire. The very low intensity of the fire along the track indicated that it had probably burnt back towards the track from one or more ignition points. We then inspected a bulldozed fire-line constructed by DCLM on 16 November that followed the edge of the burnt area to the northern boundary of the property, then eastwards along the fence-line track that formed the northern boundary of Locs. 52 and 53, and around the eastern and southern boundaries of these two properties. From this inspection it became clear that the fire originated on Loc. 52 somewhere close to the buildings and had spread into Loc. 53 under the influence of north-west winds, eventually being halted by the sparse fuels in the recently prescribed burnt area of Sheepwash block. It appeared that when the westerly change arrived during the early afternoon on 15 November the fire had then run eastwards burning out most of Loc. 53 before once again being halted by the recent prescribed burn. Investigators found several places where firebrands had landed in the recent prescribed burn and ignited localised areas of litter and dead scrub fuel.

While conducting this inspection we met the owner of the property Mr Graham Cook (Appendix 1) and spoke with him about the sequence of events on 15 November. Mr Cook recalled being present at some time during the afternoon on that day but was unable to provide specific information about the possible origin and cause of the fire, or about its subsequent spread.

It is most unlikely that the fire on Loc. 52, and which subsequently burnt Loc. 53 originated from any prescribed burning activity associated with WLP_110. This conclusion is supported by the following points:

- edging of the WLP_110 boundary adjacent to Loc. 52 had taken place in late autumn and had resulted in complete removal of litter and understorey fuel. This meant that no further edging had been ignited in spring close to the property.
- the fire started upwind of the burn at a time when winds had been consistently blowing strongly from the north-west for 5 to 6 hours;
- the shape of the fire was not consistent with a fire developing from a single ignition source under the influence of strong north to north-westerly winds.

The cause of the fire that started on Loc. 52 remains unclear.

7.3 Loc 1899

During the initial briefing with Incident Controller Greg Mair on 16 November the Investigation Team were advised of a report of damage to a building on Loc. 1899 which is situated on the eastern side of the Hay River in the locality of Spencer Vale. The Team travelled to this property on 17 November and met the owner Mr Ralph Carter (Appendix 1) who gave permission to enter the property and inspect the building. During conversation Mr Carter advised that on 15 November he had been at the property moving cattle until around 1100 hrs but had then left to go fishing, being unaware of the fire at that stage.

The Investigation Team inspected the building which was a wood and iron house some decades old, and had burnt to the ground (Figure 16). The house had been unoccupied at the time, although it was being rented to a person known to Mr Carter. There were indications that the house had been used to store a range of items including paint, fuel, and an old motorcycle. A GPS was used to fix the location of the house at 34° 50' 00.3" S 117° 33' 21.8" E.

The house was set amongst cleared paddocks and a few farm out-buildings and was surrounded by green grass. A brief search of the surroundings of the house revealed many fragments of charred bark and leaves that appeared to have come from eucalypt trees. Examples of these charred fragments were collected and retained by the Investigation Team. There were no areas of burnt eucalypt forest on the property near to the house that could have given rise to these charred fragments.

West from the house towards the Hay River there were a number of heaps of logs alight in the paddocks which still carried a dense growth of uncured pasture. It appeared that these heaps had been ignited by burning firebrands transported from the fire in the Hay River and further west (Figure 17). From the large number of heaps alight the Investigation Team judged that the shower of firebrands must have covered an extensive area and provided a high density of ignition sources on the ground.

The area west of the Hay River and opposite Loc. 1899 showed evidence of a very intense fire with complete consumption of litter and understorey shrubs, and defoliation of trees up to 25 m tall. Radiant heat from the fire in the river system had killed and dried out the pasture for a distance of 50 m east of the river channel, and in places fire had run for a distance of 20 to 30 m in the grass despite the fact that it would have been still green on 15 November (Figure 18 & 19). Patterns of leaf freeze and fire damage to pasture indicated that the wind had been blowing from the west-

south-west at the time when the fire arrived at the Hay River, suggesting that the fire reached the property boundary during the middle of the afternoon.

The Investigation Team concluded that the most likely cause of ignition in the building on Loc. 1899 was from firebrands of bark and eucalypt leaves originating from the fire west of the Hay River. This would have required burning material to be transported a distance of at least 800 m across green paddocks. The considerable age of the house, the style of construction, and the fact that it was unoccupied at the time would have contributed to its vulnerability to attack by burning fragments of bark and leaves.

References

Anon. 2002. Monthly weather review – Western Australia. (October and November issues), Bureau of Meteorology, Perth.

APPENDIX 1. List of people who provided information during the investigation of the fire outbreaks of 15 November 2002 in the Sheepwash and Hay River areas.

