



Queensland

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The first part of this chapter provides **contextual information** on Queensland, including basic information about its climate, geography, land use and population. It also provides an outline of the bushfire regimes, historically important bushfire events, and overview of fire services in Queensland. The second part represents an **analysis of data** provided by the Queensland Fires and Rescue Service, Forestry Plantations Queensland and Queensland Parks and Wildlife. Although some agencies may attend many types of fire incidents, and that data may have been supplied, this analysis exclusively refers to vegetation fires only, unless otherwise indicated.

For an explanation of the key terms, limitations and methodology refer to the introduction, glossary and methodology chapters.

Introduction

Covering an area of 1,722,000 square kilometres, Queensland is the second largest state in Australia, after Western Australia. It is located in the northeast of mainland Australia, and is bordered by the Northern Territory and South Australia in the west and New South Wales in the south. To the north lie the Coral Sea and the Pacific Ocean.

Geography

Queensland is geographically diverse. More than 2,000 km of its 7,400 km of coastline is laced with coral reefs (Figure 1). The Great Dividing Range extends from the state's southern border with New South Wales to almost its northern tip on Cape York Peninsula. The range reaches a maximum of 1,622 m at Mount Bartle Frere southwest of Cairns and forms an important climatic and geographical barrier.

Rainfall in southern Queensland, inland of the range, feeds into the extensive Murray–Darling River system, which drains through New South Wales and Victoria, before reaching the sea in South Australia. The Outback region of Queensland is characterised by vast open and largely inhospitable plains; closer to the range, where soils are more fertile and rainfall more predictable, there are vast areas of agriculture, mainly livestock and cereal production.

The northwest contains rugged uplands rich in mineral deposits. From there the land falls gently to the coastal plain. Broad tracts of salt flats mark the area around the Gulf of Carpentaria; and a narrow coastal plain runs along the entire eastern seaboard. Brisbane, the capital, is located in the southeastern corner of the state.

Figure 1: Map of Queensland



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Climate

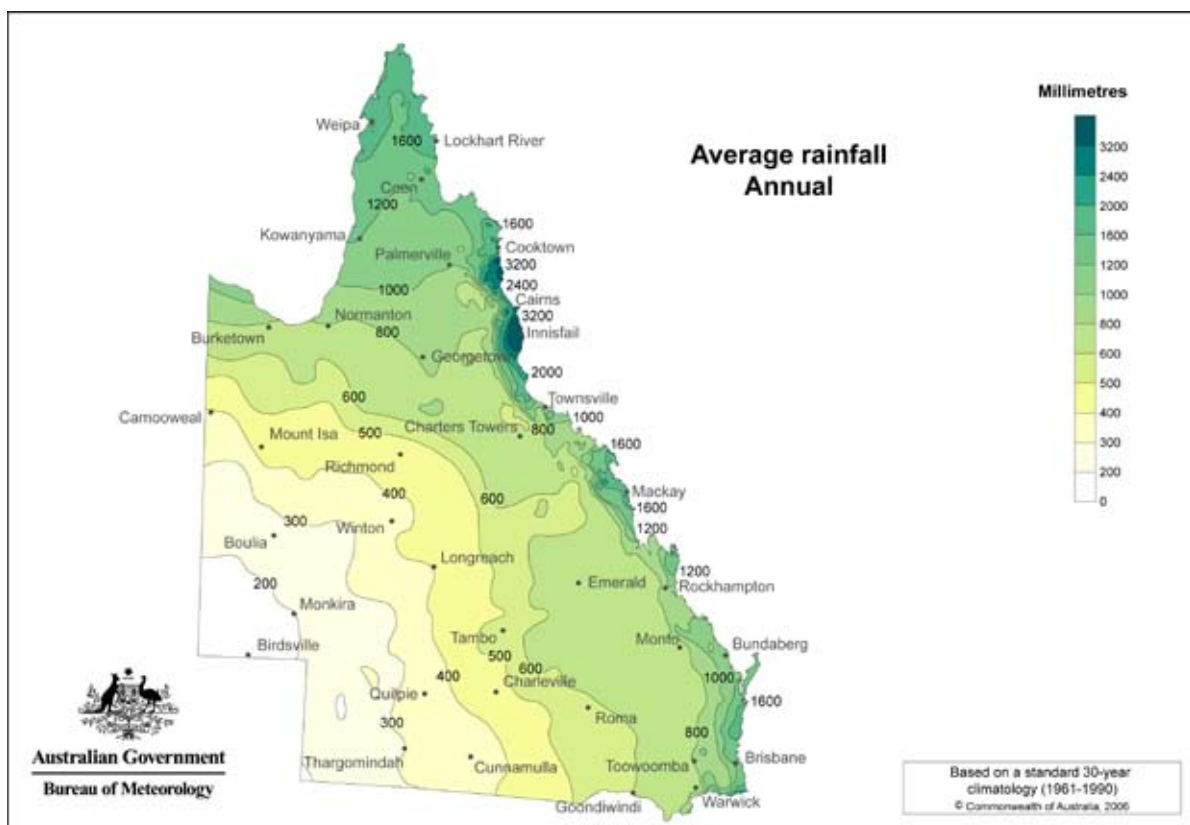
Queensland's climate is warm year round, with two main seasons; a dry winter, during which temperatures are commonly slightly lower than the rest of the year, and a hot humid summer. The lowest average maximum temperatures in summer occur along the east coast and ranges (January, 24 to 30°C). The minimum night-time temperatures in coastal areas decrease southwards, but no systematic differences occur in average daily maximum temperatures. Average daily summer temperatures increase inland, with more than one-third of Queensland recording average daily maximum temperature in January greater than 36°C. Average minimum night-time temperatures during January in inland Queensland are typically 21 to 27°C (Australian Bureau of Meteorology 2007a).

Average winter minimum temperatures increase northwards and decrease inland. Average daily maximum and minimum temperatures in Brisbane (southeast coast) in July are 18 to 21°C and 9 to 12°C, respectively. In contrast, minimum daily temperatures in northern Queensland in June typically exceed 15°C, and maximum daily temperatures commonly exceed 27°C (Australian Bureau of Meteorology 2007a).

Rainfall is highly variable across the state, ranging from greater than 3,200 mm on the northeast coast to less than 200 mm in the southwest of the state (Figure 2). Annual rainfall on the coast and ranges typically exceeds 800 mm, whereas areas just west of the ranges typically records 500 to 800 mm per annum (Australian Bureau of Meteorology 2007b).

Much of northern Queensland is dominated by monsoonal rainfall; that is, rainfall is concentrated within a distinct wet season, with little rain falling during the dry season. However, restricted areas of the northeastern coast experience copious rainfall all year round. Southern Queensland also tends to experience maximum rainfalls in summer, but there is little distinction between seasons. For example, there is sufficient winter rainfall to support the winter cropping of wheat. Rainfall extremes are not uncommon, with many regions being subject to both extremes of drought and flood because rainfall is commonly linked with the movement of low-pressure systems and tropical cyclones across the northern part of the state. Risk of damage from tropical cyclones is high in the northern part of the state.

Figure 2: Average annual rainfall for Queensland

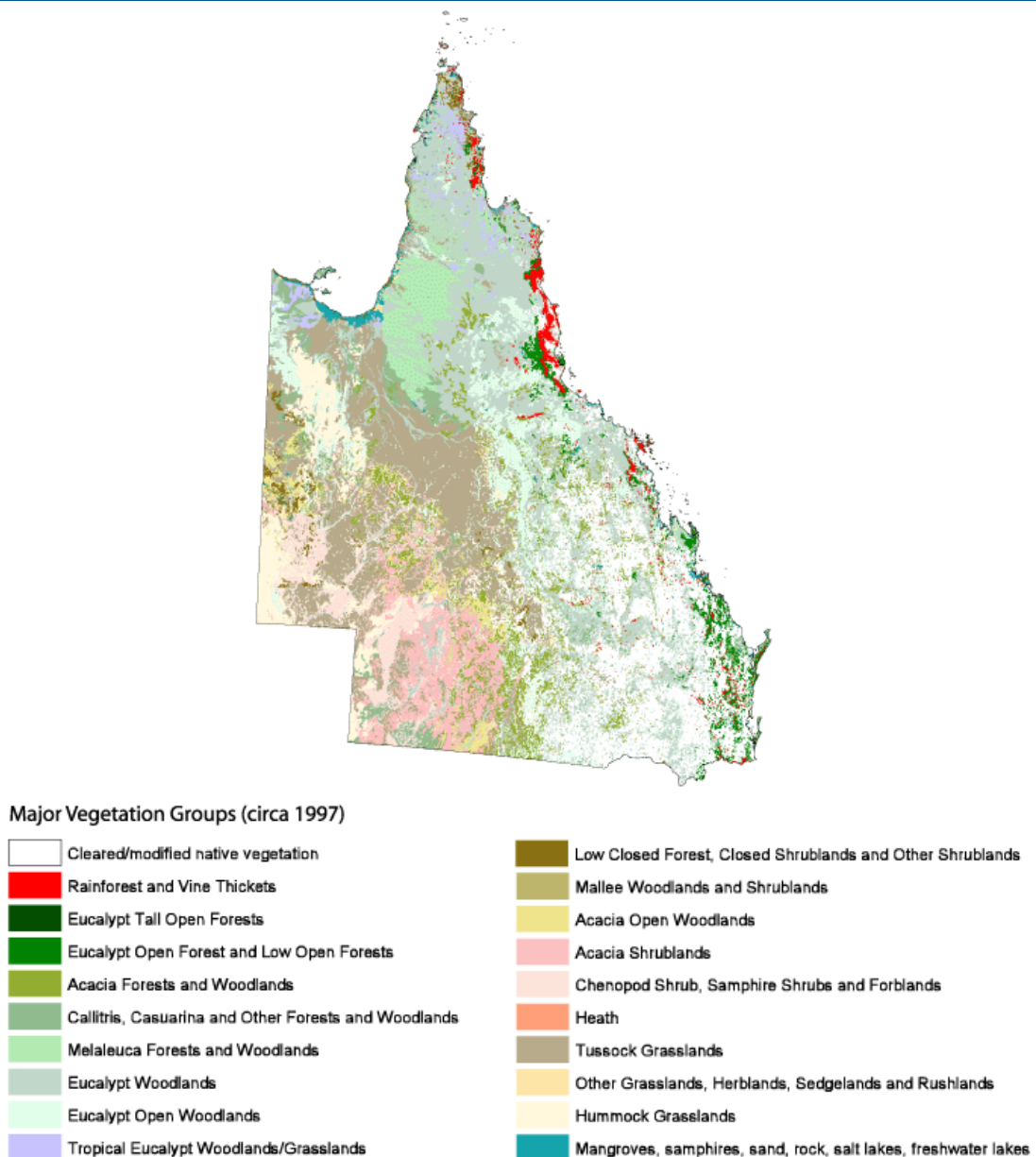


Source: Australian Bureau of Meteorology 2007b
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Native vegetation

Vegetation in Queensland is highly diverse, reflecting the great variety of climatic conditions experienced across the state. Coastal areas are mainly covered by eucalyptus open forest and woodland, with pockets of tropical and subtropical rainforests scattered in coastal and near-coastal valleys and ranges (Figure 3). Farther inland, acacia low woodlands of brigalow, mulga, and gidgee dominate, with grasslands occurring on heavier soils. The arid interior is sparsely vegetated with large areas being dominated by tough, spiky, tussocky spinifex grass, chenopod shrub (saltbush and bluebush), samphire shrublands (low shrubland of salt tolerant species) and other grasslands. Much of northern Queensland falls within the broad swathe of tropical and, to a lesser extent, equatorial savannas that extends across northern Australia (Australia. Department of Environment and Heritage 2001b).

Figure 3: Native vegetation groups (c. 1997)



Source: Australia. Department of Environment and Heritage 2001b
 © Department of Environment and Heritage

Land use

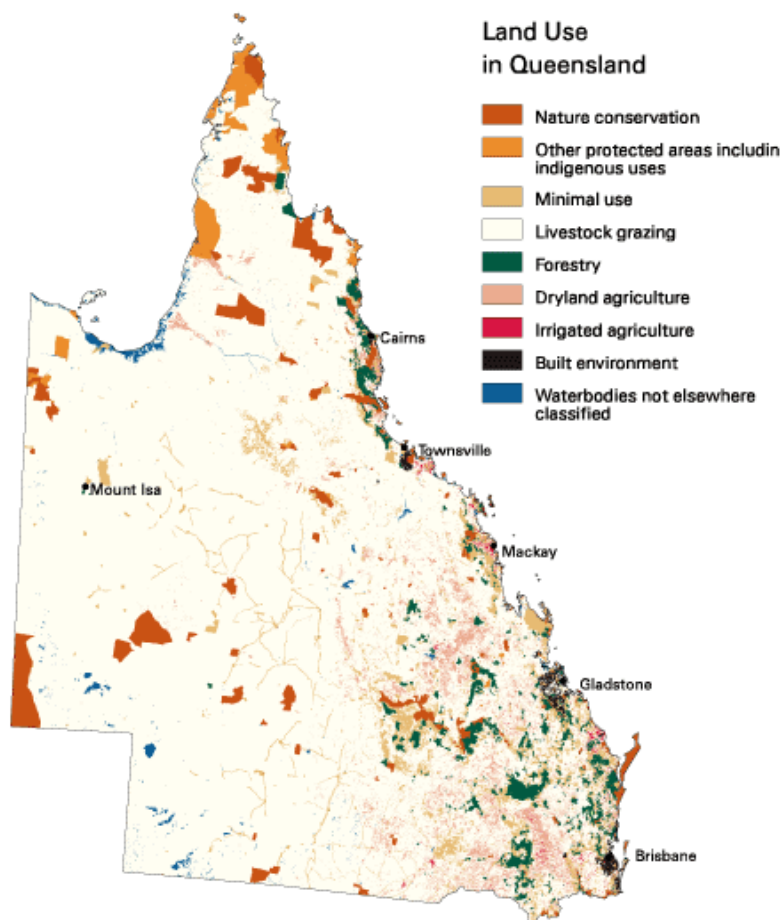
Collectively, 96 percent of Queensland is used for agriculture. As of 1996–97 almost 82 percent of Queensland was used for livestock grazing, with Queensland being the leading beef-producing state of Australia. The state is also Australia’s main producer of sugar cane (coastal regions), and a wide variety of cereal crops, citrus, tropical and exotic fruits and vegetables. Dryland agriculture principally occurs on the mountain ranges and coastal plain in the southern half of the state (Figure 4).

In 1996–97, three percent of the state was devoted to forestry, with another four percent being reserved for nature conservation. Since then complex changes in land management have resulted in substantial, but ongoing transfers between various land management agencies, making it difficult to specifically state the areas under conservation and forestry at any given time. Although the 1996–97 figures do not accurately reflect the current status of tenure or land use, collectively the area devoted to forestry and conservation combined are not markedly changed since then.

In addition, there are several large protected areas, including Indigenous use areas, many of which lie on the Cape York Peninsula. As well, 9.7 million hectares of land are of minimal use, three-quarters of which consists of remnant native vegetation cover on private land.

Other major industries in Queensland include mining (coal, copper, lead, bauxite and zinc) and tourism (Australia. Department of Environment and Heritage 2001a).

Figure 4: Land use (c. 1996–97)



Source: Australia. Department of Environment and Heritage 2001a
 © Department of Environment and Heritage

Population

The resident population of Queensland as at 30 June 2006 was 4,053,400, with Queensland accounting for 19.7 percent of Australia's population (ABS 2006a). The majority of the population lives in urban areas in the southeast corner, with approximately two-thirds living in the statistical divisions of Brisbane and Moreton. The population in southeast Queensland is among the fastest growing of any region in Australia. Other major regional centres outside the southeast of the state include Cairns, Townsville, Mackay, Rockhampton, Bundaberg, Toowoomba, and Mount Isa (ABS 2005a).

As at 30 June 2005, the median age of Queensland's population was 35.9 years, marginally lower than the national value of 36.6 years. However, the age distributions of the population were variable at local scales. Excluding statistical local areas with less than 2,000 people, 13 statistical local areas had a median age over 45 years. Of these, eight were in the Moreton statistical division in southeastern Queensland, three were in the Brisbane statistical division, and one each were recorded in the Wide Bay–Burnett and Fitzroy statistical divisions. Fifteen statistical local areas had a median age of less than 30 years, of which six were in the Brisbane statistical division (generally close to higher educational institutions). Another six were in the Northern statistical division, principally around Townsville (ABS 2005a).

As at 30 June 2005, 20.4 percent of the state's population was aged 0 to 14 years. The highest proportions of people within the age group occurred in the North West (26.0%) and South West (23.6%) statistical divisions; the lowest were in the Moreton (18.9%) and Brisbane (20.0%) statistical divisions (ABS 2005a).

Bushfire regimes

Subtle variations in the timing of the bushfire season occur across Queensland (Figure 5). In southeastern and central Queensland, bushfires typically occur during dry spring conditions. In the tropical savannas, bushfires typically occur during the dry season (winter and spring), although the exact timing may vary with latitude and distance from the coast.

Fire regimes also vary enormously across the state in terms of both size and frequency. The tropical savannas of northern Queensland are characterised by frequent large burns, with human beings playing a central role in determining the fire regions. Commonly one-third of the savannas are burned every year. Although intense, hot fires are not unknown, many savanna fires are of low intensity, and will less commonly result in loss of property or injury.

In contrast, subtropical and tropical rainforests along the east coast are extremely sensitive to fire, and a bushfire in these regions may have disastrous consequences for biodiversity. Between these extremes lie the acacia scrublands and woodlands of southern central Queensland and eucalypt open forests on the coastal plains and ranges, which do experience bushfires, but less frequently than the savannas.

Given differences in size, intensity, frequency, potential damage, environmental impacts and cause of fires, some caution is needed in attempting to integrate bushfire data from these various regions. For example, a 10,000 ha fire in Cape York's tropical savannas would be essentially negligible in terms of the total area burned in a year and is unlikely to pose a high risk to the inherently sparse population. Indeed, there may be no attempt to suppress the fire as it would either pose no problem or may be considered beneficial to maintaining the area's biodiversity. By contrast, an equivalent fire in eucalypt forests in the southeast may result in loss of life and property and great efforts are therefore likely to be devoted to its suppression.

The nature and burning practices that occur in the tropical savannas are unique. Readers unfamiliar with this topic are encouraged to read the introduction for the Northern Territory, before proceeding with the Queensland analysis.

Figure 5: Timing of bushfire seasons in Australia



Source: Australian Bureau of Meteorology 2007c
 © Australian Bureau of Meteorology

Bushfire history

Although Queensland is typically a state that sustains greater losses from cyclones and floods than from bushfires, it has experienced several devastating bushfires that have resulted in loss of life and property; as well as very large areas that were burned without extensive loss of life or property (Table 1). The 2002–03 season is discussed in detail below.

2002–03: Collectively, 2,780 bushfires occurred in Queensland during 2002–03, burning 8 million ha of land. Between 16 and 29 October 2002, three major fires broke out the Stanthorpe district (Ballandean), the Toowoomba Range and Tara (west of Dalby). The Ballandean fire, which resulted from the arcing of overhead power lines, burned 18,500 ha, was responsible for the death of one person, destroyed four houses and caused \$6.5 million in damages. The Toowoomba Range fire started at a railway siding near Mount Kynoch. The two resulting fire fronts burned 18,000 ha in rugged country, on the urban fringe, and in low-density urban areas. Approximately 1,000 people were evacuated; 10 structures were destroyed and a further 20 were damaged. The Tara fire resulted when an existing fire broke containment lines and moved rapidly toward residential areas; another fire in the area was thought to be deliberately lit. Collectively, the Tara fires burned 3,350 ha. Several hundred people were evacuated, and six homes were destroyed (Ellis, Kanowski & Whelan 2004).

Table 1: Fire history of Queensland

Date	No. of deaths	Area of fire (ha)	Losses	Location(s)
1917	3			Large fires near Hughenden, followed by a fire on Warenda Station
1918 October	2		>100,000 sheep	Fires spread over a huge area from Charleville to Blackall, Barcardine, Hughenden
1918 October	5			Saltern Creek
1926			Forests, farms, sugar cane, banana plantations and dwellings	Southeast corner of Queensland
1940		80,000		Goomeri
1941 July, August		120,000		Julia Creek and Barkly Tableland, Richmond and Cunnamulla
1941 September				Tangorin, Winton, St George, Dalby, Julia Creek, Muttaborra, Longreach
1943		45,000		Dirranbandi
1950 December		49,000	Mostly pasture	Wyandra, Charleville, Adavale, Langlo, Quilpie, Augathella, Cunnamulla, Thargomindah
1951 January, February		2,834,000	40,000 sheep, 550 stock, 650 km fencing	Charleville
1951–52 season			£2 million (1952 values) in stock and fencing	This was regarded as a bad fire season throughout the state
1954 November	3			Narollah Station, Hughenden area
1964–65 season		92,000	Cypress pine, grazing land, hardwood forest	Roundstone, Dunmore, Fraser Island, Toolara, Tin Can Bay, Badderam Holding
1965 November		97,940		Nara Holding (Croydon district)
1972–73 season		2,000	100 cattle	Arcadia Valley
1974 October to 1975 February		7,300,000	95 cattle, 6,850 sheep	Thargomindah, Bulloo Shire, Boulia Urandangie, McKinlay Shire
1976 May to December		1,891,600	5 km fencing, 5,968 sheep, 32 properties, cypress pine forests	Julia Creek, Coalbrook Station, Hughenden, South Burnett, Nanango and Brisbane Valley, Inglewood–Millmerran
1979		421,400	41,000 sheep, 400 cattle	Julia Creek, McKinlay Shire
1990–91 season	3			Two children killed in a fire in Tambo; Bald Knob, Landsborough, Mapleton, Palmwoods (Sunshine Coast hinterland)
1991–92 season	1		3 houses	Mount Tamborine (Gold Coast hinterland)
1992–93 season		40,000	4 houses, several vehicles	Coominya rural residential area near Esk
1994 September, November		5000	Plantation timber (\$35 million)	Beerburum State Forest
1995 September, November		333,000	9 volunteers severely injured, 23 houses, 93 buildings, fences, livestock	Southeast Queensland
1996 October			1 house (Ravensbourne)	Southeast Queensland
2000 August			1 volunteer severely burned, 3 buildings, 3 vehicles	Hundreds of bushfires in southeast (majority deliberately lit)
2001		1,600,000	National park, grazing land	Lawn Hill
2002 October	1	40,000	10 houses, 11 buildings, 30 structures destroyed or damaged	Stanthorpe District, Toowoomba Range, Tara

Source: Ellis, Kanowski & Whelan 2004

Fire services

Three major agencies provide fire services in Queensland. They are the Queensland Fire and Rescue Service, Forestry Plantations Queensland and the Queensland Parks and Wildlife Service.

The **Queensland Fire and Rescue Service** (QFRS) incorporates two distinct arms that operate in largely urban and rural areas respectively. The QFRS employs full-time and part-time (auxiliary) firefighters to staff more than 240 urban fire and rescue stations across Queensland. This arm of the QFRS responds to fires in homes, buildings, vehicles and on the land, but also performs rescues, chemical and hazardous material management, among other tasks. It provides fire and rescue services to the majority of Queensland's population. The Queensland Rural Fire Service (QRFS) is a distinct body within the QFRS that provides fire services in the remaining 93 percent of the state. As the name implies, the QRFS's jurisdiction is principally within regional, rural and remote areas, where the population density is comparatively low. There are about 1,550 rural fire brigades, with approximately 41,000 volunteers, and a warden network of 2,445. Although its jurisdiction lies outside that covered by land management agencies, the QFRS (including the QRFS) will attend fires in those areas and vice versa. For more information about the QFRS see <http://www.fire.qld.gov.au>.

Forestry Plantations Queensland (FPQ) is responsible for hazard-reduction and fire-response capability for the forests under its management. As at 30 June 1988, Queensland had approximately 4.5 million hectares of state forest and timber reserves. This included about 165,000 ha of plantations of which 99 percent were softwoods; the remainder was native forest. Of this, 20 percent was rainforest and not a fire hazard. The name, structure and jurisdiction of the FPQ have changed many times in the last 30 years. In 1989 Forestry became a commercial business unit within the Department of Primary Industries. Two name changes followed: in 2006, forestry (principally forestry plantations) came under the control of Forestry Plantations Queensland, a state government owned corporation. In addition to the name changes, several tenure transfers and realignments have affected the lands that fell within these various organisational jurisdictions, namely:

- in 1989, 899,000 ha of 'wet tropics' was World Heritage listed; of this, 80 percent was rainforest, but the remainder was subject to fire
- around 1992, 163,000 ha on Fraser Island was also World Heritage listed; the majority of this is eucalypt forest
- under the South East Queensland Regional Forests Agreement (December 1999), much of the native forest in State Forests became Forest Reserve (conservation status), passing directly into Environmental Protection Agency (Queensland Parks and Wildlife Service) control. Most of the remainder was/is proposed for one logging after which it reverts to National Parks and Wildlife, as State Forest Reserve. The native forests that have been set aside for logging are now managed by Natural Resources and Water (Forest Products).

Small areas of native forests are included within the boundaries of State Forest Plantations, managed by FPQ. These native forests commonly occur along watercourses and other environment buffers, or as an external strip adjacent to the plantations, and provide fire protection buffers for plantations. For more information about Forestry Plantations Queensland see <http://www.fpq.qld.gov.au/asp/index.asp>.

Queensland Parks and Wildlife Service (QPWS), which falls under the umbrella of the Environmental Protection Agency, now provides fire management for an estate of nearly 12 million ha. These lands are principally protected areas such as national parks and a considerable area of state forest under joint management with commercial forest agencies. QPWS fire management includes a considerable involvement in planned burning for ecological and hazard reduction purposes and wildfire response. The most significant changes in the land tenure and management portfolios have occurred subsequent to the South East Queensland Regional Forests Agreement. Before 1975, the Department of Forestry managed

about four million hectares of forestry reserves and one million hectares of national parks. As noted, these lands are now managed by three agencies, the QPWS, FPQ and the Natural Resources and Water, Forest Products Branch. The lands under QPWS jurisdiction have expanded by 11 million hectares since 1975. For more information about QPWS see <http://www.epa.qld.gov.au>.

Several **other agencies** are also responsible for fire management in Queensland. The structure of responsibilities for fire management in Queensland, as at May 2000, is broadly outlined in Table 2. The South East Queensland Regional Forests Agreement has also had an impact on the role of the Queensland Department of Natural Resources, now the Department of Natural Resources and Water (DNRW).

The analysis of Queensland fires was restricted to data derived from the QFRS, FPQ and QPWS. It is recognised that the DNRW and other agencies listed in Table 2 may also hold fire statistics, but these are not included within this analysis. It is also recognised that more than one agency may attend the same fires, and hence will be duplicated across those databases. No attempt has been made to identify such duplications.