Person	Address	Date and time of communication	Context of communication
Mrs Peg Buxton	Loc. 6636 West Redmond Rd.	18/11/2002 1225 hrs	Telephone conversation
Mr Simon Watkin	Walpole Backpackers	20/11/2002 1145 hrs	Telephone conversation
		25/11/2002	Written statement
Mr Duncan Small	Denmark Agricultural School	2/12/2002 1630 hrs	Conversation following fire de-brief at Denmark Shire
Mr Dene Cullen	DCLM Walpole	18/11/2002	Notes of a conversation between Dene Cullen and Howard Manning, DCLM.
Mr Ray Flanagan	DCLM Walpole	28/11/2002	Written statement
Mr Greg Hodgson	Forest products Commission Manjimup	20/11/2002	Written statement
Mr Andrew Mitton	DCLM Manjimup Spotter pilot	22/11/2002	Conversation at Manjimup.
Mr Gavin Smith	Captain, Denbarker Volunteer Bush Fire Brigade	19/11/2002	Conversation on-site at Loc. 52
Mr Brad Martin	Compliance and Fire Officer, Shire of Plantagenet	19/11/2002	Conversation on-site at Loc. 52
Mr Graham Cook	Loc. 52	19/11/2002	Conversation on-site at Loc. 52
Mr Ralph Carter	Loc. 1899	16/11/2002	Conversation on-site at Loc. 1899
Mr Howard Manning	DCLM Walpole	20/11/02	Telephone conversation
Mr John Fisher	Locs. 51 & 85	19/02/03	Telephone conversation

APPENDIX 2. Statement from Mr Simon Watkin regarding observation of lightning in the vicinity of Spencer Rd during the morning of 15 November 2002.

27/11/2002 08:33

+61-8-9840-1251

CALM WALPOLE

PAGE 02/02

Appendix 2

25-11-02

RE: Lightning Denbarker area 15/11/02.

Lachlan,

I was driving to Perth via the Mount Baker road at approx 7.00 - ~~7.15~~ 0730 and noticed bolt lightning approx 20 km north of my position (5-10 km North of Denmark on the Denbarker Road) & the lightning appeared to be around Ref JH 149 Loc 2172.

Upon passing ~~Ref~~ loc 2172, I noticed a fire developing over the ~~other~~ Eastern side of the Denbarker road. I could not see flames, because it was on the Eastern side of a ridge but could definitely see heat haze and smoke coming from that area.

Regards

Simon Watkin

27/11 '02 WED 08:44 [TX/RX NO 6718]

APPENDIX 3. Extracts from the Frankland District fire log book relating to fire activity in Sheepwash and Redmond areas on 14 and 15 November 2002. Map references are specified using the DCLM alphanumeric grid system. Three entries from the original log book recorded at 1121 hrs, 1145 hrs and 1202 hrs have not been reproduced here because they were respectively incorrect, duplicate or non-specific. Blank entry fields in the original log are shown as *n.r.*

Date	From	Time recv'd	Map reference	Tenure	Area (ha)	Attent. requ'd	Action required/taken
14 Nov	Spotter	1210	JN15184	NP	<0.01	No	Crew on site.
	Spotter	1213	JN15249	NP	3	No	Crew on site.
	Spotter	1218	JH15114	NP	4	No	Crew on site.
	Spotter	1218	JH15147	NP	2	No	Crew on site.
	Spotter	1226	JO14705	NP	1	Yes	Checked by Frankland 30
	Spotter	1456	JL14813	NP	8	No	None
15 Nov	Spotter	1055	JO14662	NP	70	Yes	Fire 5 declared.
	Spotter	1105	JT15144	NP	25	Yes	Fire 2 at Redmond block.
	N.Bentink 98481524	1105	<i>n.r.</i>	<i>n.r.</i>	<i>n.r.</i>	<i>n.r.</i>	Report of Fire 5 from Loc. 6725 Sunny Glen Rd.
	Spotter	1117	JL15150	NP	10	No	None.
	Spotter	1141	JJ15213	NP	<0.01	Yes	Crews to monitor
	Spotter	1146	JH15165	NP	7	Yes	Crews to monitor
	Spotter	1148	JH15171	Loc. 14	<0.01	Yes	<i>n.r.</i>
	Spotter	1150	JH15172	Loc. 14	<0.01	Yes	<i>n.r.</i>
	Spotter	1201	JH15203	Loc. 14	<0.01	Yes	Spot fire in Bluegums. No running fire
	Spotter	1212	JJ14945	Loc.52	5		<i>Log book entry has question marks against action required.</i>
	Spotter	1222	JT14953	<i>n.r.</i>	<i>n.r.</i>	<i>n.r.</i>	Fire 5 – spot fire
	Spotter	1230	JT14953	<i>n.r.</i>	<i>n.r.</i>	<i>n.r.</i>	Fire 5 - headfire
	Spotter	1230	JV15215	<i>n.r.</i>	<i>n.r.</i>	<i>n.r.</i>	Redmond fire – spot in Albany District.
	Spotter	1245	JV15016	<i>n.r.</i>	0.01	Yes	Fire 5 - spot over
	Spotter	1300	JM149 63	<i>n.r.</i>	10	No	Fire 5
	Spotter	1307	JN15246	Loc. 1519	0.2	Yes	Fire 5

APPENDIX 4. Statement and map from Mr Greg Hodgson, Forests Products Commission, in relation to a conversation with Mr John Fischer about fire activity in Sheepwash block adjoining Loc. 85, Spencer Rd.