Table 2: Agencies responsible for fire management in Queensland (c. May 2000)

Agency	Fire management responsibility on public lands
Local government	Public lands for which local government is trustee (road reserves, parks and recreation reserves, water reserves, etc.)
EPA ^a	Protected areas
DNR ^a	Unallocated state land and unmanaged reserves
DoT ^a	Transport corridors
DPI (FS) ^a	State forests and timber reserves
QFS ^a	Urban areas
Landholders	Freehold land and leasehold land for which they are responsible

a: EPA – Environmental Protection Agency (includes Queensland Parks and Wildlife Service); DNR – Department of Natural Resources; DoT – Department of Transport (Q-Rail and Roads); DPI (FS) – Department of Primary Industries (Forest Service); QFS (now QFRS)

Source: Queensland Department of Natural Resources and Water 2000

Queensland Fire and Rescue Service analysis

Background about the QFRS dataset and its analysis

Important information about the QFRS dataset and the methodology employed to analyse it is summarised as:

- Data were sourced from Australasian Fire Authorities Council (AFAC).
- The database included data from 1997–98 to 2001–02. However, although the QFRS introduced the AIRS system in 1997–98, full incident reporting was not in place for several years. Moreover, this dataset only included fires reported by urban stations; the reporting of fires within the AIRS database, by volunteers in rural areas (QRFS), is voluntary.
- The data were classified using Australian Incident Reporting System (AIRS) classification codes.
- The dataset provided included fires of all causes (structural, vehicle, vegetation and other). Only vegetation fires (AIRS wildfires; Type of Incident code 160 to 179) were analysed. Hence, all references to fire refer to vegetation fires, and do not include other fire categories.
- The cause of fires was defined using the ignition factor variable.

- Deliberate fires include all fires classified as incendiary (AIRS ignition factor code 110 or 120) or suspicious (AIRS ignition factor code 210 or 220).
- Natural vegetation fires refer to all fires where the ignition factor codes were 800 to 890, which incorporate any fire resulting from a natural condition or event. For the QFRS, the breakdown of specific causes of natural fires was: high wind 52.6 percent, lightning 21.3 percent, high water (including flood) 0.4 percent, and any other natural condition (not classified [NC]/insufficient information to classify further [IO]) 25.6 percent.
- The dataset included the form of heat ignition variable.
- Smoking-related fires were classified based on: 'Form of heat of ignition' = 'Heat from smokers' materials' (AIRS codes 300 to 390). The cause of smoking-related fires was 75 percent accidental, three percent incendiary, nine percent suspicious, and nine percent unknown.
- All fires started by children were identified within the database as resulting from children playing and were therefore considered non-deliberate or accidental. No information was available about the number of malicious fires children started, as these fires were classified as incendiary or suspicious, and cannot be delineated from other fires included within these categories.
- The database included information about 'type of incident'.
- Regions used in the QFRS analysis are based on ABS (2005b) tourism regions. However, there is not an exact correspondence between tourism regions used in this analysis and ABS tourism regions. In this study, assignment was based on the highest levels of concordance between postcodes and tourism regions, but ABS tourism regions are constructed from smaller statistical areas that potentially crosscut suburban and postcode boundaries.
- Statistical region sectors were used to examine the distribution of fires in southeast Queensland. The ABS defines statistical region sectors using a subset of neighbouring statistical local areas. While this report follows the ABS guidelines in generating statistical region sectors and uses ABS' terminology for them (ABS 2001a), fundamental differences exist between the sectors used in this report and those the ABS uses. Notably, in this analysis statistical region sectors were generated from SLA, which themselves were generated from the highest levels of concordance between postal areas and statistical local areas, using the ABS *Postal area to statistical local area concordance* (ABS 2001b). However, the ABS statistical local areas commonly crosscut postal areas and postcodes.
- The dataset supplied included information pertaining to the area burned.
- Information was available about the bushfire danger in approximately one-quarter of cases.

For more detail about these methodologies see the methodology chapter.

Note: All references to QFRS data in this report, and any conclusions drawn, relate only to data from urban-based stations and cannot be considered representative of QFRS vegetation fires overall.

Overview

Fires the QFRS attended can be summarised as:

- The QFRS (urban stations only) attended 45,525 fires from 1997–98 to 2001–02, representing an average of 9,105 (SD=2,831) per year. The total number of vegetation fires recorded in any one year varied between a low of 5,352 in 1998–99 and a high of 12,400 in 2000–01 and 2001–02 (Figure 6). The increase in the frequency of vegetation fires may not reflect genuine changes in fire frequency, as there was likely some lag between the introduction of AIRS in 1997 and full incident reporting within that system (QFRS personal communication 2005).

- Thirty percent of fires were small vegetation fires (generally less than one ha), with a further 30 percent grass fires, and 33 percent scrub, bush and grass mixed fires. Only one percent comprised forest or wood fires greater than one ha.
- Causal attributions were only made in 21 percent of cases. Of these, eight percent were incendiary, with a further 37 percent regarded as suspicious. Hence, deliberate causes comprised 45 percent of 'known' causal attributions.
- Approximately half of all fires urban fire services attended in Queensland occurred in the Brisbane region.
- A total of 2,166,640 ha were burned in fires attended from 1997–98 to 2001–02. Fires of known causes accounted for 19 percent of the total area burned. Incendiary fires accounted for 1.6 percent and suspicious fires 9.7 percent of the area burned by fires of known causes.

Cause

The proportion of fires of 'known' cause was low, only being assigned in 20.7 percent of cases (Figure 6). Hence, the documented cases of deliberate lighting (incendiary and suspicious causes combined) were also low, with deliberate causes being assigned to 9.2 percent of all vegetation fires attended.

Of those cases where causal attributions were made, 7.8 percent were identified as incendiary, and 37 percent were regarded as suspicious (Figure 7). A further 37 percent of attributed fires resulted from accidental causes and 3.9 percent from natural ignitions. Although some caution is needed in extrapolating these results to the entire dataset in light of the comparatively small proportion of cases where attributions were made, 45 percent of all 'known' attributions were classified as deliberate. This is comparable to the rates FPQ and QPWS reported as well as by agencies from other Australian states and territories.

The percentage of vegetation fires that were documented as having resulted from deliberate causes dropped from 14 to 16 percent in 1997–98 and 1998–99 to 7 to 9 percent from 1999–2000 to 2001–02. Although this in part reflects the greater proportions of fires of unknown causes, the percentage of fires of 'known' cause that were classified as deliberate also decreased. Notably, deliberate causes accounted for 51 to 53 percent of known causes in 1997–98 and 1998–99 but only 37 to 44 percent from 1999–2000 to 2001–02 (Figure 6).

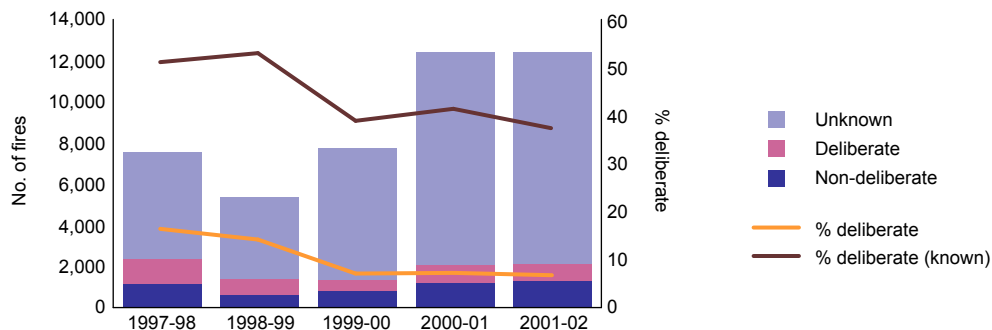
Specific ignition factors

Form of heat of ignition: The heat source contributing to ignition was identified for 16.8 percent of all vegetation fires (all causes). Of these, most resulted from the use of an open flame (Figure 8), principally matches (59% of the open flame category), followed by burn offs (13% of open flame category) and cigarette lighters (9% of open flame category). Fires started by cigarette lighters were likely under-represented owing to the lower probability of detection. Other important forms of heat of ignition included smoking-related materials (12% of known) and hot object or friction (8% of known).

Differences exist in the proportion of known attributions and types of heat of ignition responsible for deliberate and non-deliberate fires. The form of form of heat of ignition was identified for 83 percent of non-deliberate vegetation fires, but only 45 percent of deliberate vegetation fires. Approximately 90 percent of deliberate fires, where the form of heat of ignition was identified, resulted from the use of open flame/spark (Figure 9). In contrast an open flame or spark was only responsible for 52 percent of non-deliberate fires where the form of heat of ignition was identified. This reflects the greater diversity in the types of heat of ignition responsible for non-deliberate fires. Approximately 16 percent of all non-deliberate fires were smoking-related. Smaller numbers of non-deliberate vegetation fires resulted from a

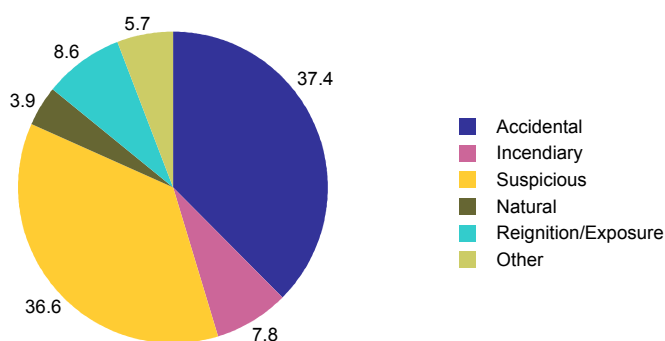
hot object or friction, hostile fires, from fuel-powered machinery, and electrical equipment. There were 10 recorded cases of where an incendiary device was identified as being responsible for a deliberate ignition.

Figure 6: Cause of fires by year



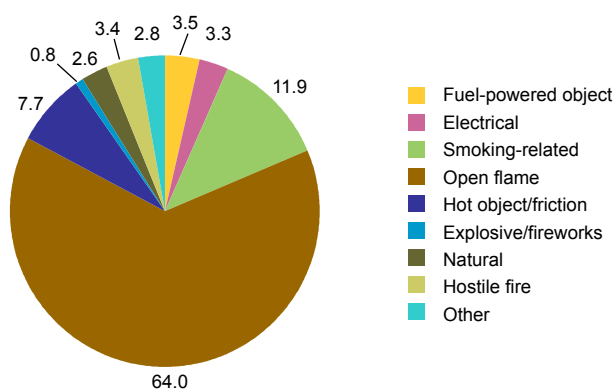
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 7: Cause of fire where 'known' (percent)



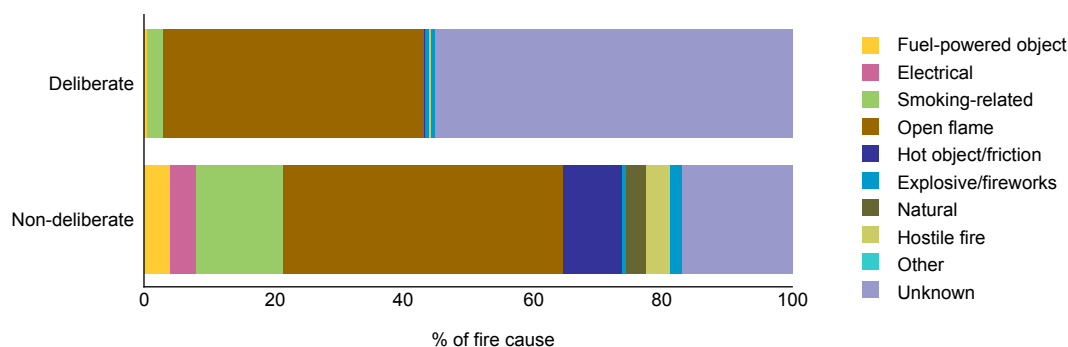
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 8: Form of heat of ignition where known^a (percent)



a: form of heat of ignition known in 16.8 percent of cases

Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 9: Form of heat of ignition for deliberate and non-deliberate causes

Source: QFRS 1997–98 to 2001–02 [computer file]

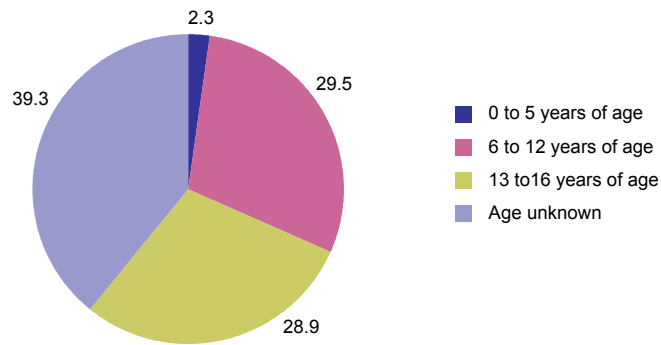
Fires started by children: In this study all fires identified as having been lit by children aged 16 years or under were non-deliberate (accidental in origin). It is impossible to ascertain the number of fires deliberately lit by children as fires lit maliciously by children are classified as incendiary or suspicious and cannot be delineated from other fires within those categories.

Children aged 16 years or younger were recorded as starting 1,089 non-deliberate vegetation fires in the reporting period. This represented 2.4 percent of all vegetation fires the QFRS documented, but 12 percent of instances where the ignition factor (cause) was assigned. Only a small fraction of non-deliberate child fires resulted from fire-play or experimentation by children 5 years of age or younger. The vast majority of non-deliberate child fires were started by 6 to 12 year olds (30%) and 13 to 16 year olds (29%) (Figure 10). The age of the children thought responsible was unknown in 39 percent of cases.

The greatest number of non-deliberate child fires occurred in 2000–01 and to a lesser extent 2001–02 (Figure 11), coinciding with greatest number of vegetation fires generally. Overall there was an excellent correlation between the numbers of non-deliberate vegetation fires lit by children and total fire numbers in any one season ($r=0.99$; $p<.001$). This means that although the actual frequencies varied, the proportion of fires children started remained comparatively constant across years. Fires attributed to children accounted for between 2.2 and 2.6 percent of all fires in any given year (Figure 11).

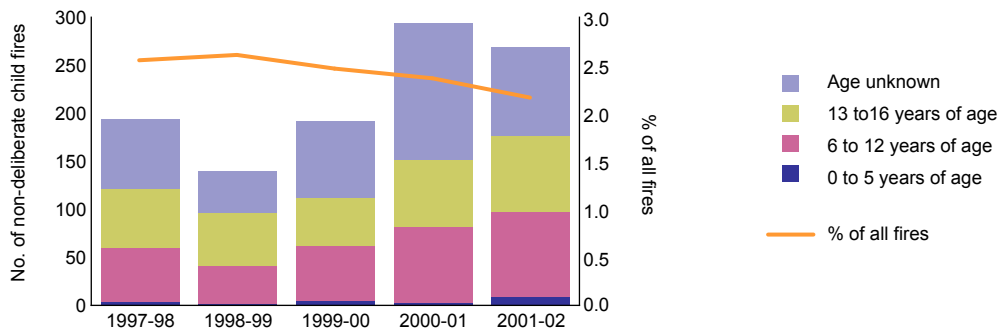
Of those non-deliberate fires attributed to children, 87 percent resulted from misuse of heat of ignition; the remainder was the result of misuse of materials ignited. The overwhelming majority resulted from the heat from an open-flame spark, irrespective of age (Figure 12). Of these, matches were the most common source of heat documented, followed by lighters, with lesser contributions from other causes (Figure 13). There was a tendency for the proportion of fires resulting from matches to increase with age. Overall, more complex forms of heat of ignition arose as the age of children increased.

Figure 10: Non-deliberate child fires by age



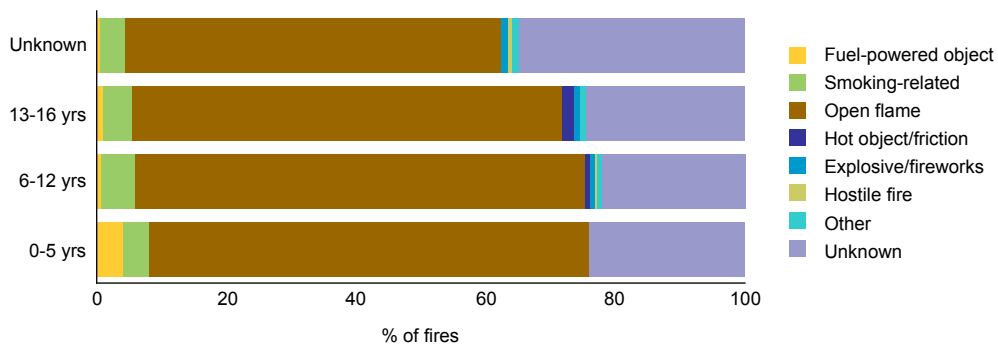
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 11: Non-deliberate child vegetation fires by age and year



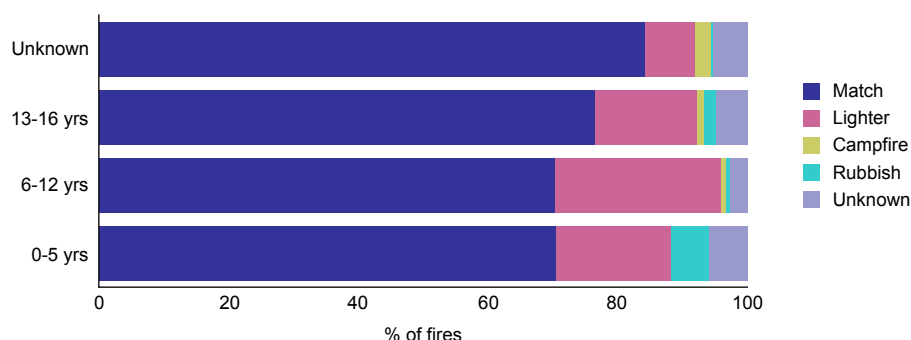
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 12: Form of heat of ignition by age (percent)



Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 13: Form of heat of ignition by age for cases involving an open flame or spark (percent)

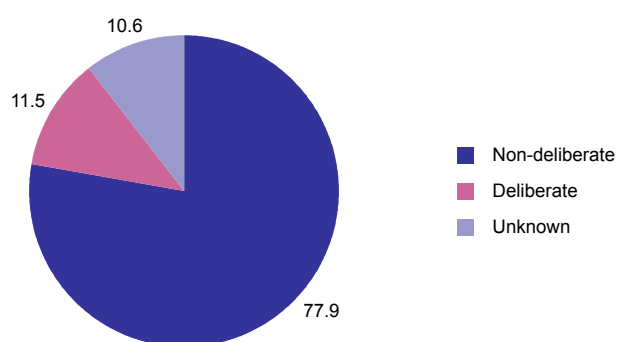


Source: QFRS 1997–98 to 2001–02 [computer file]

Smoking-related fires: The data show that smoking-related materials started 909 fires in the five-year interval, accounting for only two percent of all vegetation fires QFRS attended but 12 percent of cases where the heat of ignition was delineated. In reality the actual figure probably lies somewhere between these two extremes. The lowest rates, based only on those cases where causal attributions were assigned, are likely to underestimate the actual frequency. However, smoking-related fires were likely to have been overrepresented within the ‘known’ causes owing to more readily identifiable physical evidence. Of the 909 smoking-related vegetation fires 70 percent were attributed to cigarettes. Materials other than cigarettes, cigars or pipes were responsible for 44 vegetation fires (6.5 percent of identified smoking-related fires).

As the smoking-related fires the QFRS attended were identified based on the form of heat of ignition variable, these were potentially classified as deliberate, non-deliberate or unknown. Seventy-eight percent of smoking related fires were identified as non-deliberate, 12 percent deliberate and 11 percent unknown (Figure 14).

Figure 14: Classification of smoking-related fires



Source: QFRS 1997–98 to 2001–02 [computer file]

Location

In this section the distribution of QFRS-attended fires is examined on a region scale, and at a postcode level. Additional analysis is conducted on the distribution of fires relative to population densities. Another section examines the types of complexes where vegetation fires most frequently occurred.

Owing to the low levels of causal attribution, this spatial analysis principally focuses on QFRS-attended vegetation fires collectively rather than examining the deliberate vegetation fires in detail. It is reiterated that the QFRS data is restricted to urban areas where a station is staffed by permanent or part-time staff. Hence, this regional analysis represents the number of vegetation fires that occurred in or near major urban centres within each region rather than the total number of vegetation fires that occurred in each region.

Region

The location of regions used in this analysis is outlined in Figure 15.

All vegetation fires: Approximately half of all QFRS (urban) vegetation fires between 1997–98 and 2001–02 occurred within the Brisbane region (Figure 16). A further eight to 10 percent occurred each in the Gold Coast, Fitzroy, Northern and Tropical North Queensland regions.

Deliberate vegetation fires: The highest proportion of deliberate fires was recorded in the Outback (22%) and Hervey Bay–Maryborough (16%) regions (Figure 16). Nevertheless, it is difficult to accurately compare actual rates of deliberate fires across regions or between urban centres, owing to the low (15 to 37 percent) and variable levels of causal attribution.

When calculated as a proportion of ‘known’ causes, high rates of deliberate fires were evident in all regions that recorded a higher number of vegetation fires generally. Sixty-three percent of fires of known cause in the Outback region were deliberate. This compares with 52 percent for the Gold Coast, 50 percent for Brisbane, 47 percent for the northern region and 43 percent for the Hervey Bay–Maryborough region. In the Fitzroy, Tropical North Queensland, Sunshine Coast, Mackay, Bundaberg and Whitsunday regions deliberate causes accounted for only 25 to 36 percent of known causes. The lowest proportion occurred for the Darling Downs region, where deliberate causes accounted for only 17 percent of fires for cases where the cause of the fire was identified. While these values can be used as a guide, some caution is required in rigorous interpretations owing to the exceptionally low and potentially unrepresentative nature of causal attributions.

Non-deliberate child fires: The number of non-deliberate child fires varied substantially between regions (Figure 17). The highest number occurred in Brisbane, followed by Hervey Bay–Maryborough, Fitzroy, and Coast and Northern regions at substantially lower rates. Overall, there was excellent correlation between the numbers of fires attributed to children and the total number of fires in that region ($r=0.98$; $p<.001$), meaning the proportion of fires attributed to children was broadly constant across regions; however, in detail there were subtle variations.

The highest proportion of child fires occurred in the Hervey Bay–Maryborough region (5.4% of all fires), Whitsunday (4.0%) and Sunshine Coast (3.7%) regions. Higher than ‘predicted’ rates (based on the above correlation) occurred for the Hervey Bay–Maryborough region; and the Gold Coast region recorded lower than predicted values based on total vegetation fire numbers. Whether such variations genuinely reflect regional trends in the number of fires started by children or are an artefact of differences in observation are unclear.

In most regions the numbers of non-deliberate child vegetation fires lit by 6 to 12 year olds were comparable to the numbers lit by 13 to 16 year olds (Figure 18). Exceptions include the Sunshine Coast, Darling Downs and Tropical North Queensland, where 6 to 12 year olds were responsible for greater numbers of non-deliberate fires. Again whether this is a genuine reflection of the actual situation or a sampling bias remains unclear, particularly in light of the high proportion of cases where the age was unknown (Figure 18). The number of vegetation fires accidentally lit by children aged 5 years or younger was low in all regions. The highest numbers were recorded in regional rather than metropolitan areas.

Smoking-related causes were typically responsible for one to three percent of all vegetation fires in any one region (Figure 19). The highest proportions occurred for the Sunshine Coast (3.4%). However, in the Brisbane region, smoking-related materials were responsible for 18 percent of all fires where the heat of ignition was identified (Figure 19). In the majority of regional areas, such fires contributed to seven to 11 percent of known heat of ignitions. Exceptions included the Sunshine Coast region where smoking-related fires contributed to 13 percent of known causes, and the Bundaberg and Outback regions where smoking-related materials only accounted for two to four percent of cases where the heat of ignition was known. Overall, smoking-related causes accounted for a decreasing proportion of all vegetation fires of known cause, with decreasing numbers of smoking-related vegetation fires.

Incendiary devices: Ten cases were recorded of an incendiary device being identified as responsible for a deliberate ignition. Five of these were in the Brisbane region, two in the Fitzroy region, and one each in the Darling Downs, Northern and Outback regions.

Postcode

All vegetation fires: Twenty-one postcodes in Queensland recorded in excess of 500 vegetation fires in five years. Eight were located in the Brisbane region, three in the Northern region, two each in the Fitzroy and Tropical North Queensland regions, and one each in all other regions with the exception of the Sunshine Coast and Whitsunday regions (Table 3; Figure 20). The two postcodes to record in excess of 1,000 fires in five years were located in regional Queensland (Fitzroy and Outback regions). Collectively, the 21 suburbs that recorded in excess of 500 vegetation fires in five years accounted for 34 percent of all vegetation fires the QFRS attended in major urban centres.

Forty-three postcodes recorded between 200 and 499 vegetation fires in five years. The regional distribution of these postcodes is summarised in Table 3. These postcodes were responsible for a further 30 percent of fires. The 60 postcodes that recorded 100 to 199 vegetation fires were responsible for 18 percent of QFRS-attended vegetation fires, with the 125 postcodes recording 25 to 99 vegetation fires accounting for an additional 17.9 percent of fires.

The small number of postcodes that recorded 200 or more fires in five years typically accounted for between 55 and 83 percent of all fires in each region. Although there was one postcode in the Darling Downs region that recorded in excess of 500 vegetation fires in five years, and one postcode in the Sunshine Coast region that had between 200 and 500 vegetation fires, these postcodes accounted for 35 and 20 percent of all fires in those two regions, highlighting the more geographically dispersed nature of the fires.

Table 3: Distribution of fires (all causes) in postcodes within each region

	Brisbane	Gold Coast	Fitzroy	Northern	Tropical North Qld	Outback	Hervey Bay–Maryborough	Sunshine Coast	Darling Downs	Mackay	Bundaberg	Whitsundays
Total no. of fires	20,795	4,629	3,730	3,718	2,621	2,255	1,863	1,654	1,610	1,279	943	404
Total no. of postcodes recording a fire	132	32	20	16	23	34	15	28	46	16	13	4
Number of postcodes recording fires in the following ranges:												
TF ≥ 500	8	1	2	3	2	1	1		1	1	1	
200–499	22	7	4	4	1		3	1				1
100–199	31	7	4	2	5		2	5	1	3		
75–99	20	2		1	2	3		2	3			
50–74	12	3	1	1	2	3	1	2	3	1	2	2
25–49	19	6	2	3	3	4	1	8	8	2	2	1

Regional Queensland: Not surprisingly, given the dataset only included urban data, the highest numbers of vegetation fires in regional areas were generally associated with the largest regional centres in each region. Therefore:

- In the Bundaberg region almost two-thirds of fires occurred in and around Bundaberg.
- In the Darling Downs region, approximately 35 percent of fires occurred in and around Toowoomba, with a further 10 percent occurring in a Warwick postcode.
- Approximately one-third of vegetation fires in the Fitzroy region occurred around Gladstone. Many vegetation fires in the Fitzroy region also occurred around Rockhampton.
- Fires in the Gold Coast region were more evenly distributed across postcodes, perhaps consistent with the more even distribution of the population across that region. However, higher numbers of fires occurred in highly urban areas in the north of region (in what effectively represents the southern extension of the Brisbane metropolitan area) as well in more remote locations of Gold Coast hinterland.
- In the Hervey Bay–Maryborough region almost 65 percent of fires occurred in the postcodes encompassing Hervey Bay, Maryborough and Gympie.
- In the Mackay district, 57 percent of fires occurred in the postcode incorporating Mackay.
- In the Northern region vegetation fires primarily occurred in and around Townsville.
- Two-thirds of fires in the Outback region occurred in and around Mt Isa.
- Fires in the Tropical North Queensland region were principally associated with the postcodes that encompass Cairns (27%) and Mareeba (21%).
- A comparatively small number of vegetation fires occurred on the Sunshine Coast despite a population in excess of 250,000. Individually the greatest number of fires in this region was associated with the Caloundra (20%) and Nambour (10%) postcodes.

Brisbane: Statistical region sectors in the Brisbane region (Figure 21) can be arbitrarily subdivided into four groups based on the distribution of vegetation fires in these regions.

Logan City, Ipswich and Caboolture Shire (Part A) statistical region sectors all record in excess of 2,500 vegetation fires in five years. These statistical region sectors had between one and three postcodes that recorded more than 500 fires in five years, but also from two to four postcodes that recorded between 200 and 499 vegetation fires. In these areas high numbers of vegetation fires were observed across much of the region and postcodes recording in excess of 200 fires in five years accounted for 80 to 100 percent of all fires in the statistical region sectors (Figure 22). All three statistical region sectors are located somewhat distant from the centre of the city, on or close to the fringes of the rapidly expanding metropolitan centre.

The Southern Outer, Northern Outer, Redlands Shire, Pine Rivers Shire and Western Outer statistical region sectors recorded between 1,230 and 2,000 vegetation fires in five years. Greater than 500 vegetation fires were only recorded within one postcode each in the Pine Rivers Shire and Western Outer statistical region sectors. Only 53 to 68 percent of fires within individual statistical region sectors occurred in postcodes recording in excess of 200 fires. Between 82 and 92 percent of all vegetation fires in these regions occurred in postcodes recording in excess of 100 vegetation fires in five years (Figure 22).

In statistical region sectors that recorded between 317 and 1,202 vegetation fires in five years (North and West Moreton sectors, Eastern Outer, Redcliffe City and Eastern Inner sectors), greater than 200 vegetation fires were only evident in one postcode each in the North and West Moreton and the Eastern Outer sectors. Postcodes recording in excess of 100 vegetation fires in five years accounted for 57 to 63 percent of all vegetation fires in individual sectors (Figure 22).

Statistical region sectors in the inner metropolitan area, including the Northern Inner, City Core, Western Inner and Southern Inner sectors, recorded low numbers of vegetation fires (less than 300) in five years. The maximum number recorded in any one postcode was between 75 and 99 for all but the Northern Inner sector, where the maximum was between 50 and 75 vegetation fires.

In summary, high frequencies of fires tend to occur in geographically restricted areas that are located on the outer margins of Brisbane metropolitan area, whereas inner city areas are characterised by low numbers of vegetation fires. The maximum number of fires recorded in a postcode tended to be greatest in those statistical region sectors that, overall, recorded the highest numbers of vegetation fires. Rarely were high numbers of vegetation fires restricted to a single postcode. In sectors recording high numbers of fires, many postcodes record elevated numbers of vegetation fires, and postcodes recording high numbers of vegetation fires account for a large proportion of all vegetation fires in that statistical region sector. The maximum number of vegetation fires recorded in a single postcode, and the proportion of vegetation fires hosted within high fire frequency postcodes, overall, declines as the number of vegetation fires recorded in the statistical region sectors decreases.

Deliberate fires: Only one postcode recorded in excess of 450 deliberate fires, three reported 100 to 110 deliberate fires, 17 documented 50 to 99, and 25 postcodes had 25 to 49 deliberate fires in five years. However, the low levels of causal attribution limit the accuracy and usefulness of such results. The findings from other agencies and jurisdictions are that the highest number, and commonly the highest proportion, of deliberate fires tend to occur in those areas that record the greatest number of vegetation fires generally. This remains to be evaluated for the QFRS data, but is likely to provide a useful guide for arson reduction strategies in Queensland.

Population analysis

This analysis examines the distribution of fires relative to population densities within individual postcodes. It is necessarily, due to the low levels of causal attributions, to restrict the discussion to vegetation fires generally rather than examine deliberate fires specifically.

There is a strong tendency for the number of fires to increase with increasing population size (Figure 23). Although the maximum rate of fires per 10,000 people tended to decrease with increasing population, overall, the rates tend to be broadly similar across highly varying population densities. Most postcodes, whether they contained 1,000 or 50,000 people, recorded between one and 100 vegetation fires per 10,000 people per year (Figure 24).

In the Brisbane region, the highest rates of fires per 10,000 people per year occurred in a small number of postcodes that had small resident populations, but were likely accessed or used by the larger surrounding or visiting population, for example, Karawatha, Eagle Farm, Pinkenba and Rocklea. A higher proportion of fires per person also occurred for one postcode in the Gold Coast hinterland. It is unclear whether this reflects inaccurate population data (ABS data indicates 660 people), a high influx of visitors, or other factors. Although this Gold Coast postcode only recorded 34 fires in five years, it is noted that unplanned fires (depending on severity and location) are potentially of concern to preserving the Eastern Bristlebird, an endangered species in the region (QPWS 2001).

The results, on a per-person basis, are most significant for postcodes with higher populations, as these are less likely an artefact of statistical anomalies resulting from a small resident but potentially large migratory population. Postcodes that have both high resident populations with a high rate of fires per person, particularly as compared with other postcodes in the region, include single postcodes in the Mount Isa (Outback region), Mount Morgan (Fitzroy region), Murgon (Hervey Bay–Maryborough region) and Mareeba (Tropical North Queensland region) statistical local areas.

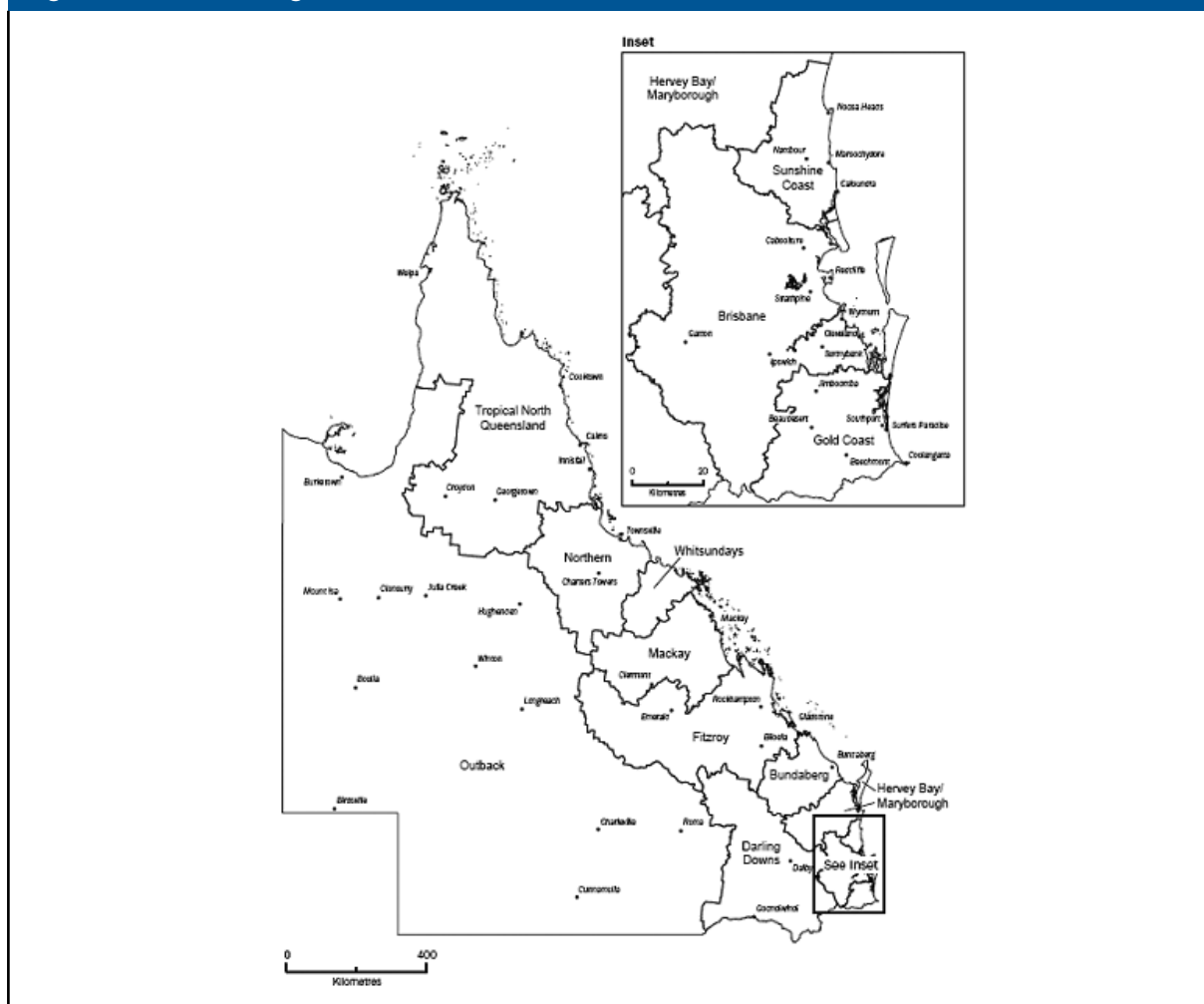
Although there is considerable overlap, there is some tendency for postcodes in regional areas to be characterised by lower rates of fires per person. In some cases this may reflect the fact that data for rural postcodes are incomplete as the QFRS data analysed does not incorporate rural fire service data. However, given this is also witnessed in postcodes with large population densities (where inclusion of rural data would only have a small affect), it is possible that regional areas in Queensland are genuinely characterised by low numbers of fires per person.

Complex

The majority of vegetation fires the QFRS attended in urban locations occurred on unused property or Crown land. Other important locations included parks, forests, reserves, road complexes (roads, tracks, parking lots, etc.), followed by single dwellings, farms, and construction/demolition sites and railroads (Figure 25). The rates of causal attribution varied between these various complex types. Deliberate causes comprised the highest proportion of fires (50 to 60%) on unused property or Crown land, parks, forests and reserves, but also at public recreation complexes, schools, marinas and piers (Figure 25). Comparatively fewer vegetation fires along road complexes or at single dwellings, farms or construction sites were identified as deliberate (15 to 35% of known attributions).

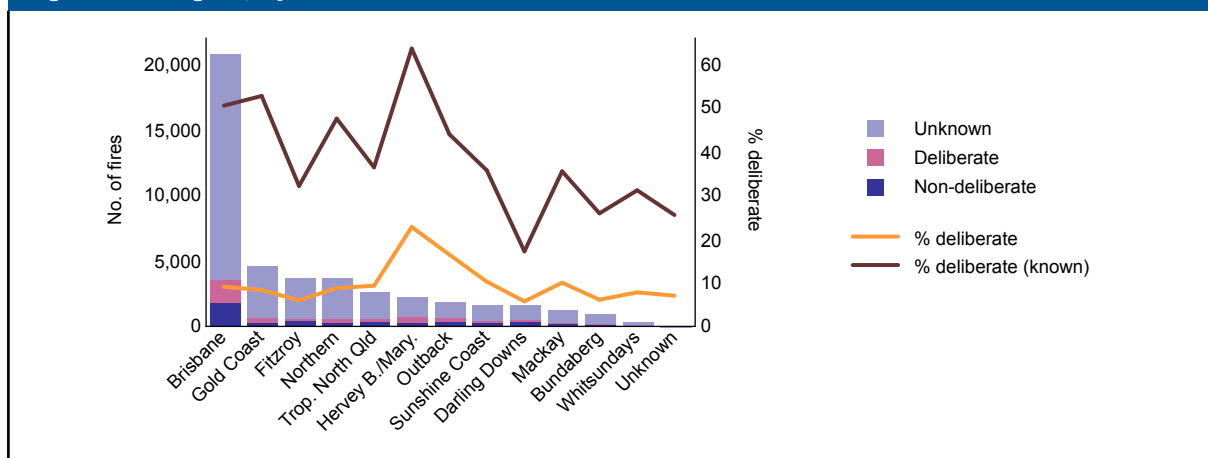
The general distribution of non-deliberate child vegetation fires paralleled that observed for vegetation fires generally. Namely, the majority of all vegetation fires accidentally lit by children were greatest for unused property or Crown land, parks, forests and reserves, road complexes and single dwellings. Subtle differences are evident between age groups (Figure 26). A comparatively high proportion of fires lit by children five years and younger occurred at single dwellings. Fires at these locations comprise a progressively smaller proportion of non-deliberate fires for older age groups. The range of locations where children light fires also became more diverse as children become older.

Figure 15: Tourism regions of Queensland



Source: ABS 2005b
© Australian Bureau of Statistics

Figure 16: Region, by cause^{a,b}

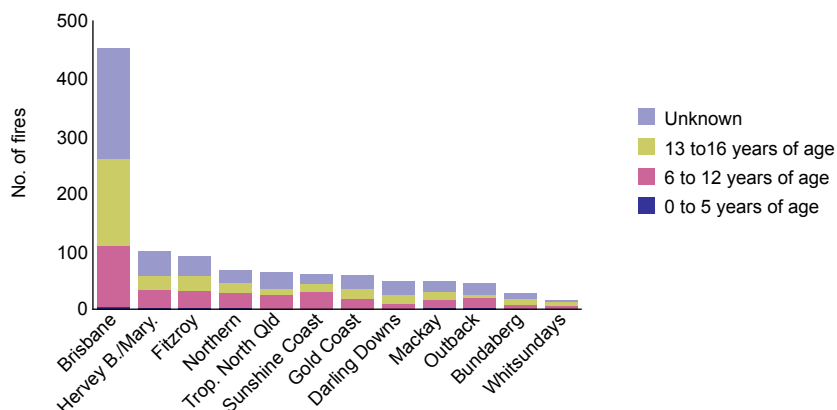


a: % deliberate (known) is the percentage of fires of known causes that were deliberate

b: Hervey B./Mary. = Hervey Bay/Maryborough; Trop. North Qld = Tropical North Queensland

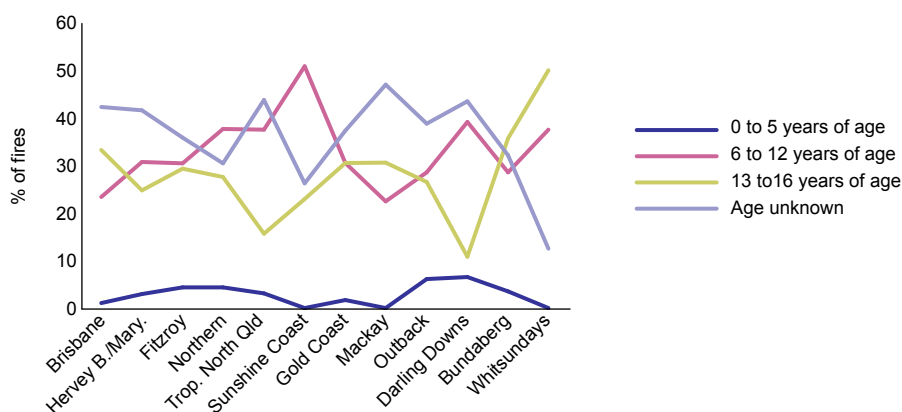
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 17: Non-deliberate child fires, by region (number)



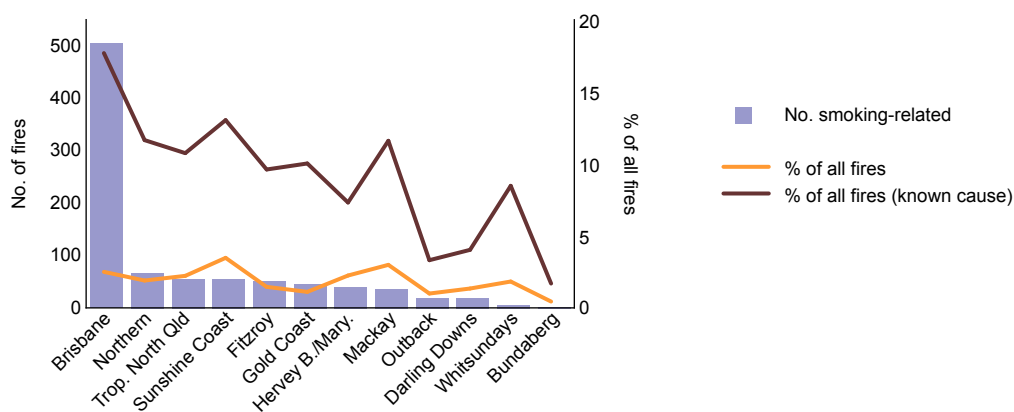
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 18: Non-deliberate child, by age group and region (percent)



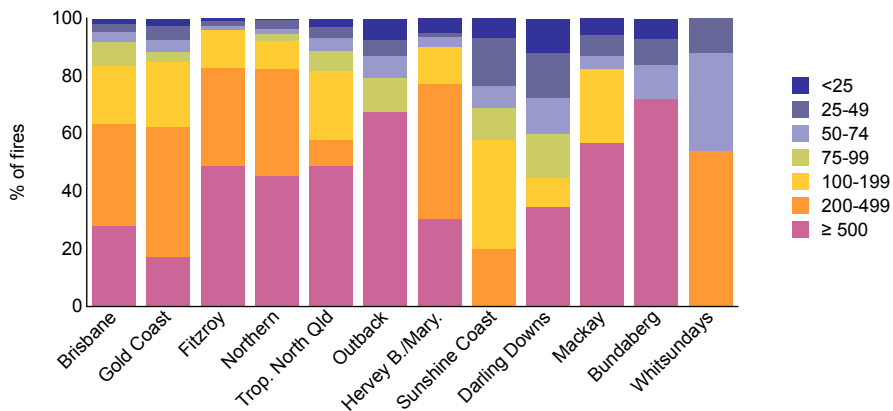
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 19: Smoking related fires, by region



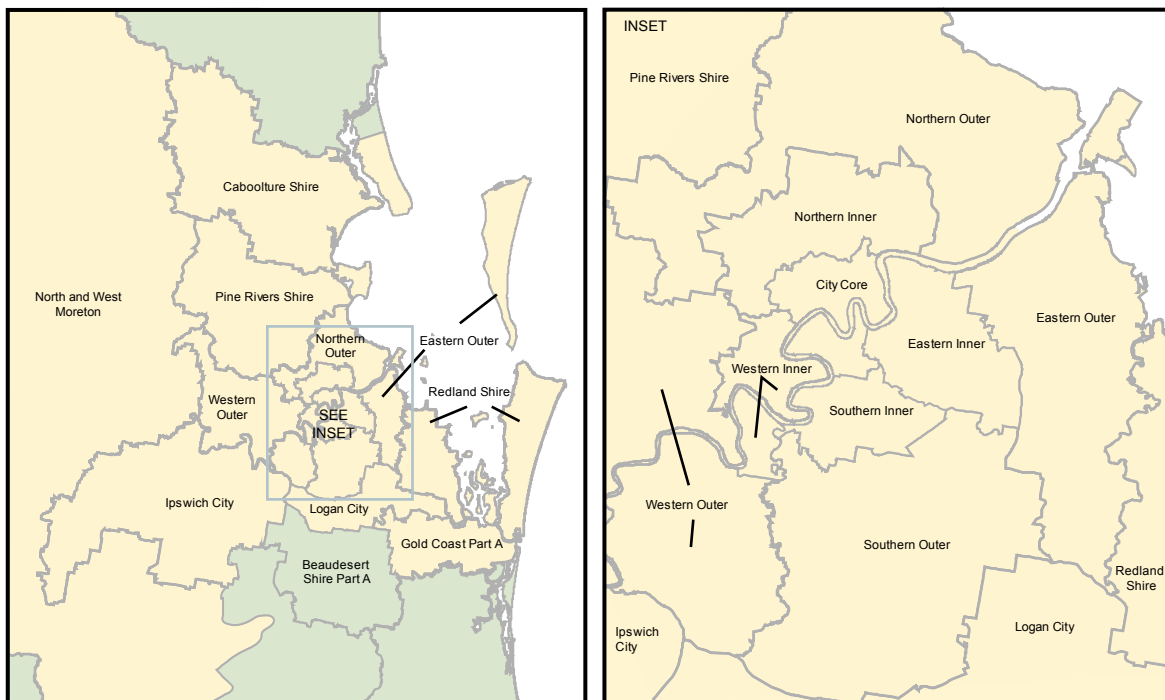
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 20: Fires occurring in postcodes with total fire frequencies in the specified ranges, by region (percent)



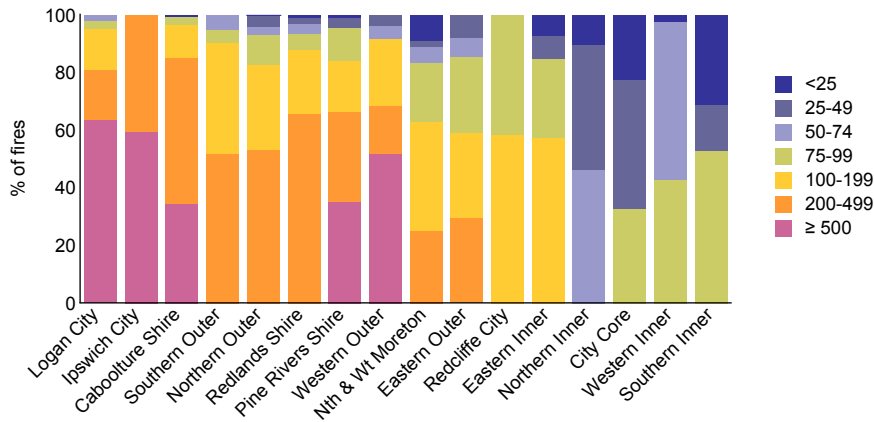
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 21: Statistical region sectors in southeast Queensland



Source: ABS 2006b
© Australian Bureau of Statistics

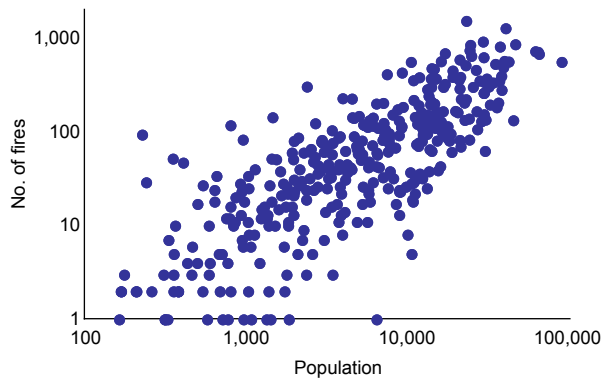
Figure 22: Fires occurring in postcodes with total fire frequencies in the specified ranges, by statistical region sectors^a in the Brisbane region (percent)



a: Ipswich City = Ipswich City (Part B in BSD); Caboolture Shire = Caboolture Shire (Part A); Nth & Wt Moreton = North and West Moreton

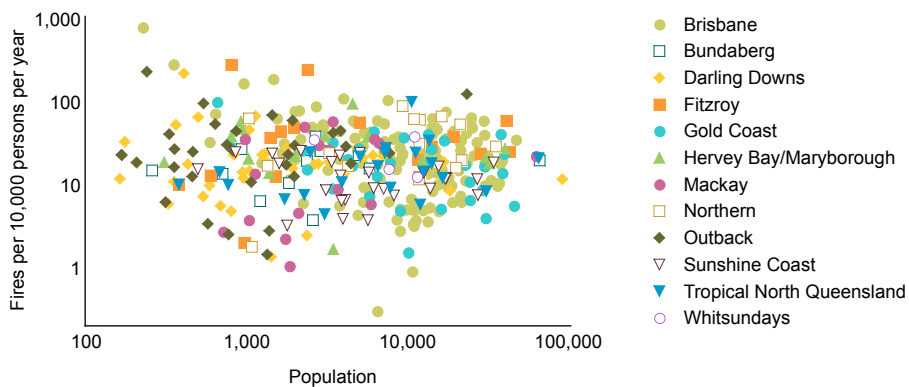
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 23: Fires and population, by postcode



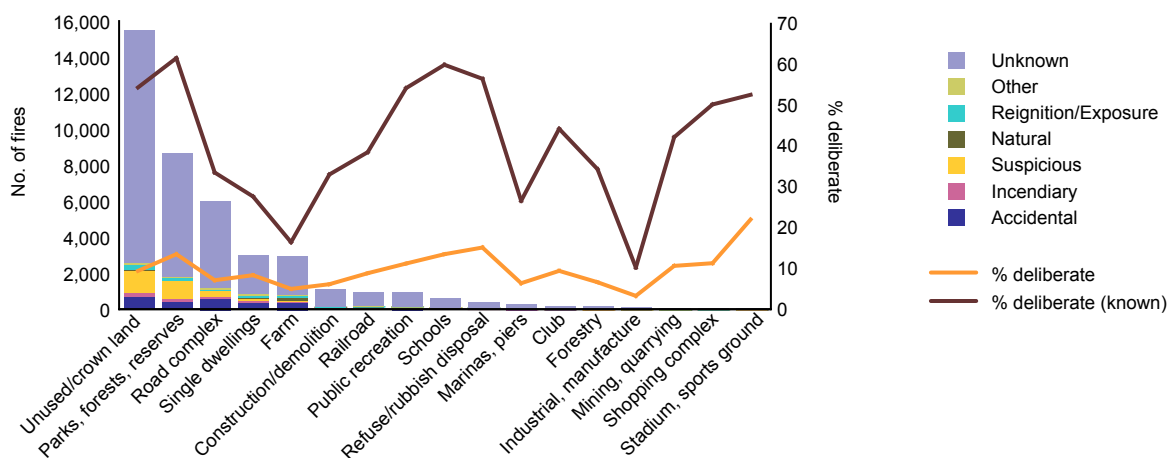
Source: QFRS 1997–98 to 2001–02 [computer file]; ABS 2004. Population by post office area, 2001 [computer file]

Figure 24: Postcodes within each region, by fires per 10,000 people and population



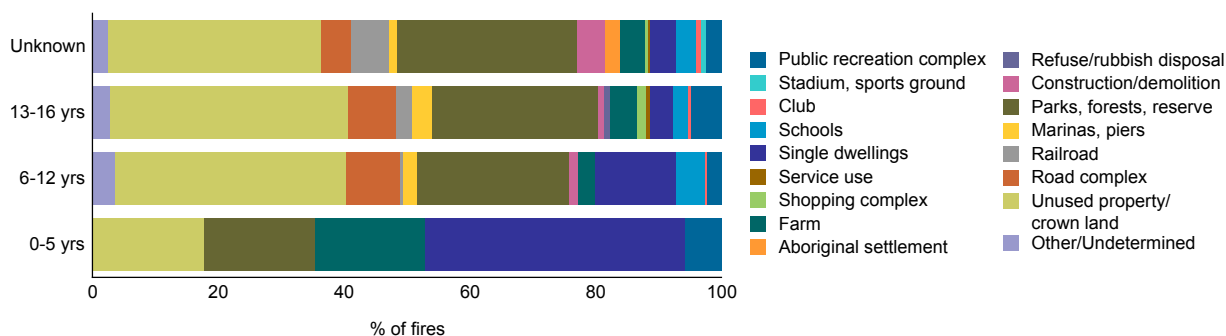
Source: QFRS 1997–98 to 2001–02 [computer file]; ABS 2004. Population by post office area, 2001 [computer file]

Figure 25: Complex type, by cause



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 26: Non-deliberate child fires lit at complex type for child's age (percent)^a



a: Other/undetermined includes a single fire lit by a 6 to 12 year old at a communication use complex and a child day care complex; a single fire lit by 6 to 13 year old at an apartment complex; a single fire lit by child of unknown age each at a forestry complex, and medical care complex

Source: QFRS 1997–98 to 2001–02 [computer file]

Timing

The timing of fires is examined by week of the year, day of the week and time of the day.