Appendix 4

StatementFrom: Greg Hodgson (FPC/DCLM)

**Re:Origin of "Spencer Rd sect of Fire 5 Frankland District(Walpole)"
15th November 2002**

The following is an account of discussions G Hodgson had with Mr John Fischer the owner of farmland North, South, East and West of the Hay River on Spencer Road where Fire originated and crossed on Friday 15th November.

During Mop up operations on 17th November at approximately 1145hrs I asked Mr Fischer what had happened on the day of the Fire escapes from the DCLM burn area.(He was actively involved with Mop up on his property and repairing fences burnt in the fire at the time)

Fischer volunteered to show me where he had seen smoke early in the day of the 15th November and where he had pushed up a Smoking heap in the Nature Reserve (Autumn edging area just south of Spencer Rd) and where the fire run had come from inside the burn before it jumped into PP in location 14 "Great Southern Plantations" (4yo Euc globulus plantation) and the South west corner of "Fischers" location 85 **See Map**

I was unable to pursue the discussion any further due to DCLM commitments at Fire 6 at approximately 1210hrs that day however I passed this information onto the District Manager and Fire Investigations unit prior to leaving the District on 19th November 2002.


Greg Hodgson
Forester
Forest Products Commission
Manjimup

08 9777 0913

25th November 2002



Figure 3. Centre Break Rd, showing an area on the north side of the road where the fire had re-burnt through previously edging and spread to the south side of the road.



Figure 4. Centre Break Rd, showing an area directly north from the location of Figure 3 where fire had been active during the morning of 15 November. Note the evidence of high intensity fire behaviour in shrubby fuels at the rear of the photograph.



Figure 5. Centre Break Rd, showing an area north of the location of Figure 3. Blackened areas on the right of the photo indicate where fire has re-burnt through shrub fuels previously burnt at low intensity during edge burning operations. The left side of the photo shows browned shrub foliage remaining from the edge burning.



Figure 6. Centre Break Rd, showing the path of fire spread south of the road from the same location as Figure 3.



Figure 7. West Redmond Rd, looking east across the path of the head-fire. Cleared paddocks on Loc.6636 are visible on the right hand side of the photo behind the road reserve vegetation.



Figure 8. West Redmond Rd, looking east along the northern boundary of the Reed bluegum plantation. Photographed from the north-east corner of Loc 6636. Note defoliated native vegetation in the road verge on the left of the photograph.



Figure 9. West Redmond Rd, view south into Loc.6636 with burnt log piles in the foreground. Brown appearance of pasture is due to heat scorch from the fire.



Figure 10. Reed bluegum plantation, looking south. The patch of remnant native vegetation on the right of the photograph has been ignited by spotfires, and following the west-south-west wind change has spread across the track into the 3-year-old bluegum plantation resulting in defoliation of the first 5 rows of trees. Fire subsequently reverted back to a surface fire burning in sparse litter beneath the plantation, and spread a total distance of about 70 m into the plantation.



Figure 11. West Redmond Rd, looking south into Loc. 6638 across burnt bluegum slash fuel.



Figure 12. Spencer Rd, looking north along the edge of Sheepwash block where it adjoins Loc. 85.



Figure 13. Area of Sheepwash block adjacent to Loc.85 showing blackened ground where the fire of 15 November had re-burnt through the edging done in late autumn 2002. The patch of green shrubs behind Jim Gould (CSIRO) is a section of the autumn-burnt edge that did not re-burn.



Figure 14. View to the south-east from the boundary of Sheepwash block across Loc.85 showing the 35 m wide cleared break in the foreground and the remnant native forest beyond. The Crystal Brook bluegum plantation is beyond the firebreak that is visible in the middle of the photograph, and is about 170 m from the point where the photograph was taken.



Figure 15. Light surface fuel of litter, bracken and clover ignited by a spot-fire that landed in the Crystal Brook bluegum plantation.



Figure 16. East side of the Hay River on Loc. 1899, showing the remains of the wood and iron house burnt on 15 November 2002. The photograph is looking west back towards the river. The grass surrounding the house was uncured at the time of the fire.



Figure 17. East side of the Hay River on Loc. 1899, looking south-west back towards the river. Note the green grass in the paddocks and the numerous piles of smouldering logs that appear to have been ignited by firebrands.



Figure 18. Loc. 1899, looking south-west back into the channel of the Hay River. The blackened grass in the foreground has been dried out by the heat from the fire and then burnt.



Figure 19. Forest along the Hay River defoliated by high intensity fire.