Week of the year

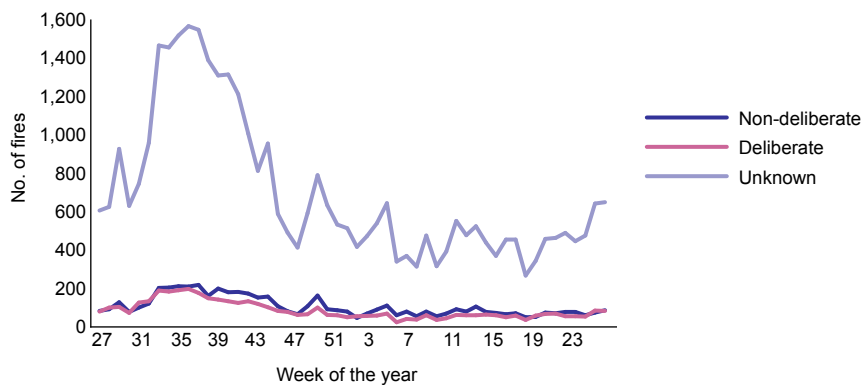
The QFRS attended peak numbers of fires in late winter and spring irrespective of cause (Figure 27), although the number of fires attended in any one week, and the length of time over which elevated numbers of fires occurred, varied considerably between seasons (Figure 28). The highest number of fires recorded in any one week occurred in 2001–01, when 1,015 vegetation fires were attended during week 36 (early August). Nevertheless, an elevated number of fires occurred over a comparatively short period (approximately 10 weeks). In contrast, during 2001–02, four distinct smaller peaks occurred over a 17-week period.

Most fires the QFRS attended during the reporting period occurred in southeast Queensland. There are some subtle regional differences in the timing, length and intensity of the bushfire season. For example,

the Brisbane (Figure 29) and Gold Coast (Figure 30) regions experienced a high frequency of fires during a particularly short interval in late winter and spring, whereas fires in the Northern region occurred over an extended period and the activity during any one week was typically less intense when compared to background levels (Figure 29). In the Outback (principally Mount Isa) region, fire numbers steadily increased from March onwards, peaked in late winter, before subsequently dropping off sharply. This pattern is typical of the fire regimes of the tropical savannas, in northern Australia.

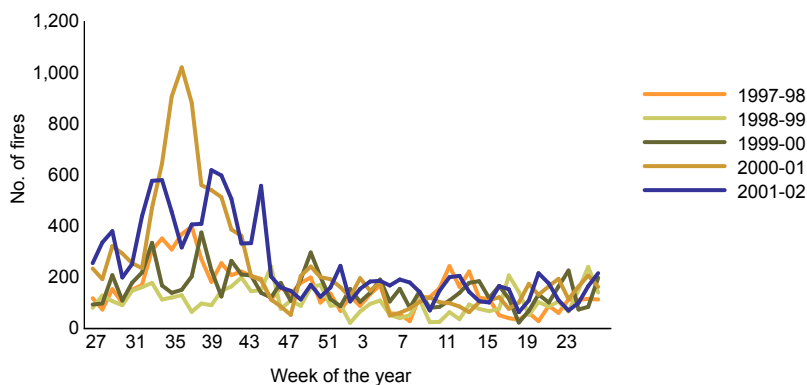
A number of regions recorded a small increase in the number of fires during weeks 50 and 4. This spike is particularly evident for fires that resulted from an open flame (Figure 31), but this heat of ignition factor is not a definitive guide to the deliberate or non-deliberate nature of the fires. There is no definitive cause for increased fire frequencies at these times, although it is noted that the timing of the two spikes roughly coincides with the end and resumption of the school year respectively. Fires caused by abandoned or discarded materials were highest during the peak bushfire period but remained comparatively elevated until the end of March (Figure 31). Children accidentally lit the greatest number of fires during the greatest period of bushfire danger, with comparatively smaller numbers being recorded for the Christmas school holiday period (Figure 32).

Figure 27: All vegetation fires, by week of the year, by cause



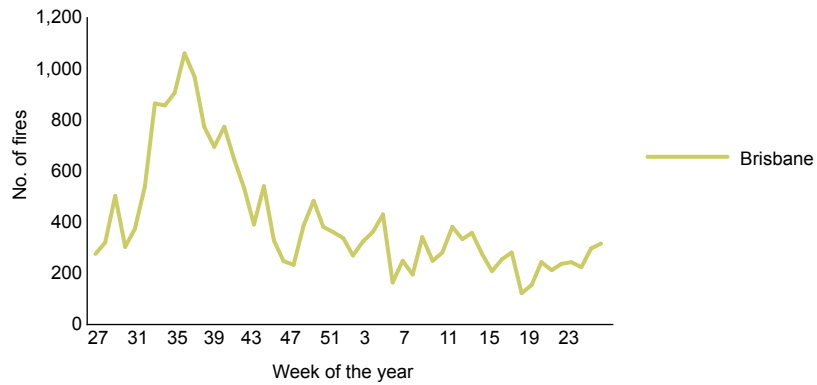
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 28: All vegetation fires, by week of the year, by year



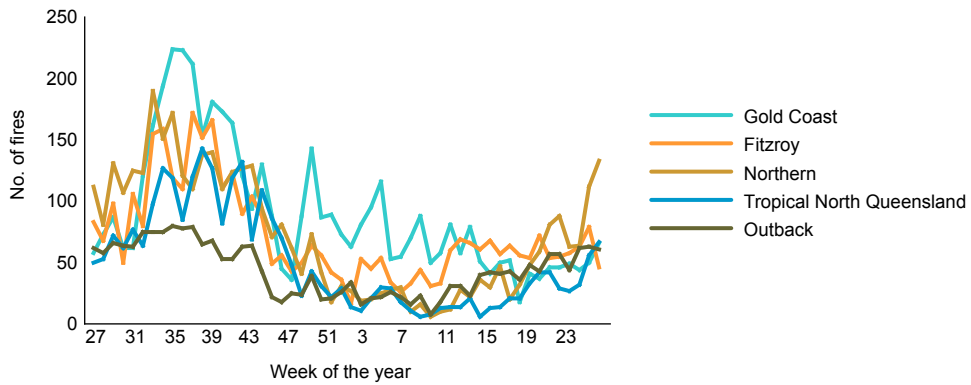
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 29: All vegetation fires, by week of the year for Brisbane region



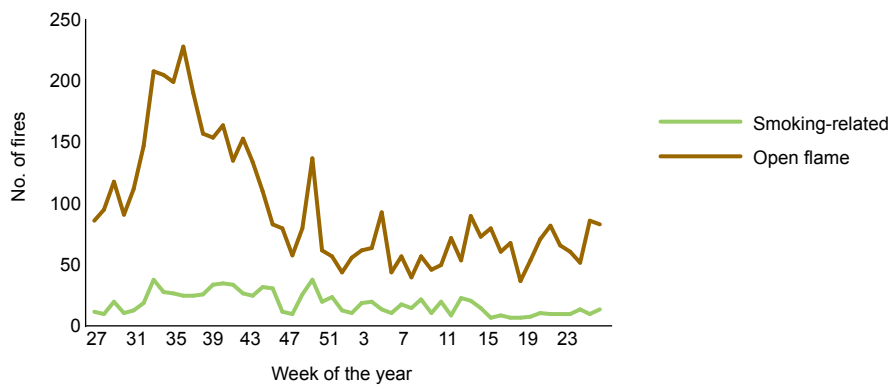
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 30: All vegetation fires, by week of the year for other regions



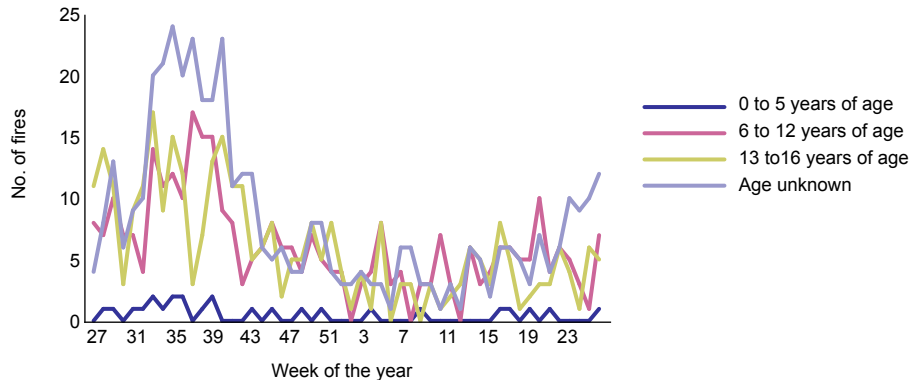
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 31: Abandoned/discarded material and open flame/spark fires, by week of the year



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 32: Non-deliberate child fires, by age and week of the year



Source: QFRS 1997–98 to 2001–02 [computer file]

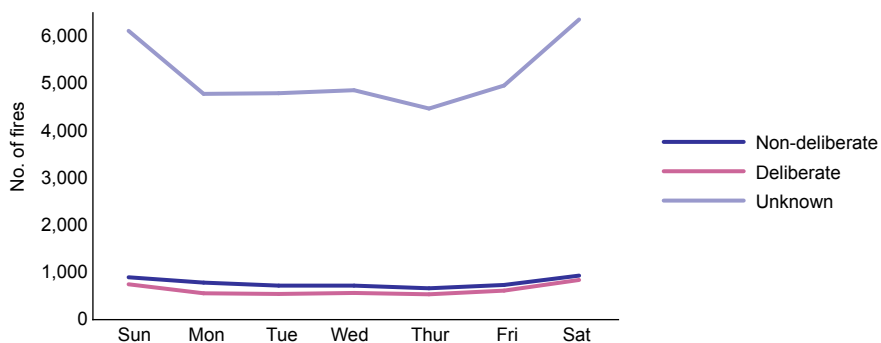
Day of the week

The QFRS attended 28 percent more vegetation fires on Sunday and 35 percent more fires on Saturday than on the average weekday. This was observed for non-deliberate, deliberate and unknown fires (Figure 33). However, for deliberate causes 35 and 52 percent more fires occurred on Sunday and Saturday respectively. This is somewhat higher than for non-deliberate fires where only 25 to 29 percent more fires occurred on a weekend day than on a weekday.

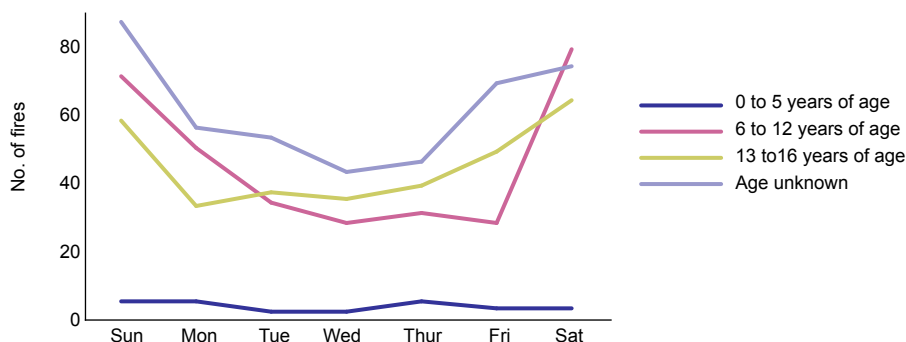
A higher incidence of vegetation fires on weekends was observed in all areas except the Whitsunday region. Comparatively higher proportions of fires on weekends occurred in the Mackay, Bundaberg and Darling Downs regions. In the Mackay area, 49 percent more fires occurred on Saturdays and 60 percent more fires occurred on Sundays than on the average weekday. For Bundaberg, these values were 37 and 67, respectively. For the Darling Downs region, 35 percent more fires occurred on Saturdays and 44 percent on Sundays relative to the average weekday.

Overall, non-deliberate child vegetation fires were 70 percent higher on weekend days than on the average weekday. Increased numbers of fires were observed on weekends for all groups except the zero to five year old age group. Six to 12 year olds lit between 2.1 and 2.3 more fires on Sunday and Saturday than on the average weekday (Figure 34). The values were 1.5 and 1.7 times higher on Sunday and Saturday for 13 to 16 year olds.

Figure 33: Day of the week, by cause



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 34: Non-deliberate child fires, by age and day of the week

Source: QFRS 1997–98 to 2001–02 [computer file]

Time of the day

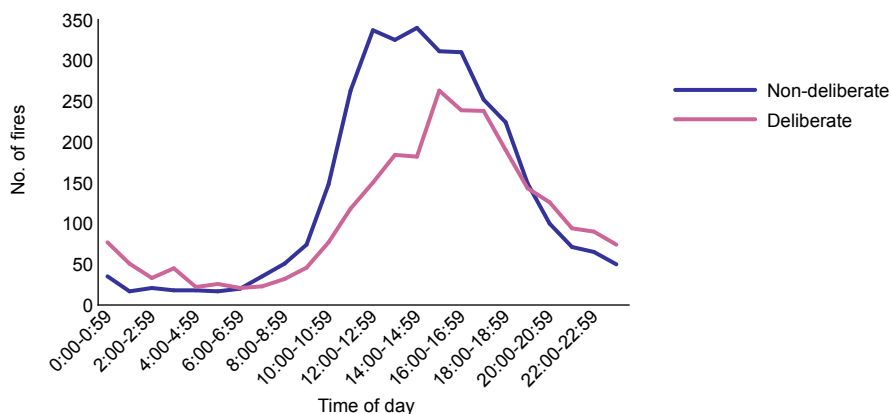
The QFRS attended the greatest number of fires between 9 am and 9 pm, with peak numbers occurring between 3 and 4 pm. Within the 13 percent of all fires where both cause and time were delineated, subtle differences were evident between the timing of deliberate and non-deliberate related fires (Figure 35). Deliberate vegetation fires lit during the day have a skewed distribution, whereas non-deliberate fires more closely resemble a normal distribution. Hence, although the frequencies for both deliberate and non-deliberate fires increased from 10 am onwards, the greatest number of deliberate fires occurred between 3 and 6 pm, whereas for non-deliberate fires the peak was between 12 and 3 pm. Also, as noted in other jurisdictions, a greater number and proportion of deliberate fires occurred at night as compared with non-deliberate fires. Thirty-seven percent of deliberate fires occurred between 6 pm and 6 am as compared to 24 percent for non-deliberate fires. However, the proportion of deliberate fires the QFRS attended between midnight and 6 am was comparatively low when compared to many other jurisdictions, with only 9 percent of deliberate fires (where both time and cause were known) occurring within this timeframe.

Subtle variations were evident in the timing across different regions. In approximately 10 percent of cases information about both the cause and time were known for fires in the Brisbane region. Overall, the timing of fires in the Brisbane region mirrored the general trend QFRS outlined above (compare Figure 35 and Figure 36). Fires between 6 pm and 4 am in the Brisbane region were marginally more likely to occur on Friday night–Saturday morning and Saturday night–Sunday morning than on other nights of the week. This was particularly evident for the 8 to 9 pm interval on Saturday night.

A high proportion of fires in the Outback region occurred at night when compared with many other areas of the state (Figure 37); 44 percent occurred between 6 pm and 6 am (Figure 38). This was more evident for deliberate than for non-deliberate causes; 51 percent of deliberate fires occurred between 6 pm and 6 am whereas only 31 percent of non-deliberate fires occurred in this timeframe. If these distributions are generally representative of deliberate and non-deliberate fires, roughly two-thirds of the fires of unknown origin in the Outback region may have been deliberate in origin. This is similar to the proportion of deliberate fires calculated based on ‘known’ causes alone. Seventeen percent of deliberate fires in the Outback region occurred between midnight and 6 am compared to a value of five percent for non-deliberate fires. Fires that occurred between midnight and 6 am in the Outback region were more frequent on Saturday and Sunday mornings than on any other day of the week. Fire frequencies spike between 7 and 8 pm for both Mondays and Saturdays. As for the Brisbane region, the daytime peak for deliberate fires occurred somewhat later than non-deliberate fires, with the greatest frequency of deliberate fires in the Outback region occurring between 4 and 5 pm (Figure 38).

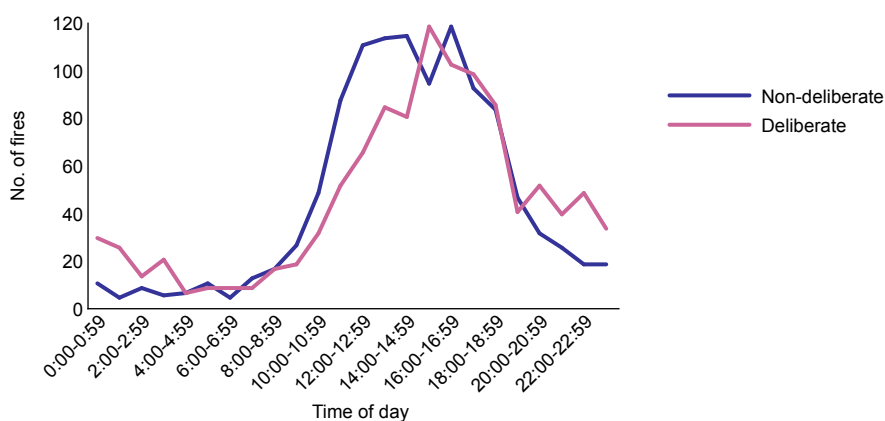
Non-deliberate fires attributed to children primarily occurred during the day. The distribution is skewed with peak numbers occurring between 4 and 6 pm (Figure 39). This distribution is observed for both 6 to 12 year olds and 13 to 16 year olds. This distribution is similar to that observed for deliberate daytime fires generally.

Figure 35: Time of day, by cause



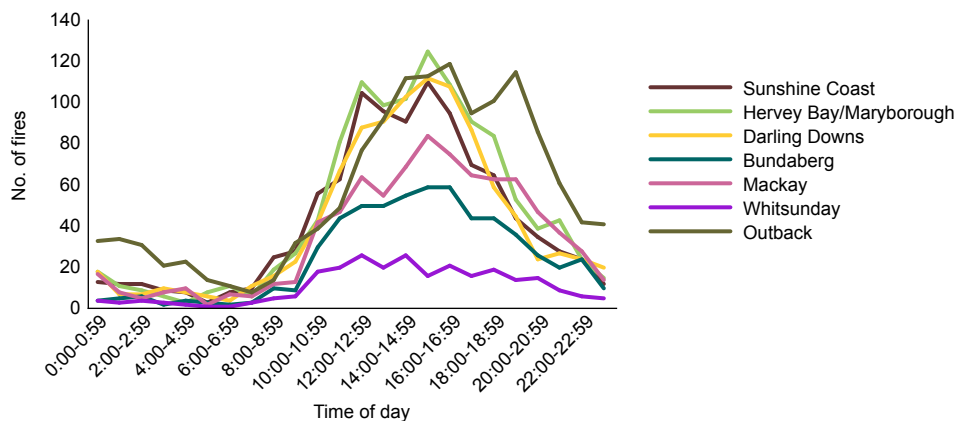
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 36: Time of day, by cause for the Brisbane region



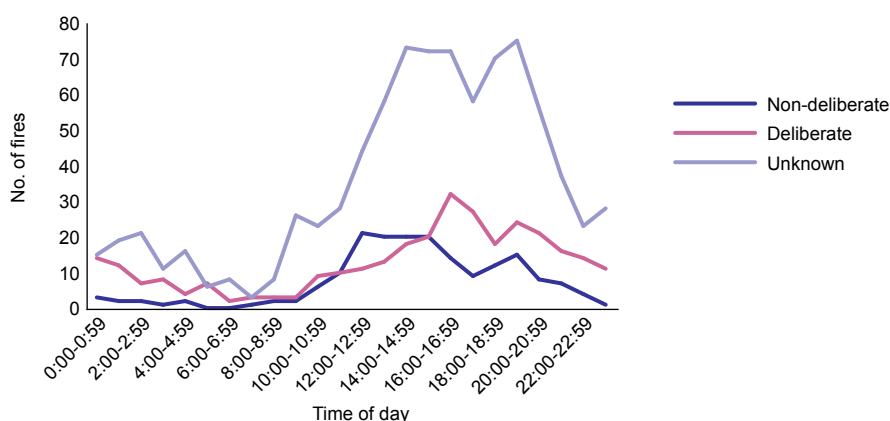
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 37: All vegetation fires, by time of day, by region



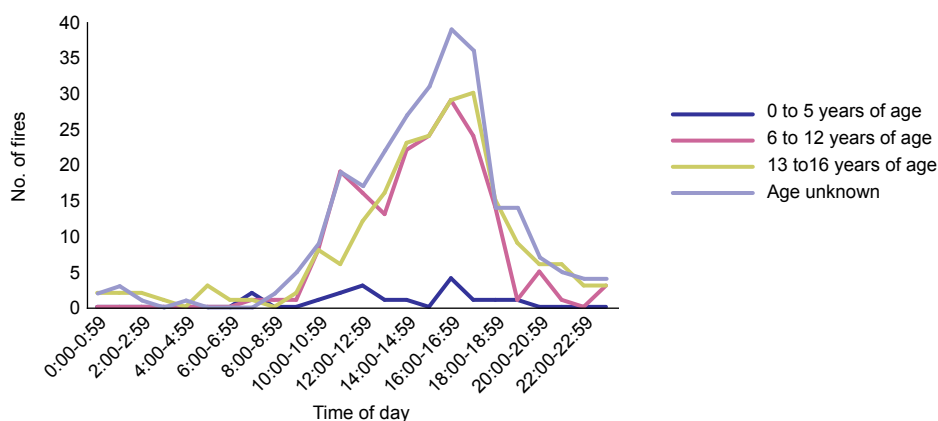
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 38: Time of day, by cause for the Outback region



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 39: Non-deliberate child fires, by age and time of day



Source: QFRS 1997–98 to 2001–02 [computer file]

Area burned

Data about the area burned between 1997–98 and 2003–04 was available in 94 percent of cases. Collectively, the area burned amounted to 2,166,640 ha. However, information about the area burned and cause were only available for 19.4 percent of fires.

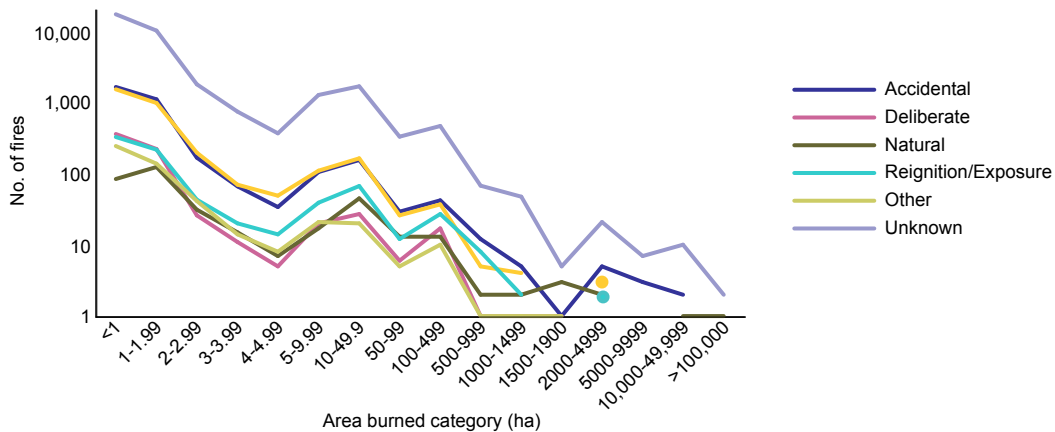
The number of fires decreased sharply with increasing area burned, irrespective of the cause (Figure 40). Collectively, deliberate fires accounted for a decreasing proportion of fires with increasing area burned. The majority of larger fires resulted from natural or accidental causes (Figure 41).

The largest identified deliberate fire burned 1,500 ha. However, one fire labelled suspicious burned 12,000 ha. In contrast, the largest natural fire in this period burned 250,000 ha. The cause of the largest recorded fire, which burned 1,000,000 ha, was unknown. However, caution is needed when interpreting these results due to the small proportion of cases where cause was attributed and the markedly variable fire sizes across the state; fire size depended on the environment, accessibility, resources available for suppression, and potential threat to life and property. Potential ecological benefits of a fire also need to be considered when interpreting the data. Nevertheless, the observation that deliberate fires tended to be smaller than natural fires is consistent with the trend observed in many jurisdictions in Australia.

The area burned annually varied substantially, primarily because of the distribution of a small number of large-scale events. The greatest area of land burned during the five-year interval surveyed occurred during the season of 1998–99, when a fire of unknown cause burned 1,000,000 ha in Tropical North Queensland (Figure 42). Given this, it is not surprising that unknown attributions accounted for the greatest area burned. Fires of unknown cause accounted for 80 percent of the total area burned in fires the QFRS attended (Figure 43). Of the fires where cause was known, natural fires were the largest contributor (66% of known) followed by accidental fires (17% of known; Figure 44). Incendiary and suspicious fires accounted for 1.6 and 9.7 of fires where cause was attributed, respectively.

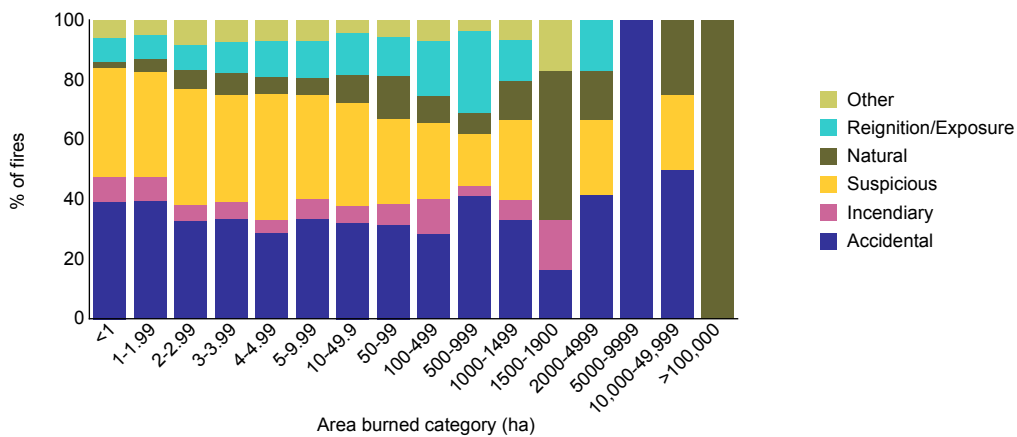
The largest areas were burned in those areas that experienced the largest fires, namely Tropical North Queensland, the Outback, Mackay, and the Northern regions. Although almost 50 percent of all fires the QFRS attended occurred in the Brisbane region, these fires accounted for less than five percent of the area burned in Queensland between 1997–98 and 2001–02. Nevertheless, approximately 107,000 ha of land burned in the Brisbane region during this interval. The largest deliberate fire, the 12,000 ha fire noted above, occurred near Ipswich, in the Brisbane region. Seventeen fires in the Brisbane region exceeded 1,000 ha of which four were suspicious in origin. These principally occurred to the north of Ipswich and to the west of Caboolture. A total of 333 fires in the Brisbane region exceeded 50 ha. Thirty-four of these were in the Caboolture area. Only 31 of the 333 fires exceeding 50 ha were incendiary or suspicious in origin. The cause of 265 fires of the greater than 50 ha was unknown.

Figure 40: Area burned (ha) category, by cause (number)



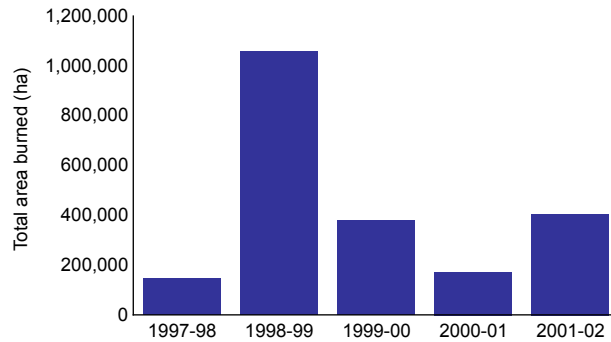
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 41: Area burned (ha) category, by cause (percent)



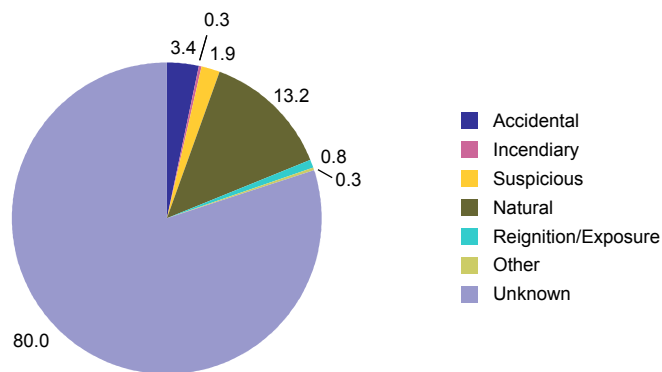
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 42: Area burned (ha) each year



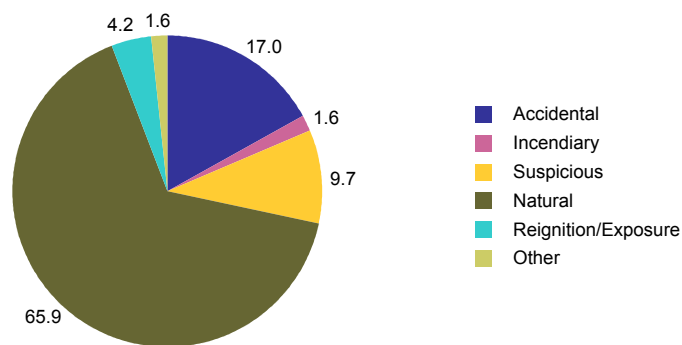
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 43: Area burned (ha), by cause



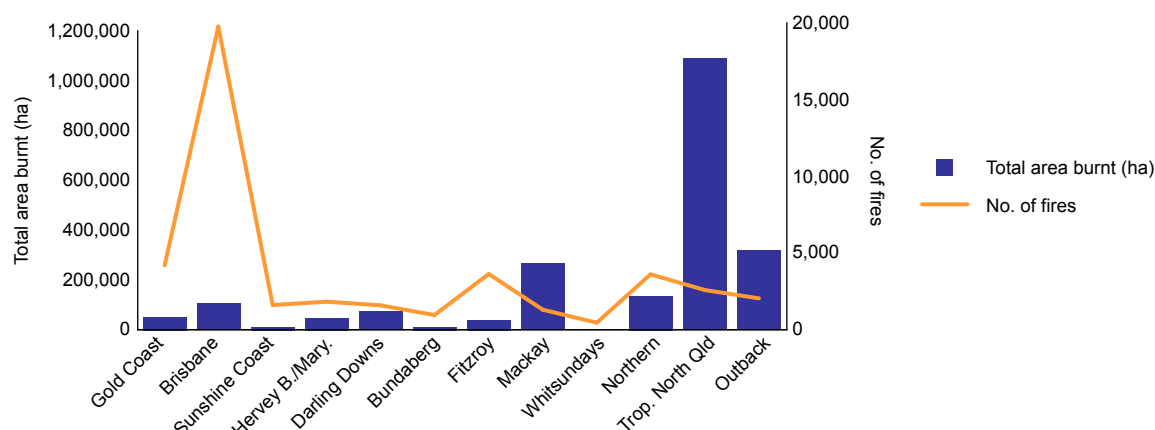
Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 44: Area burned (ha), by cause^a



a: only includes the 19.4 percent of cases where both cause and area were known

Source: QFRS 1997-98 to 2001-02 [computer file]

Figure 45: Region, by number of fires and area burnt

Source: QFRS 1997–98 to 2001–02 [computer file]

Type of incident

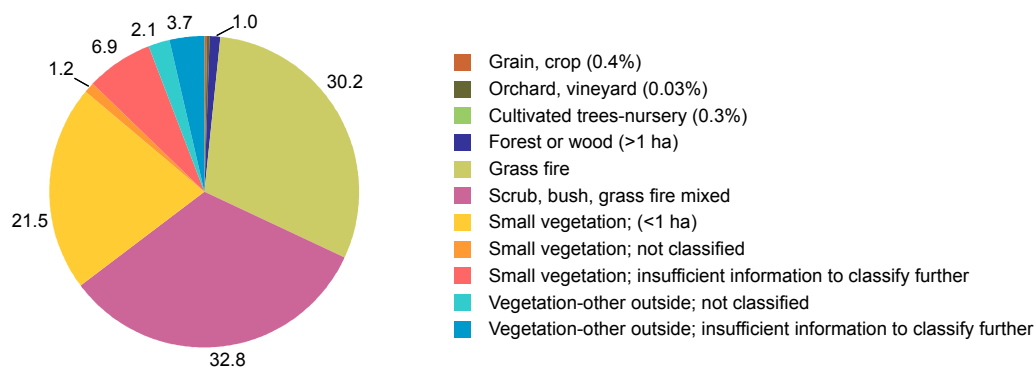
Twenty-two percent of all fires QFRS urban services attended were small vegetation fires of less than one hectare in size (Figure 46). A further eight percent were small vegetation fires that were either not classified or there was insufficient information to classify. Thirty percent of all fires were grass fires with another 33 percent of fires occurring in scrub, bush or mixed grass environments. Only one percent of all fires attended were forest or wood fires greater than one hectare.

The cause of the fires was more likely to have been determined for fires occurring in orchards, vineyards and nurseries (53%), and grain or crop fires (43%) than for any other incident type. The lowest rates of causal attributions occurred for scrub, bush and grass mixed fires (14%) and for grass fires (18%).

Deliberate causes accounted for 38 and 57 percent of known causes for all incident types except grain and crop fires (Figure 47). The highest rates of deliberate fires (as a percent of known causes) occurred for fires in orchards, vineyards and nurseries (57%), scrub, bush and grass mixed fires (54%), and for forest and wood fires greater than one ha (47%). In comparison, only 43 percent of small vegetation fires and 40 percent of grass fires were considered deliberate in instances where cause of the fire was assigned.

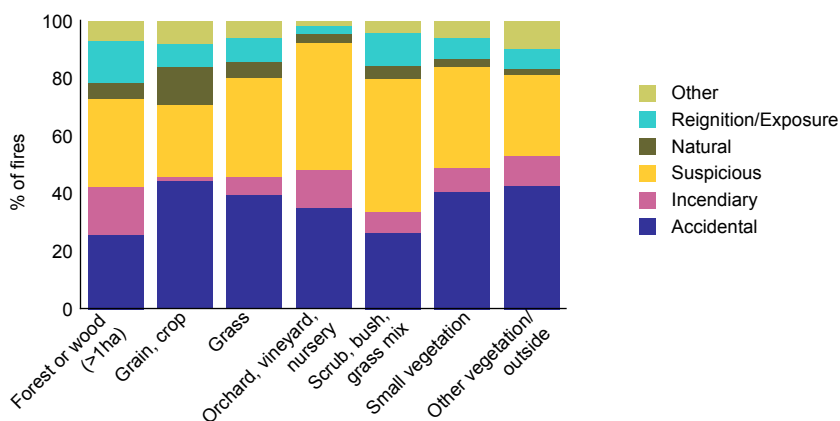
The proportion of vegetation fires classified as small vegetation fires was comparatively uniform across all regions, excluding Tropical North Queensland and to a lesser extent the Sunshine Coast regions, where there were higher proportions of small vegetation fires (Figure 48). Similarly, the combined proportions of grass fires and scrub, bush and grass mixed fires were comparatively uniform across most regions, although in detail the ratio of these vegetation types varied; the Gold Coast and Brisbane regions recorded more scrub, bush and grass mixed fires, whereas the Fitzroy, Northern, Darling Downs and Hervey Bay–Maryborough regions recorded a higher proportion of grassfires. This likely reflects different vegetation distributions in or near major urban centres in these regions.

Figure 46: Type of incident (percent)



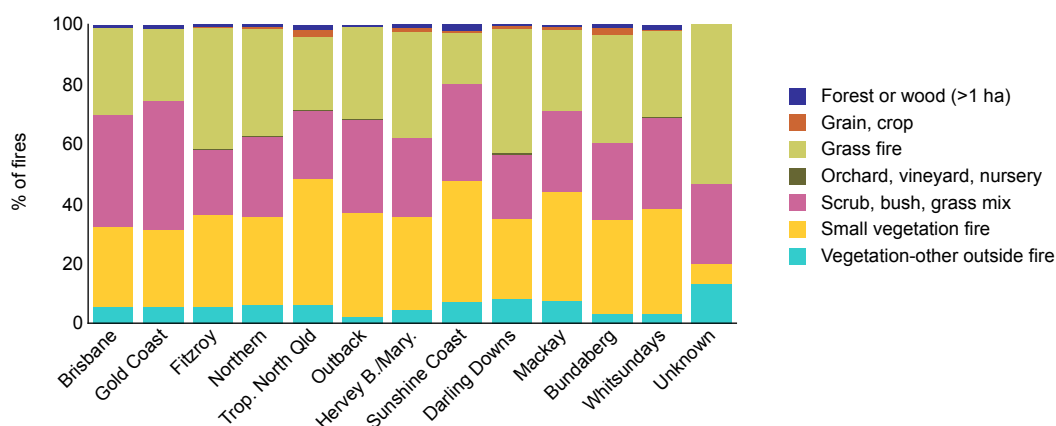
Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 47: Type of incident, by cause



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 48: Region, by type of incident



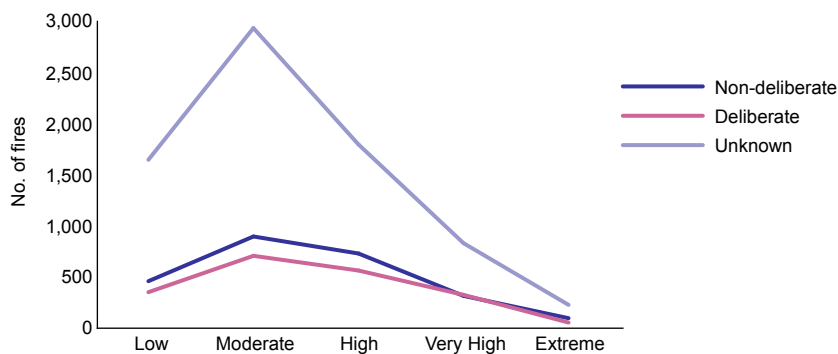
Source: QFRS 1997–98 to 2001–02 [computer file]

Bushfire danger

The fire danger rating was available for approximately one-quarter of fires the QFRS attended, although the small proportion of cases where causal attribution was known limits interpretation. The available evidence suggests that most fires occurred under moderate fire danger conditions. This was followed by high and low bushfire danger days, and subsequently by very high bushfire danger conditions (Figure 49). A very small proportion of fires occurred on extreme bushfire danger days.

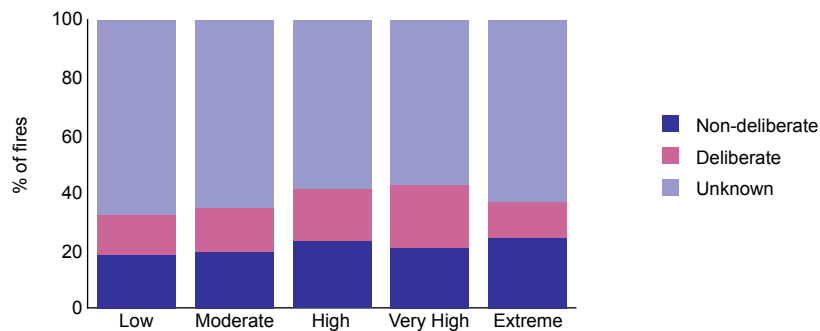
Although the ratio of deliberate to non-deliberate fires increased from low to very high bushfire danger conditions, this ratio was considerably lower for extreme bushfire weather (Figure 50). Considerable uncertainty exists within these results owing to the low number of vegetation fires for which both causal attributions were made and information pertaining to the bushfire danger period was available.

Figure 49: Bushfire danger, by cause



Source: QFRS 1997–98 to 2001–02 [computer file]

Figure 50: Fire danger condition, by cause



Source: QFRS 1997–98 to 2001–02 [computer file]

Forestry Plantations Queensland analysis

Background about the FPQ dataset and its analysis

Important information about the FPQ dataset and the methodology employed to analyse it is outlined below:

- The fire data were sourced from FPQ.
- The database spans from 1975–76 to October 2004, and hence principally reflects the lands under management of the Queensland Department of Primary Industries (inclusive of the various name changes), prior to 1999, and of FPQ subsequent to 1999. In considering the FPQ analysis it is necessary to take into account the reduction in land tenure over the interval, particularly following the large tenure transfer after 1999, following implementation of the South East Queensland Regional Forests Agreement.
- The database does not use AIRS classification codes.
- Cause was defined using the cause variable supplied (in some cases categories were summarised).
- All fires where the cause was identified as ‘Intentional: Illegal attempts at hazard reduction burning’, ‘Intentional: Malicious incendiary’, ‘Intentional: Mischief making’ or ‘Intentional: Torching abandoned/stolen vehicle’ were classified as incendiary.
- All fires where the cause provided was classified as ‘Intentional: Unknown but suspected’ were labelled suspicious.
- Deliberate causes refer to fires defined as incendiary and suspicious above.
- All natural vegetation fires were the result of lightning.
- No information was available about the number of vegetation fires that FPQ believed were started by smoking-related materials or by children.
- The ‘regions’ used in the FPQ are based on FPQ districts.
- The dataset included information about the area burned.
- Information was available about fire danger index and weather conditions at the time the fire occurred in approximately one-quarter of cases.

For more detail about these methodologies see the methodology chapter.

Overview

Fires the FPQ attended can be summarised as:

- FPQ records indicate, attendance at 3,531 fires from 1975–76 to 2003–04, representing an average of 122 fires per season (SD=66; excludes 2004–05 data). The actual frequency of vegetation fires attended in a year ranged from a low of 17 in 1983–84 to a high of 239 in 1977–78 (Figure 51).
- Of the five years with the highest recorded numbers of vegetation fires, four were associated with seasons during which there was an El Niño event. Nevertheless, high fire numbers also occurred in 1979–80, 1990–91, 2000–01 and 2001–02, years that were not concurrent with an El Niño event. Nor, were higher fire numbers evident for the 2002–03 season (El Niño event). The number of fires attended in the latter year was similar to low values observed throughout much of the 1990s (45 to 85 fires per season). The number of fires attended after 1999–2000 were likely impacted by the transfer of substantial amounts of lands so the number of fires attended in any one year, including 2002–03, cannot be compared with each other or with previous years.

- Fires ranged from small through to large. Given the FPQ's jurisdiction, it is reasonable to assume that the majority of fires occurred in or near a highly vegetated area. Hence, the fires within this database were either bushfires or had the potential to develop into a bushfire under more adverse circumstances.
- Twenty percent of fires attended from 1975–76 to October 2004 were classified incendiary with a further 16 percent being regarded suspicious.
- One-third of all FPQ fires occurred in the Beerburrum district.
- The 3,573 fires the FPQ attended between 1975–76 and October 2004 burned around 1,580,444 ha; 18 percent of this was burned by fires of deliberate (principally suspicious) origin.

Cause

Deliberate (incendiary and suspicious combined) lightings accounted for 36.2 percent of FPQ-attended fires between 1975–76 and 2003–04, with the proportions of identified incendiary cases (20%) slightly outweighing suspicious cases (16%; Figure 52). In contrast to the QFRS data, almost 12 percent of fires were natural, with a further 23 percent being the result of accidental causes. Unknown attributions account for 28 percent of fires attended. Hence, deliberate causes accounted for 50 percent of known causes.

The proportion of deliberate fires varied between years, ranging from 17 percent in 1981–82 to 70 percent in 1998–99 (Figure 53). The highest proportions of deliberate fires occurred during the seasons with lowest total number of fires. At the beginning of the 1990s rates of deliberate fires jumped from about 25 to roughly 50 percent per annum. There is some uncertainty over the actual percentage of deliberate fires during the mid to late 1970s owing to higher proportions of fires of unknown cause. However, the proportion of unknown causes has remained comparatively low since the early 1980s. The large increase in the proportion of deliberate fires in the early 1990s appears to reflect a genuine increase in the number of deliberate fires rather than simply changes in the proportions of other causes. The average number of deliberate fires lit per year for the 1981–82 to 1988–89 period was 24. The average number lit per year between 1989–90 and 2003–04 was 60.

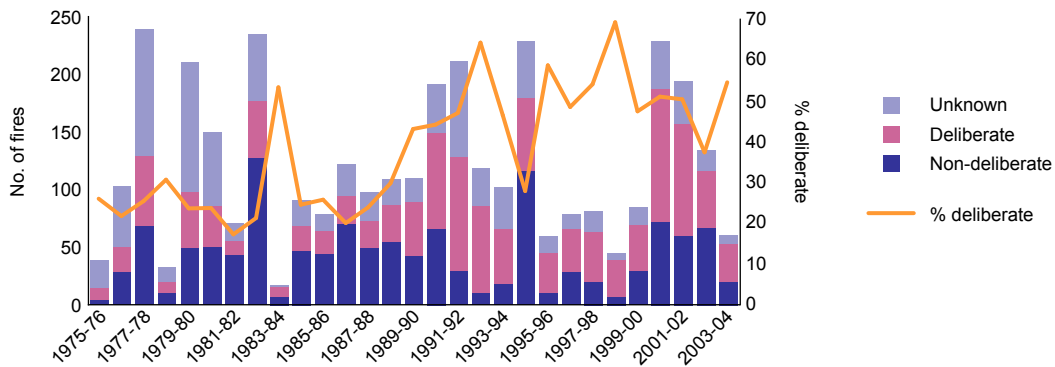
Specific ignition factors

The FPQ database incorporated ten separate causal categories, four relating to non-deliberate causes, one category to unknown causes, and five categories to deliberate causes (including unknown but suspicious fires). The most common human-related cause of non-deliberate fires occurred in instances where all reasonable care was taken (19.1%; Figure 54). Cases deemed to have been the result of carelessness (3.2%), gross negligence (0.5%) and reasonably foreseeable–stupidity (0.9%), appeared comparatively infrequently. Of the deliberate attributions, cases of suspected arson dominated (16.7% of all fires), followed by instances of malicious incendiarism (12.5%), the torching of abandoned/stolen vehicles (5.0%) and mischief making (1.4%).

Subtle temporal changes are evident in the number and proportions of some specific non-deliberate and deliberate causes, although caution is needed as the classification scheme of fire causes may have changed over the observation period. Of note is the decline in fires where all reasonable care was taken (Figure 55). This is counterbalanced by greater attributions of carelessness, gross negligence and stupidity. Collectively these trends may signify a lower tolerance by fire authorities toward avoidable bushfire ignitions rather than a significant shift in the attitudes of those lighting fires. A point particularly worthy of note is the marked reduction in the number (Figure 55) and proportion (Figure 56) of fires of unknown cause where arson was not suspected.

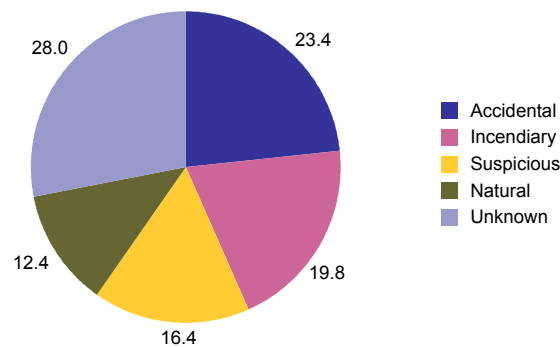
Although variable, the number (Figure 57) and proportion (Figure 58) of fires attributed to malicious incendiary have tended to increase over the observation interval. The torching of abandoned/stolen vehicles increased markedly from the early 1990s onwards. In 2000–01, there were 24 reported cases of where vehicles were torched on or near FPQ lands. The proportions of ‘unknown but suspicious’ fires have fluctuated about a roughly uniform mean.

Figure 51: Cause of fires, by year



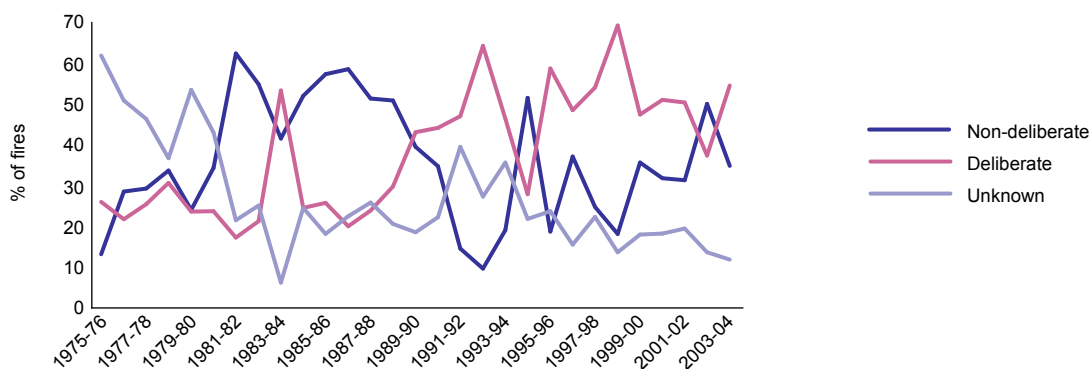
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 52: Cause (percent)



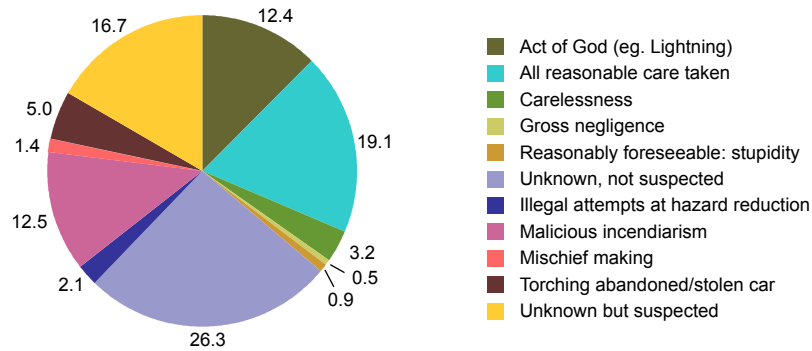
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 53: Cause of fires, by year (percent)



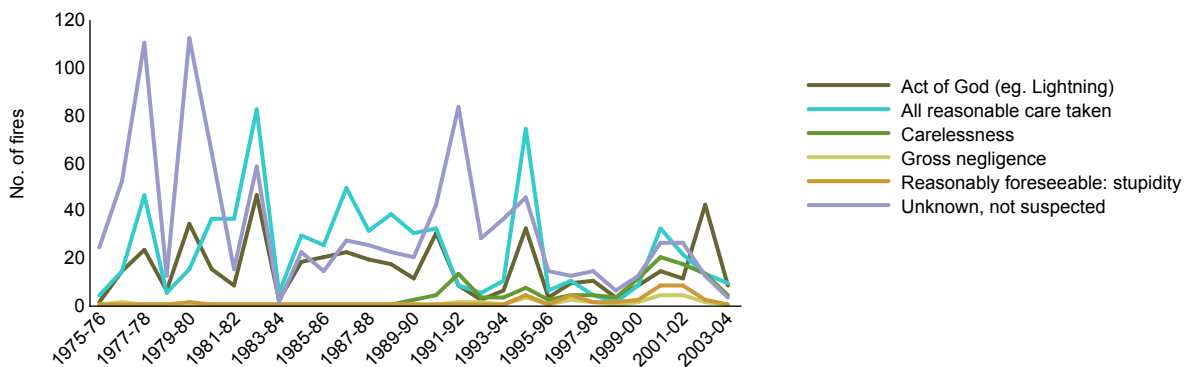
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 54: FPQ cause (percent)



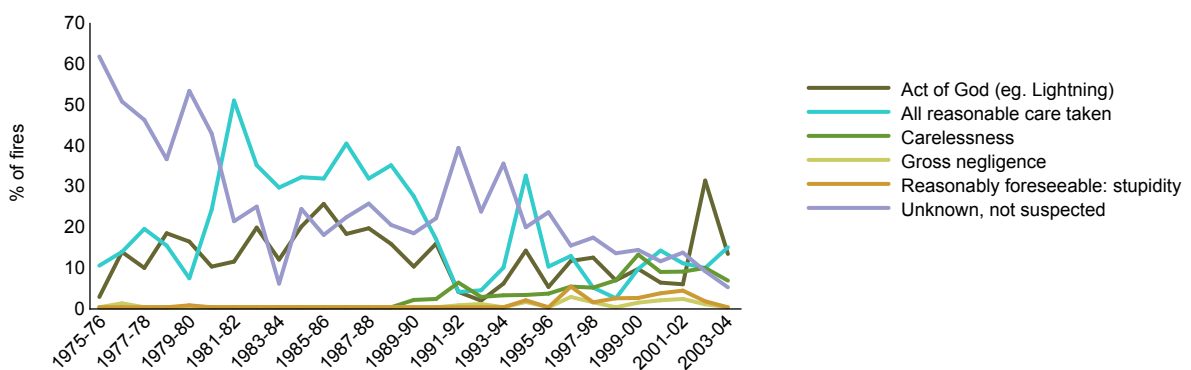
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 55: Non-deliberate fires, by cause and year (number)



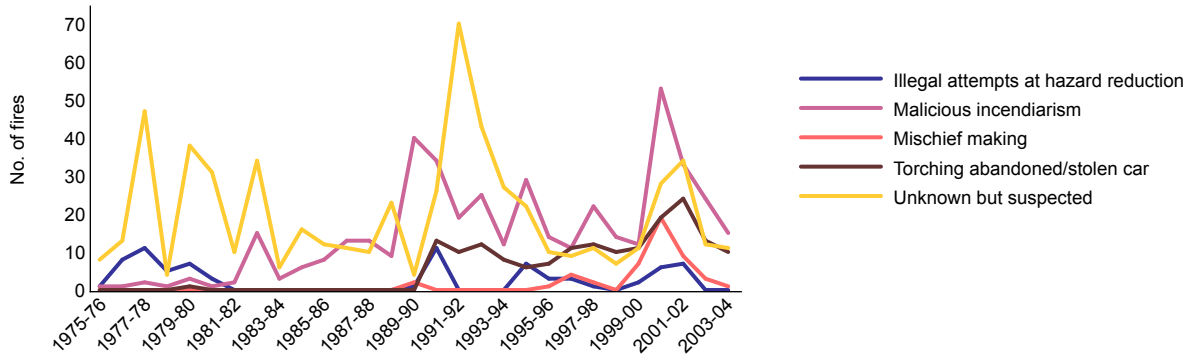
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 56: Non-deliberate fires, by cause and year (percent)



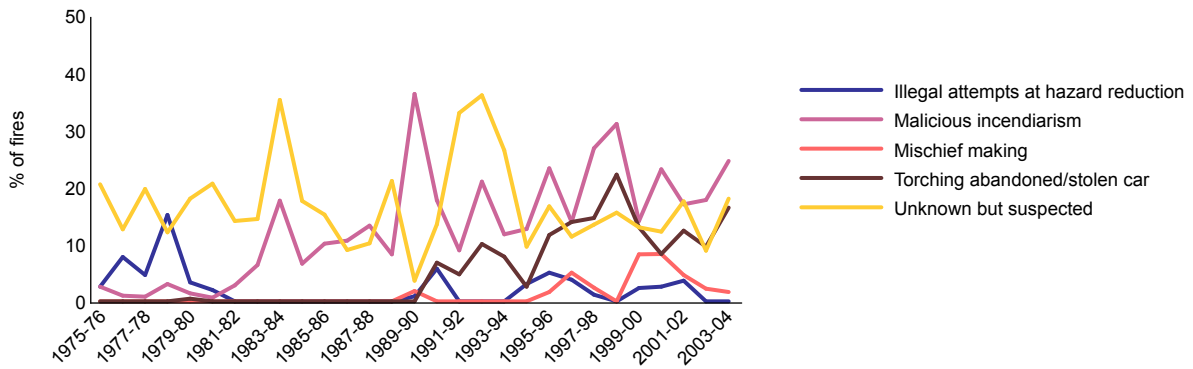
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 57: Deliberate fires, by cause and year (number)



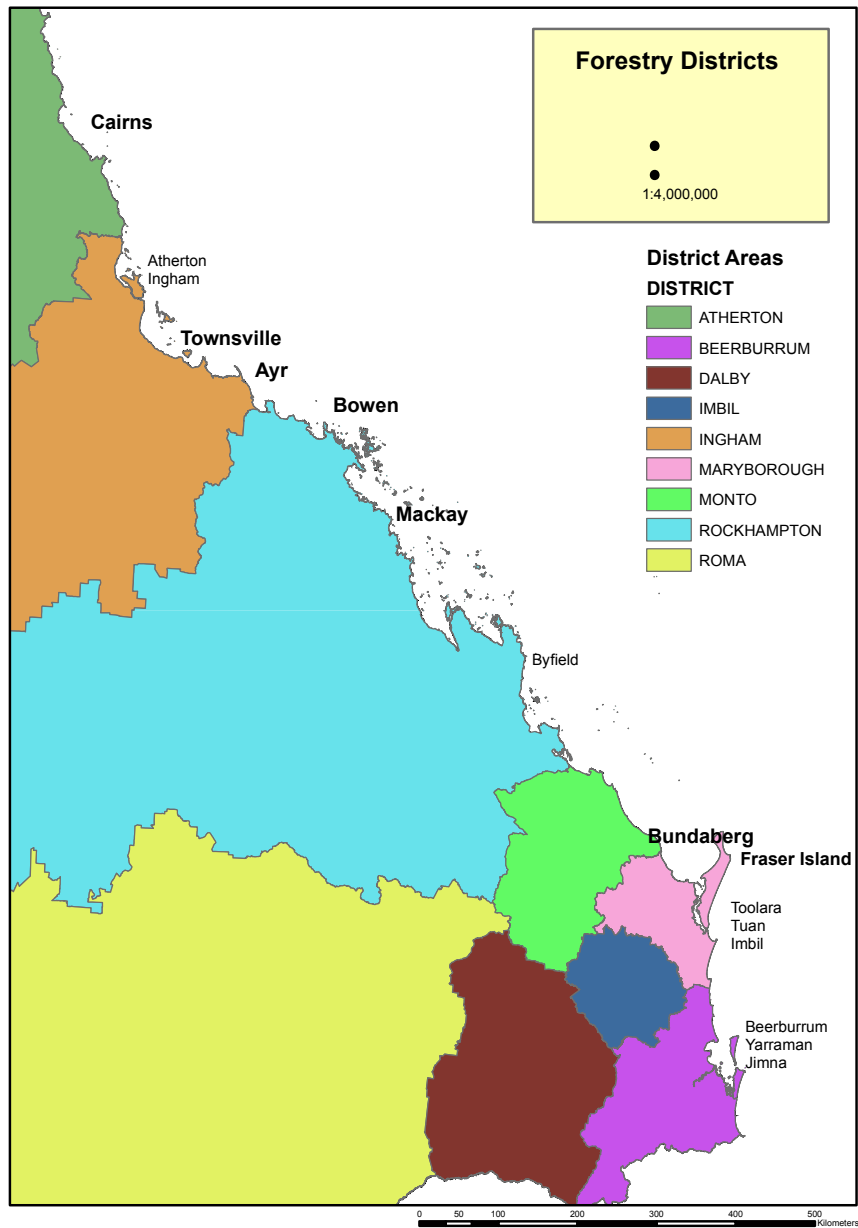
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 58: Deliberate fires, by cause and year (percent)



Source: FPQ 1975-76 to October 2004 [computer file]

Figure 59: FPQ Forestry districts



Source: © Forestry Plantations Queensland

Location

Information about the location of fires is discussed in relation to the district and tenure where fires occurred.

District

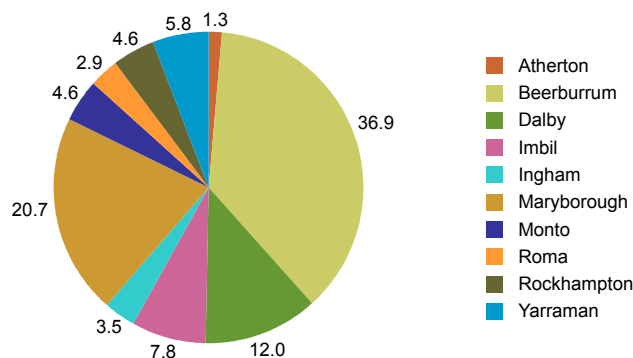
The distribution of fires within the FPQ database is necessarily influenced by the distribution of lands over which the FPQ had jurisdiction, and this has not remained uniform during the observation period. The distribution of lands used for forestry as at 1996–97 are illustrated in Figure 4.

FPQ define nine forestry districts (Figure 59). These differ from the regions used in the QFRS analysis. As a broad guide, Atherton lies in Tropical North Queensland, Ingham in the Northern District, Rockhampton in Fitzroy, Monto in the Bundaberg region, Roma in the Outback region, Dalby and Yarraman in the Darling Downs, Imbil and Maryborough in the Hervey Bay–Maryborough region, and Beerburrum in the Sunshine Coast region. The latter may however also include land within the Brisbane tourism region.

Thirty-seven percent of vegetation fires the FPQ attended occurred in the Beerburrum district (Figure 60), with the Maryborough, Dalby and Imbil districts accounting for a further 21, 12 and eight percent of fires the FPQ attended, respectively. The majority of fires occurred in the southeast of the state, within districts with both the highest density of FPQ forests and the areas of greatest population density and growth. Only about five percent of the FPQ fires occurred in the northern half of the state.

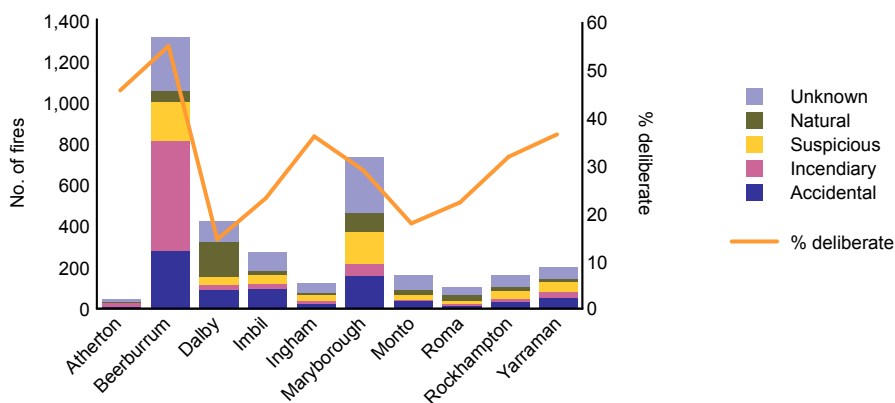
The greatest number and highest proportion of deliberate fires occurred in the Beerburrum district, with 55 percent of all fires in that area being deliberately lit (Figure 61). A high proportion of fires in the Atherton district were also deliberate but the incidence of such fires was very low (n=21). Natural fires were a major contributor to increased numbers of fires in the Dalby and to a lesser extent, Maryborough districts.

Figure 60: District (percent)



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 61: Cause of fires, by district

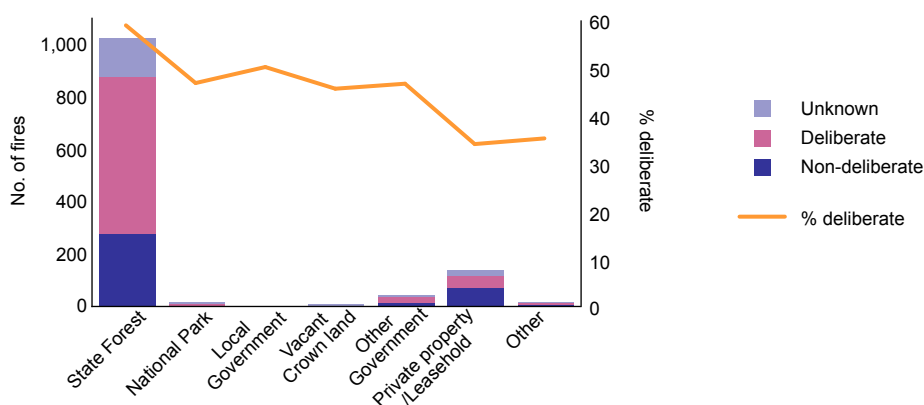


Source: FPQ 1975–76 to October 2004 [computer file]

Tenure

The tenure of property on which fires occurred was only identified in 35 percent of cases. Of these the majority (81%) were in state forests with a further 11 percent occurring on private property or leasehold; only one percent originated in national parks (Figure 62). The rates of deliberate fires were marginally higher in state forests than in other property types.

Figure 62: Tenure



Source: FPQ 1975–76 to October 2004 [computer file]

Timing

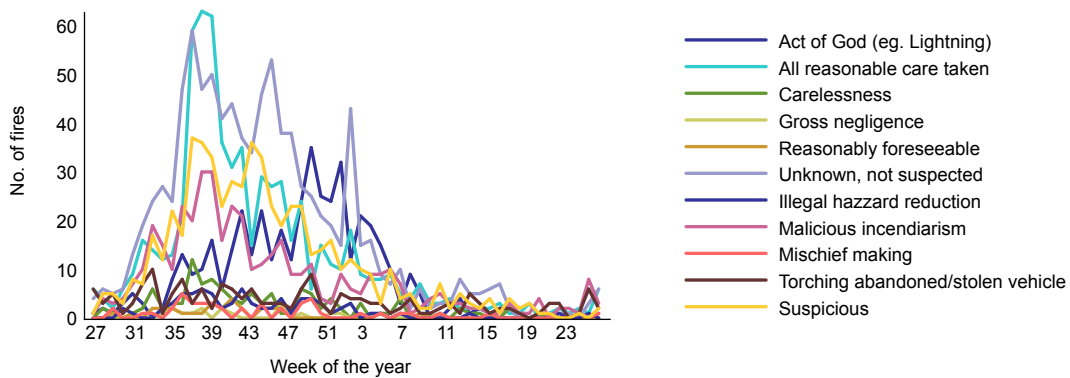
The timing of fires is examined by week of the year, day of the week and time of the day.

Week of the year

The number of fires the FPQ attended increased rapidly in late winter to early spring before decaying over the remainder of spring and summer. However, subtle differences were evident in the distributions for individual causes (Figure 63). Most human-caused fires occurred between mid August and mid January with the peak occurring in September. This was evident for both deliberate and non-deliberate causes. The peak in fires for which all reasonable care was taken (September) does not correspond with the peak in natural fires (December). This may reflect the fact that many natural fires occurred in the Dalby district, where peak intensities in vegetation fires occurred somewhat later. Statewide, the number of natural fires increased from early October onwards, but also may vary from year to year.

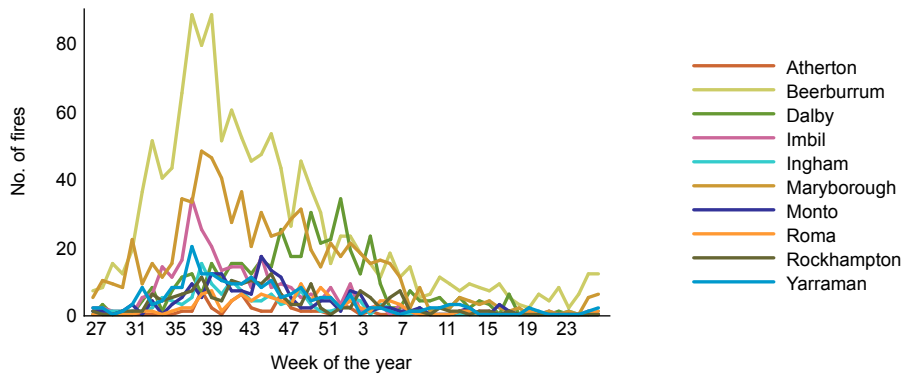
The timing and number of fires also varied markedly between years, but this is too complex to be able to illustrate figuratively. The timing of fires also varied subtly between regions (Figure 64). Most notable is that fires in the Dalby and, to a lesser extent, Roma districts tended to occur somewhat later than in other areas (Figure 65). In the Dalby area, the number of fires began to increase from early September onwards, peaking around early New Year. Fires in the Outback region and northern savannas tended to occur early in the calendar year than those in southern Queensland. Hence, the overall timing depends on the relative proportions of fires from regions with diverging fire regimes. Overall, comparatively few fires originated in either the Dalby or Atherton districts; hence the distribution of fires the FPQ attended most closely approximates the fire region that dominates in southeast Queensland.

Figure 63: Week of the year, by cause



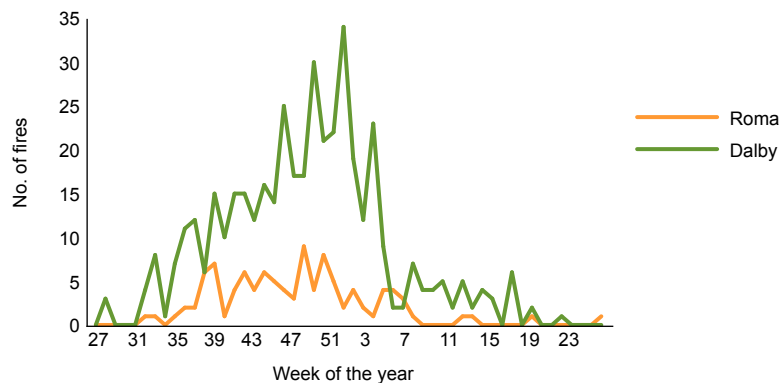
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 64: Week of the year, by district



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 65: Week of the year for Dalby and Roma districts



Source: FPQ 1975–76 to October 2004 [computer file]

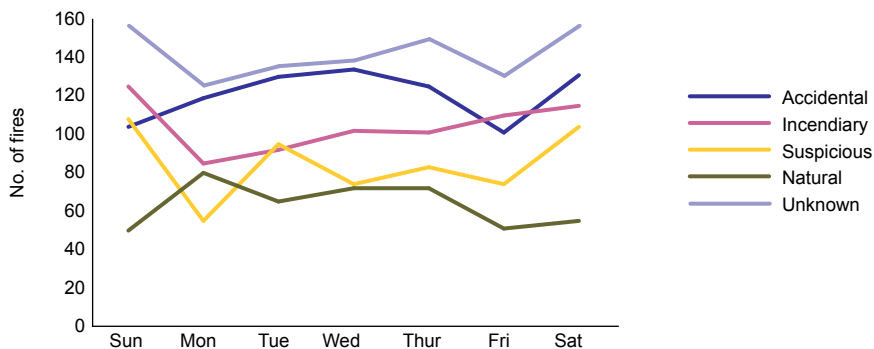
Day of the week

Overall, eight percent more fires occurred on Sunday and 12 percent on Saturdays than on the weekday average. However, this principally relates to the greater number of deliberate fires lit on those two days. Notably, 34 and 26 percent more deliberate fires occurred on Sunday and Saturday than on the average weekday. In contrast, non-deliberate fires were slightly less likely to happen on a weekend, or if they did occur on a weekend, were more likely to occur on a Saturday (Figure 66).

The increase in deliberate fires was observed across all categories, with the exception of mischief making. Seventeen to 20 percent more cases of malicious incendiarism occurred on Sunday and Saturday than on the weekday average. Approximately 40 percent more cases of torching of abandoned or stolen vehicle also occurred on Sunday and 24 percent more on Saturday than on the weekday average. A high number of illegal hazard reduction also occurred on Sunday.

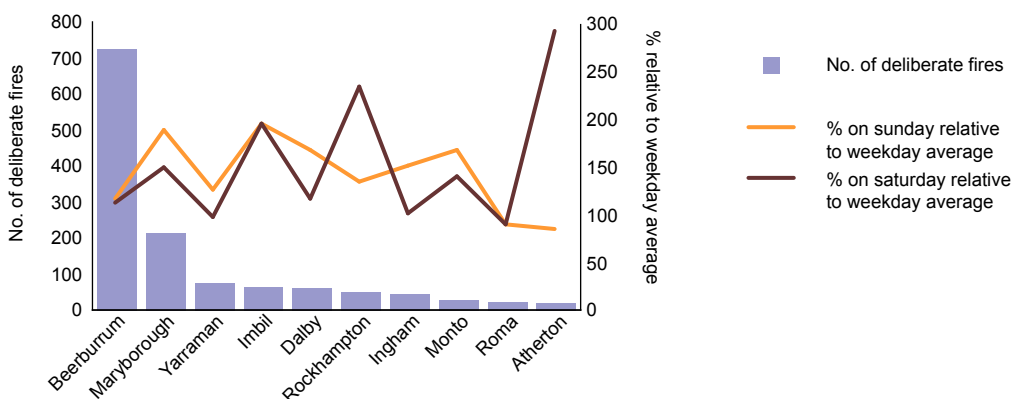
The extent of the increase in deliberate fire numbers on weekends varied between districts (Figure 67). In the Beerburrum district, an area characterised by a high number of deliberate vegetation fires generally, only 10 to 15 percent more deliberate fires occurred on Saturday and Sunday, whereas in Maryborough between 50 and 90 percent more deliberate fires occurred on weekend days. In Rockhampton, substantially more deliberate fires occurred on Saturdays than on Sundays, whereas in Maryborough, Ingham and Monto the reverse prevailed. In the Imbil district 90 percent more deliberate fires occurred on both Saturday and Sunday relative to the weekday average.

Figure 66: Day of the week, by cause



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 67: Weekend bias, by forestry district



Source: FPQ 1975–76 to October 2004 [computer file]

Time of day

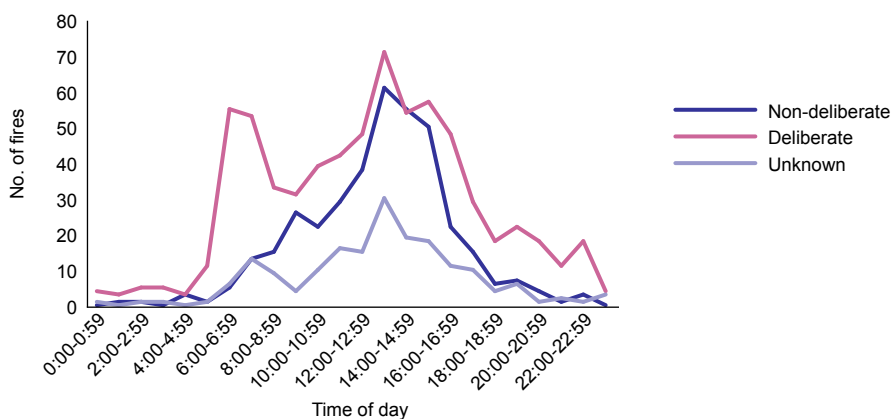
The overwhelming majority of FPQ-attended vegetation fires – be they deliberate or non-deliberate in origin – were detected during daylight hours. High numbers of non-deliberate fires occurred within a narrow window between 11 am and 4 pm (Figure 68). The peak was somewhat narrower and slightly earlier (1 to 2 pm) than the peak in non-deliberate fires documented for the QFRS data (3 to 4 pm). Unlike the QFRS data, the daytime peak for deliberate and non-deliberate fires coincided, with the ‘midday’ peak in deliberate fires being earlier than for QFRS-attended fires.

There was a high incidence of deliberate fires just after 6 pm. This trend was not evident for non-deliberate fires, but there were comparatively few fires detected between midnight and 5 am. However, the FPQ is characterised by a large spike in deliberate fires between 6 and 8 am. This spike is unique to the FPQ data, and although morning firesetting cannot be dismissed; it is more likely that this subset represents fires ignited the previous night but only detected the following morning.

Fires with detection times of between 6 and 8 am were primarily located in the Beerburrum area (compare Figure 69 and Figure 70). Of those fires in the Beerburrum area occurring between 6 and 8 am, 53 percent resulted from the torching of abandoned vehicles with a further 35 percent resulting from malicious incendiary. Another 10 percent were suspicious in origin. Fires lit within this timeframe accounted for 11 percent of all malicious lightings and 31 percent of all torched vehicles the FPQ attended in the Beerburrum area.

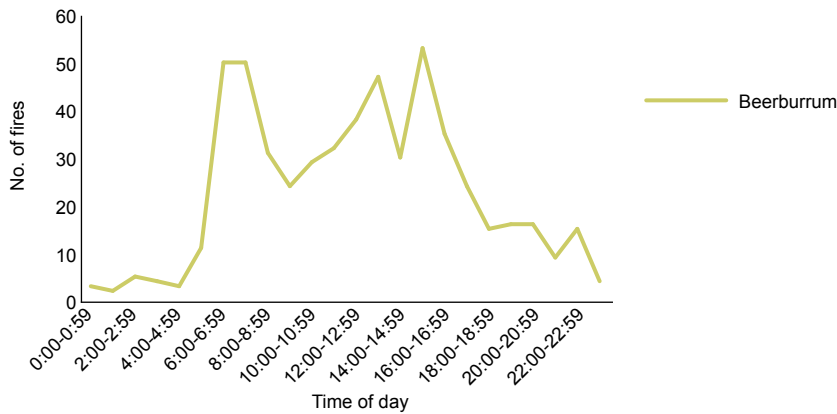
Cultural and social patterns, and hence temporal patterns of deliberate fires, are likely to have altered significantly in 29 years; patterns that were relevant in the late 1970s are unlikely to be the same as today. However, as the number of deliberate fires has increased over time, the general patterns described above were dominated by recent trends.

Figure 68: Detection time, by cause



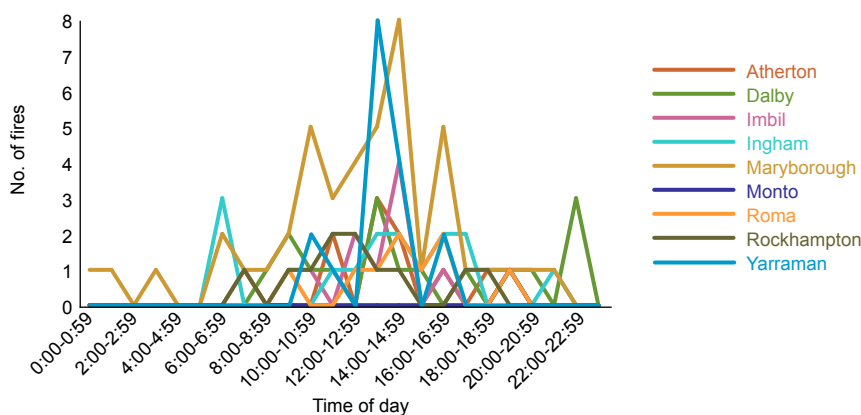
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 69: Detection time of deliberate fires in the Beerburrum district



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 70: Detection time of deliberate fires in selected districts



Source: FPQ 1975–76 to October 2004 [computer file]

Area burned

There was a sharp decrease in the number of vegetation fires with increasing fires size (Figure 71). Although similar to the trend observed for the QFRS data, there were clearly a higher proportion of moderate sized fires than in urban areas, with the pronounced spikes for the 10 to 49.9 and 100 to 499 ha categories. The latter were as frequent as fires within the less than one hectare category. An increased proportion of moderate-sized fires occurred across all causal categories, although subtly different distribution occurred for individual causes.

The majority of larger FPQ fires (those exceeding 1,000 ha) fires were natural, accidental (where reasonable care was taken) in origin, or the result of unknown causes (Figure 72). Natural fires accounted for all fires greater than 50,000 ha.

Deliberate fires accounted for a decreasing proportion of vegetation fires as the size of the fire (area burned) increased (Figure 72). This principally reflects decreases in the proportion of fires resulting from malicious incendiarism and the torching of abandoned and stolen vehicles. Fires of suspicious origin were more evenly distributed across area categories of varying size.

There were 341 deliberately lit fires that burned greater than 50 ha, 60 that burned greater than 1,000 ha, and five that burned greater than 10,000 ha. The largest occurred in the Monto district, covering an area of 25,000 ha. Nevertheless, some caution is needed when interpreting these results as the cause of 47 of the 60 fires that burned 1,000 ha or more was listed as 'unknown but suspected'. Six of the 60 fires that burned greater than 1,000 ha were identified as resulting from malicious incendiarism. The largest of these burned 10,600 ha in the Rockhampton area. A further six of the deliberately fires greater than 1,000 ha resulted from illegal attempts at hazard reduction. The largest of these occurred in the Roma district and burned 11,250 ha. That fires lit carelessly in natural reserves have the potential to cause significant damage is evidenced by the fact that one fire in the Beerburrum district that resulted from the torching of an abandoned or stolen vehicle subsequently burned 1,993 ha of land.

Between 1975–76 and October 2004, 1,580,444 ha were burned by the 3,573 fires that the FPQ attended; 45 percent of which was burned by non-deliberate fires. Approximately 17 percent of the total area burned resulted from lightning strikes (Figure 73) and accidental fires, where all reasonable care was taken, burned a further 25 percent of land.

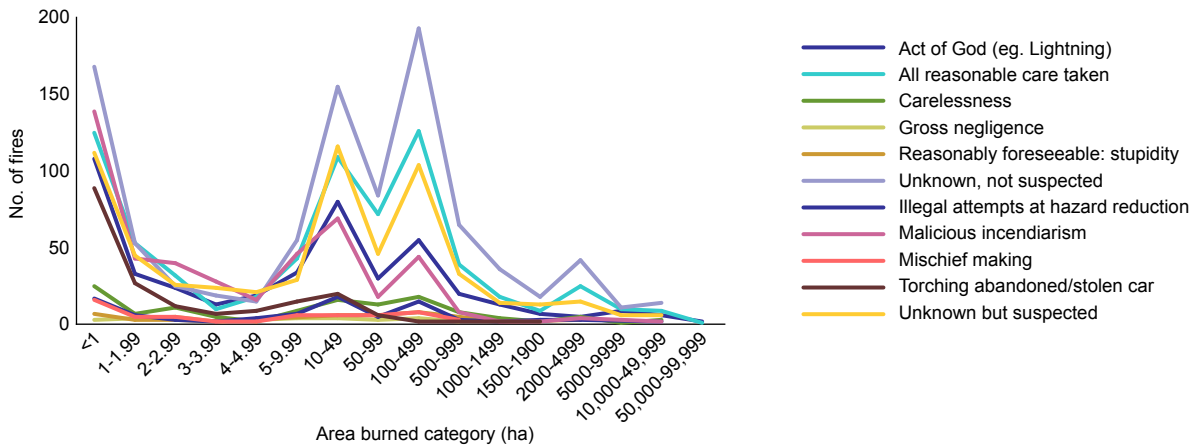
Deliberate or suspected fires were responsible for burning 18 percent of the total area burned. The majority of this relates to suspicious fires, with malicious incendiarism and the torching of vehicles accounting for just 2.5 and 0.2 percent of the total area burned, respectively (Figure 73).

The total area burned varied substantially across seasons, from a maximum of 229,570 ha during the drought of 1982–83 to a minimum of 2,580 ha in 1998–99 (Figure 74). Two of the three years during which very large areas were burned were associated with El Niño events, namely 1982–83 and 1994–95. The amount of land burned on FPQ lands during subsequent El Niño events (1997–98 and 2002–03) were not remarkable in comparison to the average yearly area burned. Prior transfers of land tenure may have affected total area burned in 2002–03.

Deliberate fires typically accounted for about 20 percent of the total area burned in one year, although in detail it was somewhat variable (Figure 74). Deliberate causes typically contributed to the highest proportions of area burned in years during which the total area burned was very low. Although the number of deliberate fires has increased, five-year averages reveal that the total area burned by deliberate fires has decreased since the peak in the late 1970s–early 1980s (Figure 75). This related to fundamental long-term changes in the size and distribution of FPQ-attended vegetation fires over time. The proportion of smaller fires, particularly those less than 10 ha, has increased substantially over the observation period (Figure 76). This may reflect improved response and firefighting capacity; or it may reflect a change in the character of fire setting, with an increasing propensity for a greater number of small deliberate fires – the class of fire that characterises many urban environments.

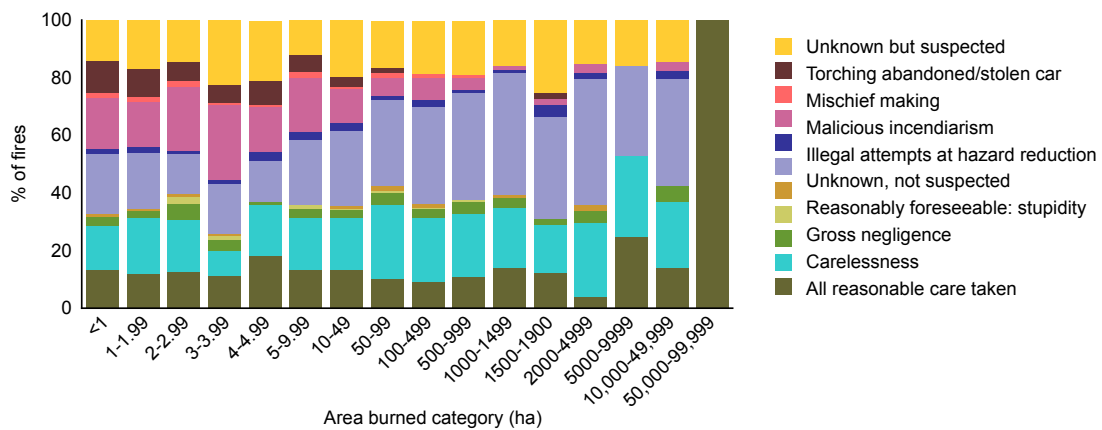
Between 1975–76 and October 2004 the greatest total area was burned in the Rockhampton, followed by Maryborough, Monto, Roma and Beerburrum districts (Figure 77). Comparatively smaller areas of land were burned in the Atherton, Ingham and Yarraman districts. Deliberate fires accounted for 20 percent of the total area across most districts (Figure 77). The notable exceptions were for the Atherton and Ingham districts, where the number of fires and the area burned by fires of all causes was very low. The size distribution of vegetation fires varied substantially between districts. Beerburrum accounted for a decreasing proportion of fires as fire-size increased (Figure 78). In contrast, Monto, Rockhampton and Roma accounted for a higher proportion of the total area burned as the total area burned increased.

Figure 71: Area burned category, by cause (number)



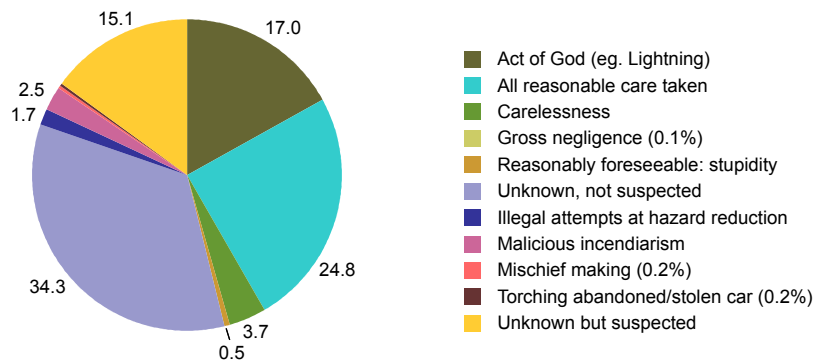
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 72: Area burned category, by cause (percent)



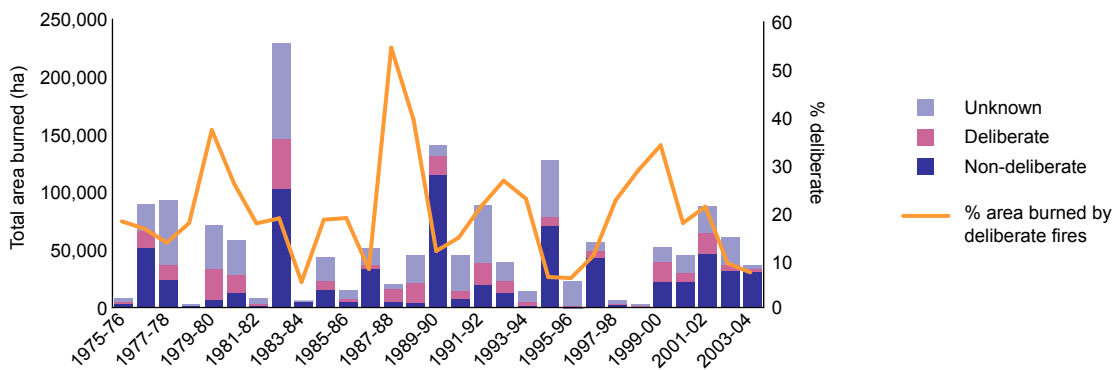
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 73: Total area burned (percent)



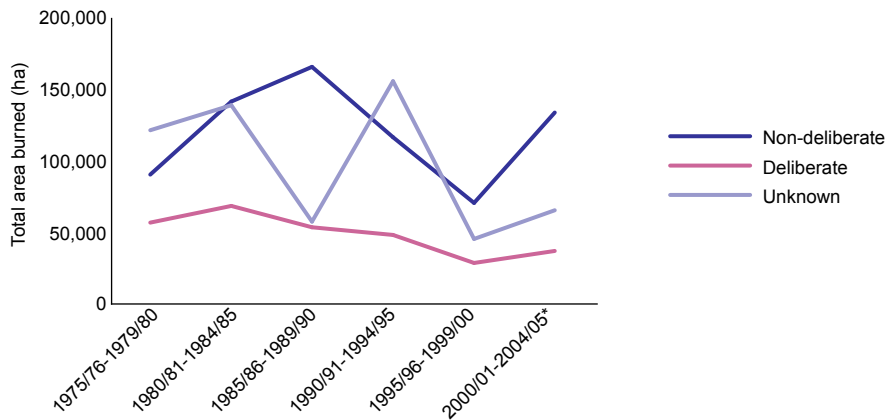
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 74: Area burned, by cause each year



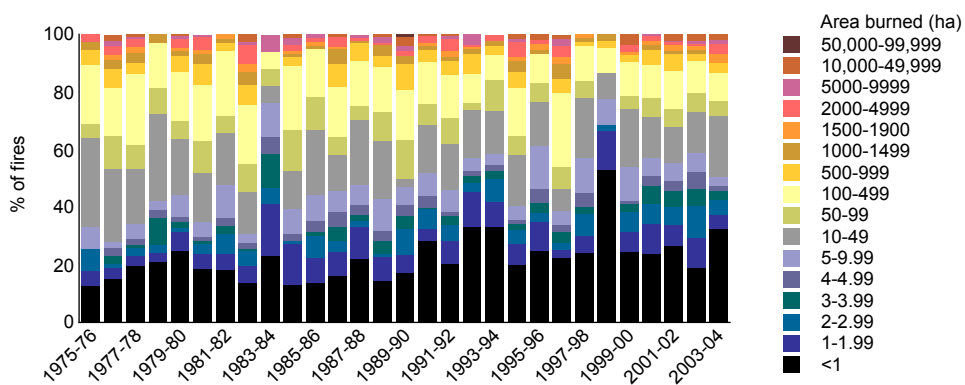
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 75: Area burned, by cause in five-year intervals



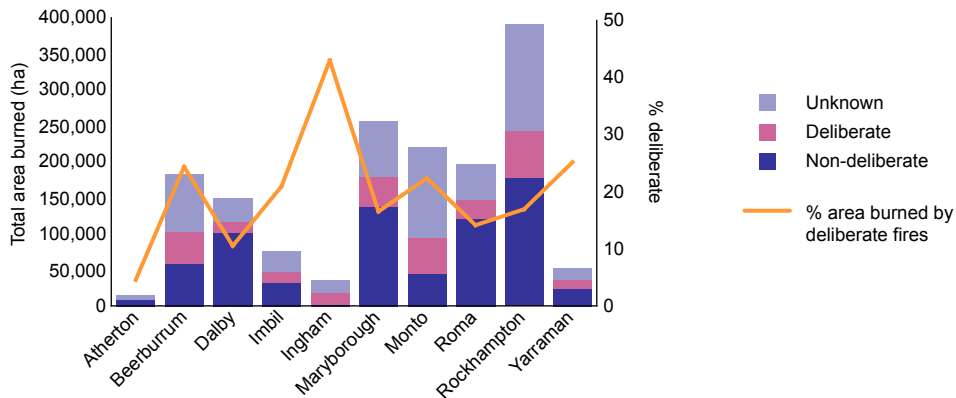
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 76: Temporal changes in the size distribution of fires



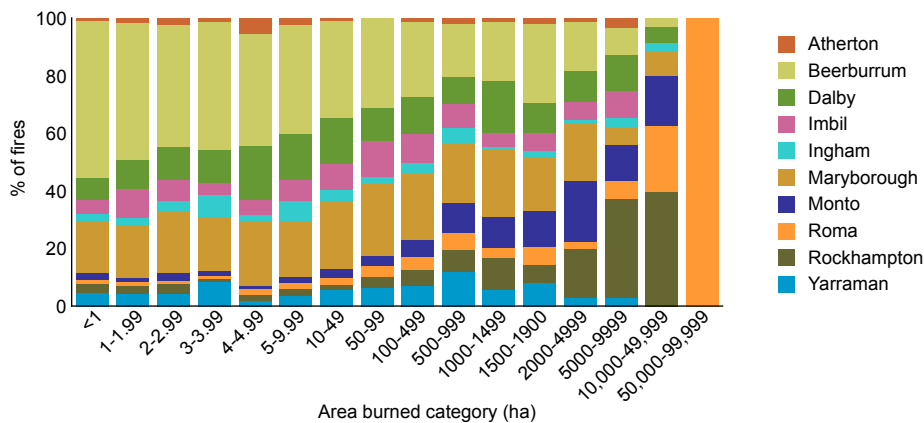
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 77: Total area burned, by cause in each region



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 78: Area burned category, by region (percent)



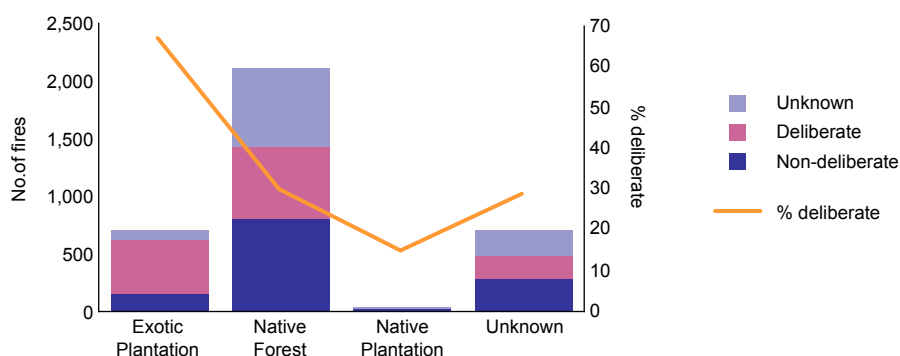
Source: FPQ 1975–76 to October 2004 [computer file]

Vegetation

Approximately 60 percent of fires the FPQ attended occurred in native forests with a further 20 percent in exotic plantations. Only one percent of fires occurred in native plantations. In 20 percent of cases the vegetation burned was unknown.

Approximately, 65 percent of fires in exotic plantations were, or were suspected of being, deliberately lit (Figure 79). At least 30 percent of fires in native forests were deliberately lit, although the actual figure was likely to have been much higher given the low level of causal attributions for this forest type.

Figure 79: Forest type, by cause



Source: FPQ 1975–76 to October 2004 [computer file]

Bushfire danger and weather

This section analyses the weather conditions, including temperature, humidity, wind speed and bushfire danger rating, at the time the fires occurred. This enables some assessment of the conditions under which people deliberately light fires.

Temperature: Temperature data was available for 93.5 percent of fires the FPQ attended between 1975–76 and October 2004. Although the greatest number of both deliberate and non-deliberate fires occurred in the 25 to 29°C range it is evident from Figure 80, that non-deliberate fires were more likely to occur at higher temperatures than deliberate fires.

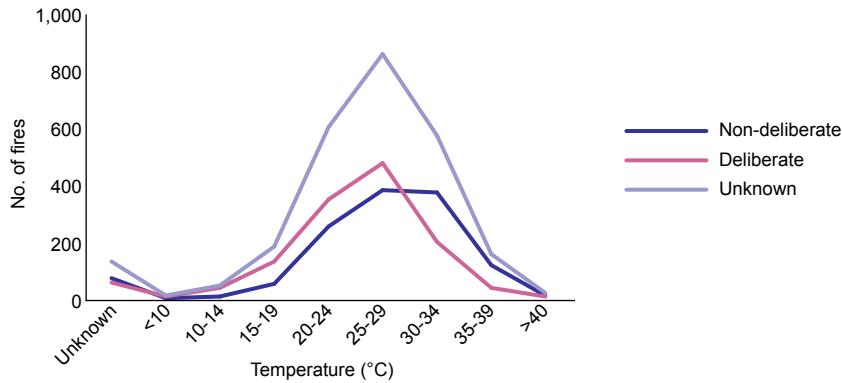
The distribution for non-deliberate fires is strongly influenced by natural fires, which peaked at temperatures of 30 to 34°C (Figure 81). Malicious incendiarism and the torching of abandoned or stolen vehicles tended to peak at lower temperatures than human-caused non-deliberate fires. However, this discrepancy is not evident for suspicious (unknown but suspected) fires, illegal attempts at hazard reduction, or fires resulting from mischief making. The numbers of deliberate fires that occurred when the temperatures exceeded 40°C was very small (Figure 80); only two fires occurring at temperatures exceeding 40°C were attributed to malicious incendiarism, but a further seven were suspicious in origin. However, only one of those suspected cases occurred after June 1994.

The extent to which the listed temperature corresponds to the temperature at the precise time the fire started is unclear. The data were reanalysed to only include those fires that were detected between 10 am and 6 pm, thereby excluding the spike in deliberate fires between 6 and 8 am. If the temperature recordings are accurate, then the inclusion of the latter fires – fires that were more likely to have been lit at night – would generate comparatively lower average temperatures for deliberate compared with non-deliberate fires. The 10 am to 6 pm interval is also of interest as it represents the interval where fires were more likely to spread and therefore pose the greatest danger.

A total of 795 fires occurred between 10 am and 6 pm for which both time and temperature were known (98 percent of those cases where time was known). It is clear that the trends for deliberate and non-deliberate fires are more alike when data pertaining to fires lit between 6 pm and 10 am are removed. Notably, there were fewer deliberate fires within the less than 15°C and, to a lesser extent, the 15 to 19°C categories. The ratio of deliberate to non-deliberate fires at higher temperatures is largely unchanged (Figure 82). These results imply that the temperatures were largely indicative of the time that fire occurred, and that the strong bias toward lower temperature for deliberate fires was affected by the greater number of night-time–early morning fires when compared with non-deliberate causes. Nevertheless, it remains

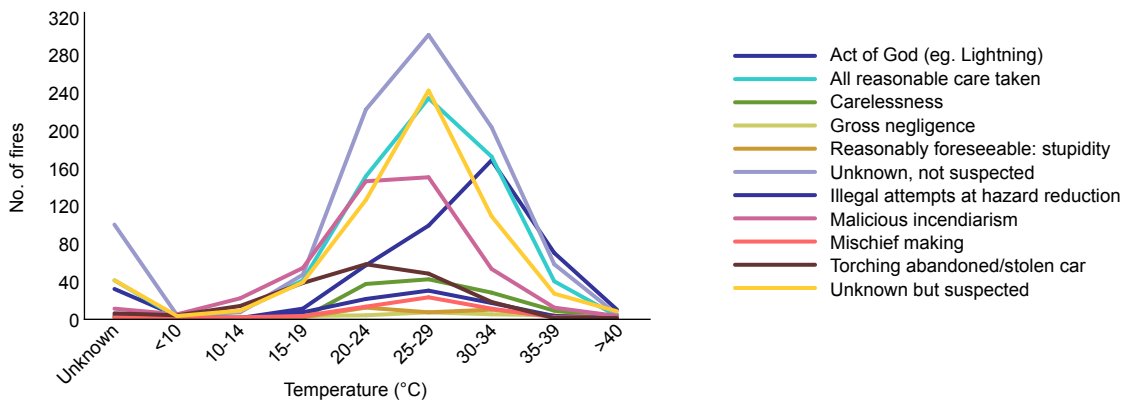
that malicious incendiarism, torching of motor vehicles and, to a lesser extent, suspicious fires occurred at marginally lower temperatures than accidental causes for fires between 10 am and 6 pm (Figure 83).

Figure 80: Temperate, by cause



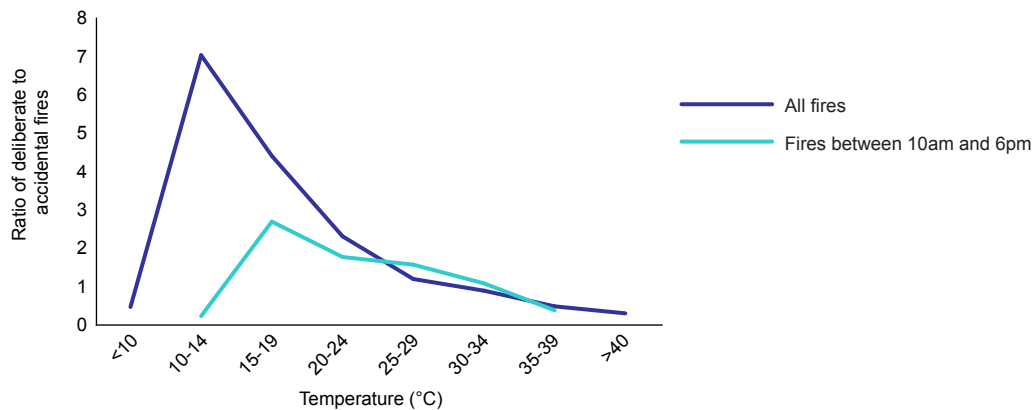
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 81: Temperate, by specific cause



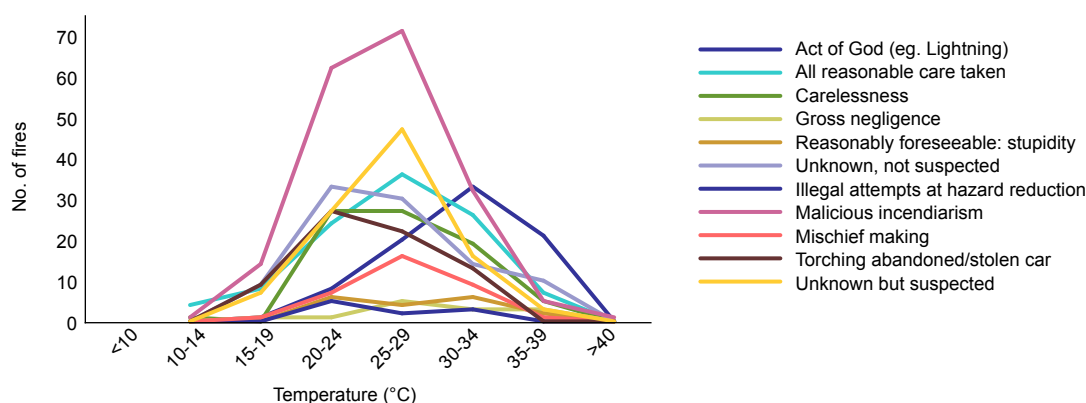
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 82: Deliberate/non-deliberate ratio, by temperature



Source: FPQ 1975–76 to October 2004 [computer file]

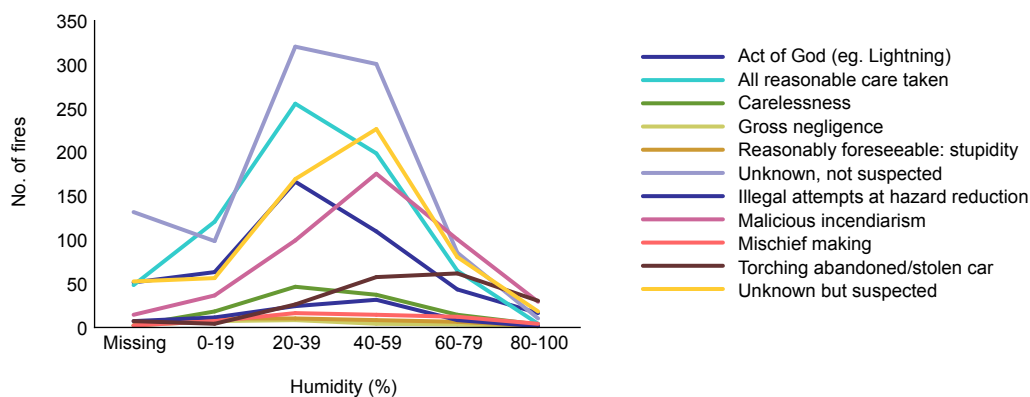
Figure 83: Temperature, by specific cause for fires occurring between 10 am and 6 pm based on cause



Source: FPQ 1975–76 to October 2004 [computer file]

Humidity: Variations in the humidity for deliberate and non-deliberate fires mirror that observed for temperature. Natural fires were more likely to occur on low humidity days, whereas malicious incendiarism and vehicle torching occurred under comparatively more humid conditions (Figure 84).

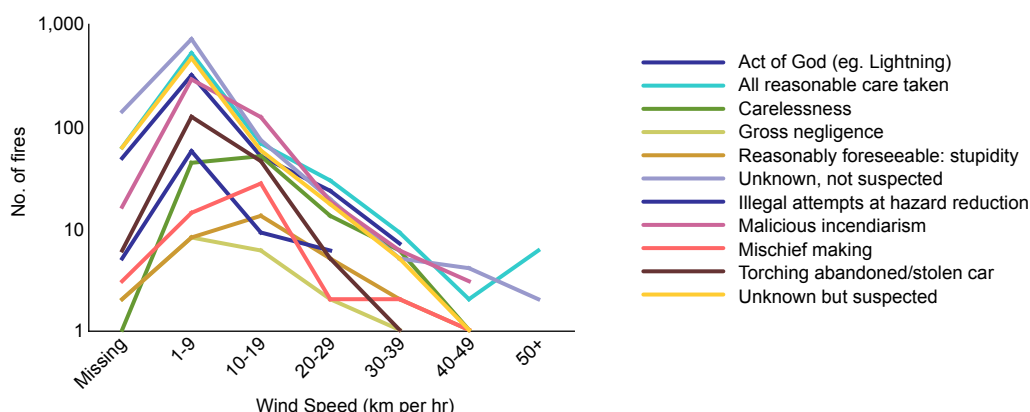
Figure 84: Humidity, by cause



Source: FPQ 1975–76 to October 2004 [computer file]

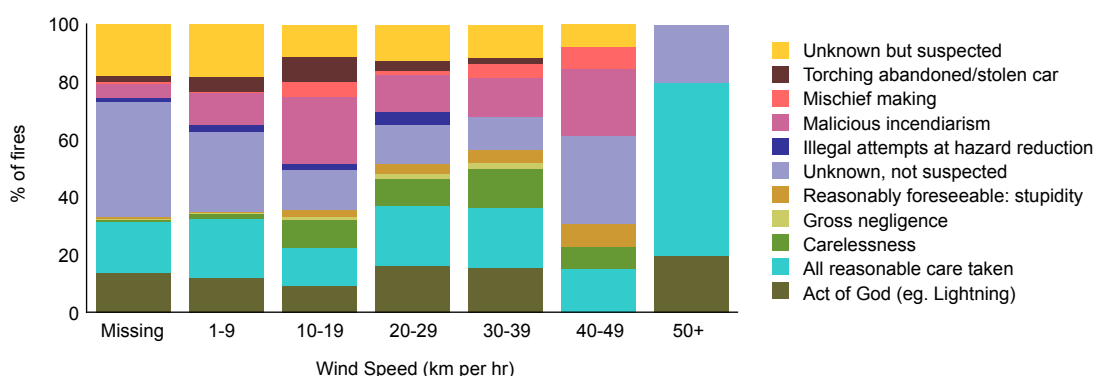
Wind speed: The vast majority of all FPQ-attended vegetation fires, irrespective of cause, occurred on days where wind speed was less than 10 km per hour, with the frequency of fires decreasing as wind speed increased (Figure 85). Nevertheless, for causes such as ‘carelessness’, ‘reasonably foreseeable–stupidity’, and ‘mischief making’, where the total frequencies were low, the maximum occurred in the 10 to 19 km per hour category. Malicious incendiarism also accounted for a disproportionate number of fires within the 10 to 19 km per hour range (Figure 86). However, most fires started under conditions where the wind speed exceeded 50 km per hour were the result of lightning strikes or were attributed to accidental causes where all reasonable care was taken. No illegal attempts at hazard reduction occurred on days where the wind speed exceeded 30 km per hour.

Figure 85: Wind speed, by cause (number)



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 86: Wind speed, by cause (percent)



Source: FPQ 1975–76 to October 2004 [computer file]

Bushfire danger: The bushfire danger rating takes in account the weather (temperature, humidity and wind speed) as well as factors such as the levels of curing within vegetation.

Most deliberately lit fires occurred on low bushfire danger days; with fewer deliberate fires occurring as the bushfire danger increased (Figure 87). Seventy percent of deliberately lit fires occurred during a low or moderate bushfire danger ratings, with only 5.4 and 0.5 percent occurring during very high and extreme bushfire danger periods. In contrast, the number of non-deliberate fires peaked on moderate bushfire danger days, followed by high and then low bushfire danger rating days, respectively. Only a small proportion of all fires, deliberate and non-deliberate, occurred under conditions of extreme bushfire weather (Figure 87), but a lower proportion of deliberate fires occurred under high to extreme bushfire conditions than non-deliberate fires (Figure 88).

The proportion of deliberate and non-deliberate fires that occurred during a high to extreme bushfire danger period varied between districts, a reflection of the varying climatic conditions across the state, as well as differences in land use patterns and population distributions. The climatic conditions place a natural limitation on the number of days and hence the probability for ignition under each bushfire danger rating. For example, no deliberately lit fires (Figure 89), and only five percent of non-deliberate fires (Figure 90) in the Atherton district occurred during periods of high to extreme fire danger. In contrast, in Dalby, which is located further inland and has a drier climate, 54 percent of fires occurred during high to extreme

bushfire danger ratings; eight percent of deliberate fires and 36 percent of non-deliberate fires occurred under conditions of high to extreme fire danger. In the Imbil district, 49 percent of fires occurred on high to extreme fire days. Again, these were primarily non-deliberate in origin. Only eight percent of deliberate lightings and approximately eight percent of non-deliberate fires in the Beerburrum district occurred during high to extreme bushfire danger periods. Of these the majority were under conditions of high and to a less extent very high, rather than extreme danger ratings. The only area where deliberate fires exceeded non-deliberate fires under high to extreme bushfire danger conditions occurred in the Ingham district, but as this is based on a sample of four it is not significant. The highest percentage of fires of unknown cause during high to extreme bushfire danger periods occurred in the Imbil, Monto, Dalby and Yarraman districts.

The proportion of non-deliberate fires that occurred during high to extreme bushfire danger days was systematically correlated with the total proportion of fires that occurred during high to extreme bushfire conditions in each district ($r=.96$, $p<.001$), with non-deliberate causes being the principle cause of fire under high to extreme fire danger conditions (Figure 91). However, the actual incidence of fires during high to extreme bushfire danger periods was intimately related to the total frequency of fires, and hence the population distribution across the state. Although the proportion of fires occurring during high to extreme fire danger periods in the Beerburrum district was low, this area recorded the greatest number of fires occurring under high to extreme bushfire danger as it has such a high number of fires.

This illustrates is the, perhaps fortunate, preference for the population in Queensland, and Australia in general, to inhabit coastal areas with their milder climatic conditions and less extreme bushfire conditions. It is evident from this discussion that, were population density to increase in areas that experience more severe weather conditions, the number of deliberate fires during high to extreme bushfire danger periods would become increasing problematic. By combining population density structures and bushfire danger studies it should be possible to model total fire frequency and deliberate frequencies based on climate (that is, distribution of bushfire danger period within the fire season) and the regional distribution of the population with respect to climatic zones. This could be of immense benefit to land planning and the necessary provision of services that may be needed to cater for likely bushfire outcomes, in the absence of more intensive effort to prevent bushfire arson.

Not surprisingly, there was an intimate relationship between the size distribution of vegetation fires and the inherent bushfire danger conditions, with large fires accounting for an ever-increasing proportion of fires as bushfire conditions worsened (Figure 92). These changes were evident for both non-deliberate (Figure 93) and deliberate fires (Figure 94). As the bushfire danger increased from low to very high there was:

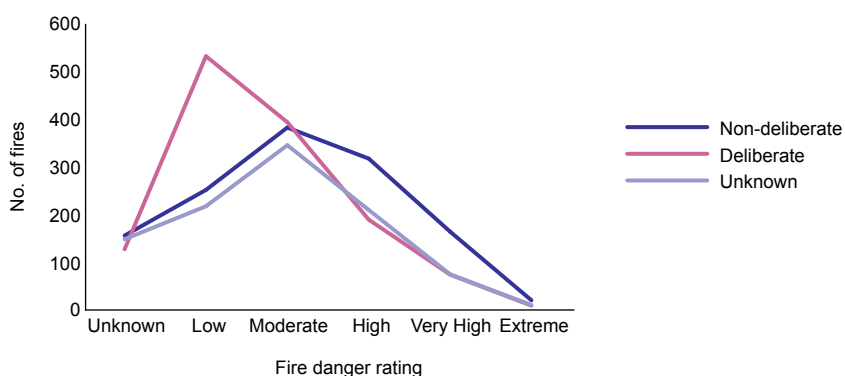
- a decrease in the relative size of the less than one hectare spike
- a subtle decrease in the proportion of fires in the three to 10 ha category
- very little change in the proportion of fires in the 10 to 50 ha category as the bushfire danger increases from low to very high
- a substantial increase in the proportion of fires in 100 to 500 ha category.

With a shift from very high to extreme bushfire danger weather there was a marked shift to larger fire sizes. In addition to significantly lower frequencies in the less than one ha category, there was a virtual absence of fires between two–three ha and 50 ha. Although the spike at 100 to 500 ha remained, there was a large increase in the proportion of fires within the 500 to 1,000 ha category, and a greater proportion of even larger fires occurred. In effect, there is a shift in the entire frequency distribution to the right in Figure 93 and Figure 94, toward greater fire sizes. Approximately 60 percent of fires that occurred on extreme fire danger days burned greater than 100 ha. Almost 20 percent burned more than 1,000 ha.

The perceived risk associated with the rapid spread of bushfires under extreme conditions appears to be manifest in the FPQ records. However, comparatively few fires the FPQ attended occurred under

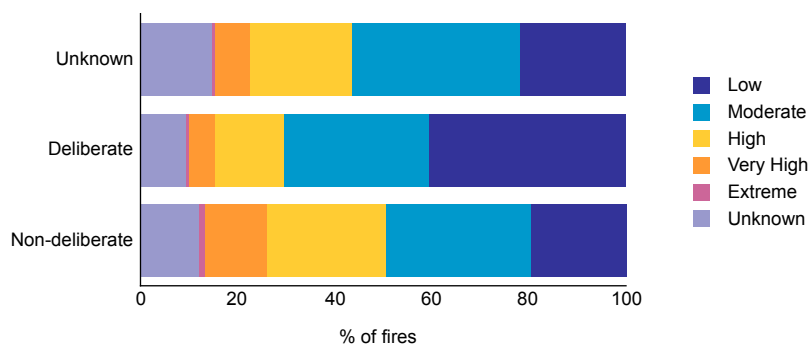
conditions of extreme bushfire weather and, despite the larger fire sizes, the total area burned under such conditions was less than that burned under mild conditions (Figure 95). This reflects the interplay between frequency and severity. As discussed, fire frequency is largely a function of human actions and is related to population distributions, whereas the bushfire danger is largely governed by the climate–weather in a particular area. These two variables are not independent, as climate plays a significant part in the population distribution across the state. In most coastal areas, there were a large number of small fires, and the greatest total area was burned under low to moderate bushfire danger conditions. By contrast, in the drier areas further inland (such as Dalby) the greatest total areas were burned under moderate and high bushfire danger conditions (Figure 96).

Figure 87: Bushfire danger rating, by cause (number)



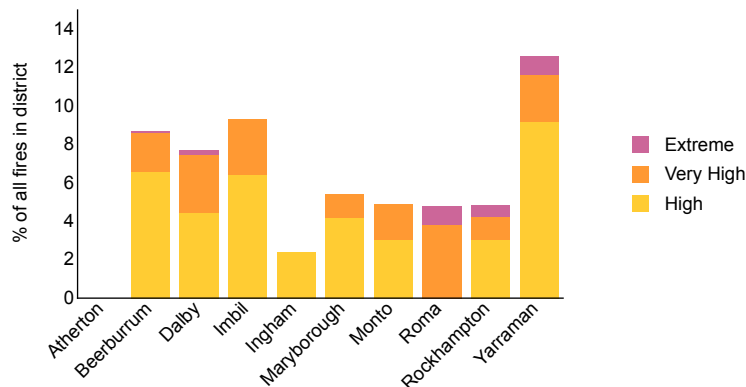
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 88: Cause, by bushfire danger rating (percent)



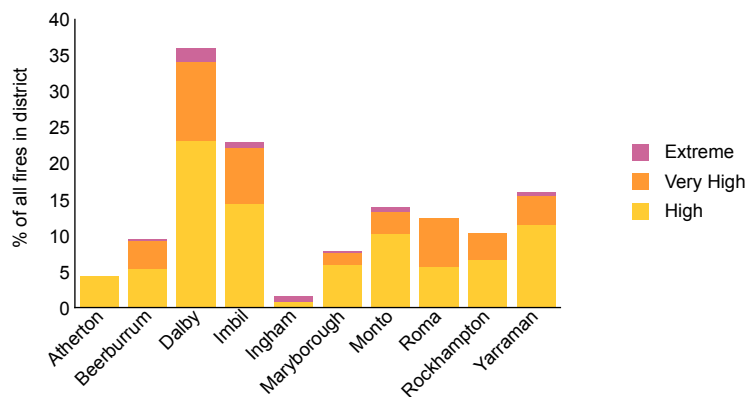
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 89: Deliberate fires under high to extreme bushfire danger conditions, by region (percent)



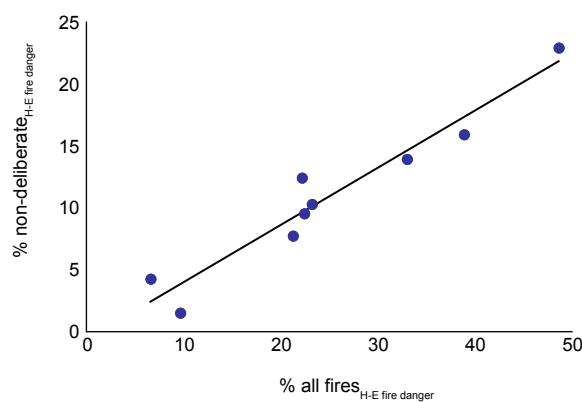
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 90: Non-deliberate fires under high to extreme bushfire danger conditions, by region (percent)



Source: FPQ 1975–76 to October 2004 [computer file]

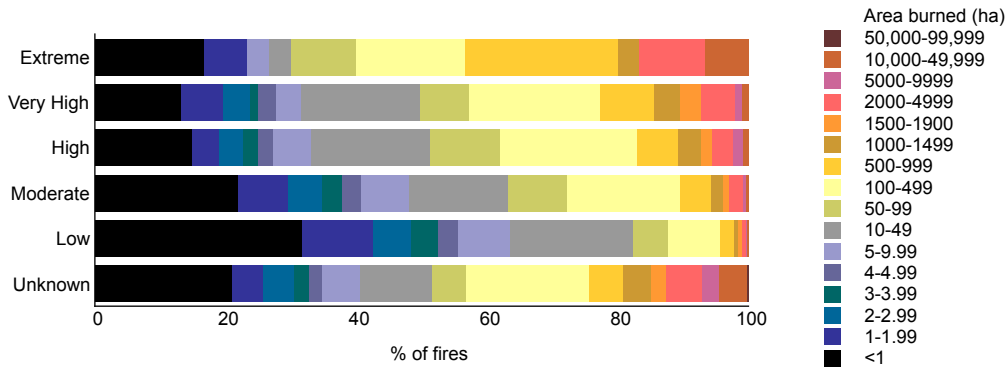
Figure 91: Fires occurring under high to extreme bushfire conditions^a



a: % all fires H-E fire danger = the percentage of all fires in each district that occurred under high to extreme bushfire danger conditions; % non-deliberate H-E fire danger = the percentage of all fires in each district that occurred under high to extreme bushfire danger conditions and that were non-deliberate in origin; that is, % all fires H-E fire danger = % non-deliberate H-E fire danger + % deliberate H-E fire danger + % unknown H-E fire danger

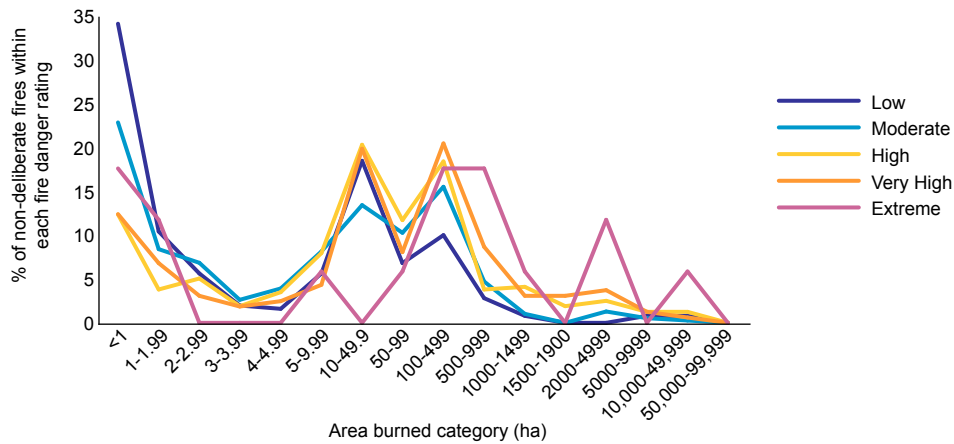
Source: FPQ 1975–76 to October 2004 [computer file]

Figure 92: Bushfire danger, by area burned category (percent)



Source: FPQ 1975-76 to October 2004 [computer file]

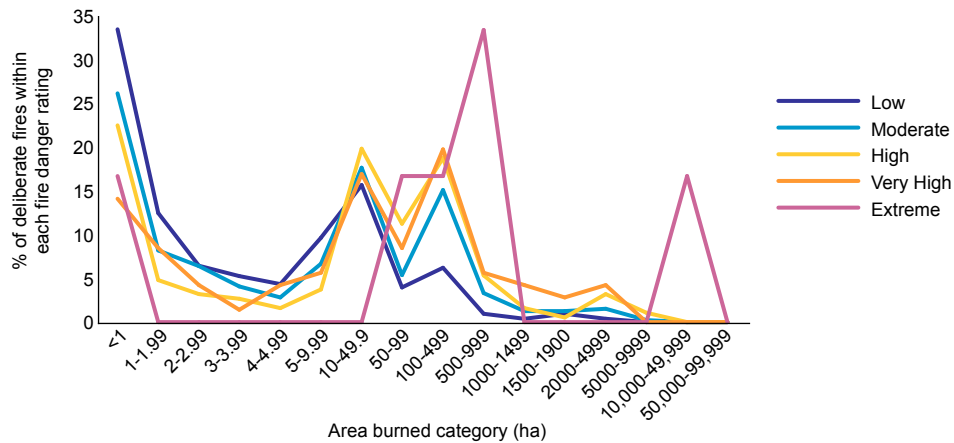
Figure 93: Bushfire danger (percent)^a, by area burned (percent) for non-deliberate fires



Note: a Represents the percentage of all fires with each fire danger rating that occurred within specific area burned categories

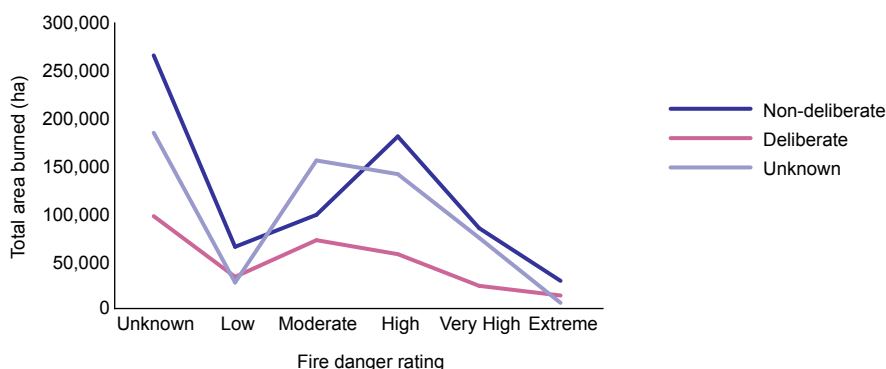
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 94: Bushfire danger (percent)^a, by area burned (percent) for deliberate fires



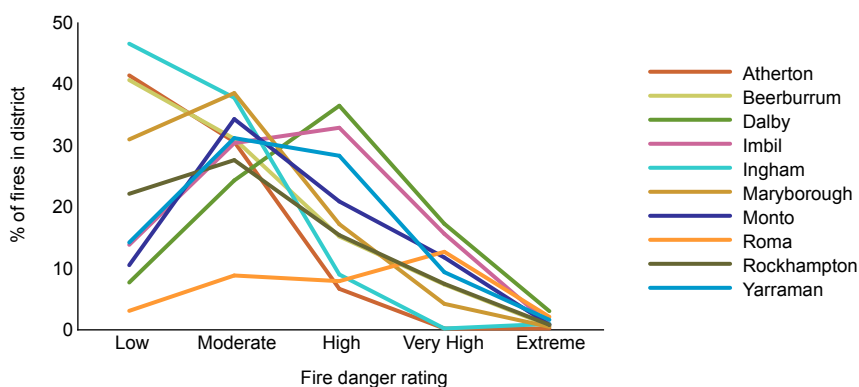
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 95: Total area burned, by cause under varying bushfire danger conditions



Source: FPQ 1975–76 to October 2004 [computer file]

Figure 96: Bushfire danger, by region (percent)



Source: FPQ 1975–76 to October 2004 [computer file]

BEERBURRUM: A CASE STUDY

A high proportion of all FPQ-attended vegetation fires occurred in the Beerburrum district and a high proportion of those fires were deliberately lit. This case study examines the nature of bushfire activity in the Beerburrum district.

The yearly fluctuations in the number of fires in the Beerburrum district parallels the overall trend observed for FPQ data, highlighting the extent to which fire patterns in this district influenced state-wide trends observed in the FPQ data (Figure 51 and Figure 97). The proportion of FPQ fires occurring in the Beerburrum district increased from 20 to 25 percent in the early 1980s to almost 70 percent in 1998–99 (Figure 97), although this has subsequently decreased to between 45 or 50 percent. Commensurately, the proportion of deliberately lit fires in the Beerburrum district increased from approximately 30 percent in the early 1980s up to 60 to 80 percent since the early 1990s (Figure 98), with a distinct jump in both frequency and proportion of deliberate fires occurring in 1989–90. The increase primarily reflects the increased frequency of fires classified as malicious incendiary and to a lesser extent the torching of stolen or abandoned cars (Figure 99). Attempts at illegal hazard reduction have remained relative constant over the same interval although three spikes of activity were evident in the late 1970s, the early 1990s, and early 2000s.

Interpretations of long-term changes are hampered by uncertainty posed by higher proportions of unknown causes during the early portion of the observation period. Notably, there have been greater

levels of causal attributions since the late 1970s, which can lead to apparent increases in the rates of deliberate fires. However, the proportion of unknown and deliberate fires combined (that is, the maximum possible rate for deliberate fires) increased from 50 to 60 percent in the mid 1980s to 80 to 90 percent since the mid 1990s. Although it is not impossible that the rate of deliberate fires has remained relatively constant over the 29-year period it is more probable that both the frequency and proportion of deliberate lightings have increased.

This increase in deliberate fires in the Beerburrum area coincided with a phenomenal population growth in southeast Queensland during the same interval (Figure 100). Similar trends are also evident in the QFRS data in both the Brisbane and Gold Coast regions that have experienced massive population growth.

Although there is broad correlation between a higher population and greater fire frequency this relationship breaks down when examined in detail. Beerburrum lies within the Sunshine Coast tourism region (ABS 2005), which as a whole has experienced massive population growth. However, the incidence of bushfires on the Sunshine Coast (QFRS data) is substantially lower than in most other areas with an equivalent population. For example, the QFRS attended just 1,654 vegetation fires in 27 postcodes within the Sunshine Coast region in five years. During the same period, the QFRS attended 3,718 fires in 16 postcodes of the Northern region (combined population of 194,384) and 1,863 fires in 15 postcodes of the Hervey Bay–Maryborough region (combined population of 140,437). The apparent incongruence between the FPQ and QFRS data may relate to the heterogeneous demographics distribution in the Beerburrum–Sunshine Coast region.

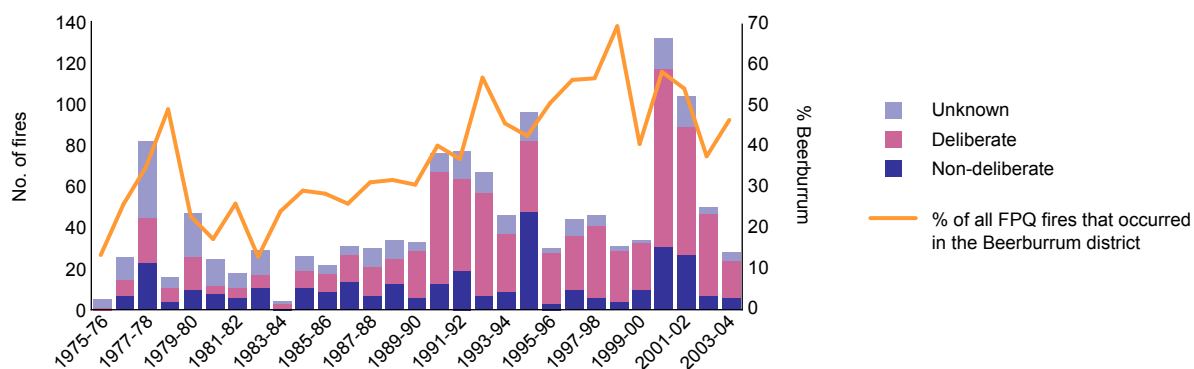
Beerburrum is located midway between Caboolture (Brisbane region) and Caloundra (Sunshine Coast region). Although the population of the postcodes incorporating Caloundra and Caboolture are roughly similar (approximately 35,000 and 30,000 respectively), the prevalence of fires in these regions is remarkably different. QFRS data indicate 335 fires in the Caloundra postcode but 923 in the Caboolture postcode between 1997–98 and 2001–02. These differences are likely related to the substantially different population demographics evident for these two regions. Caloundra is characterised by a high proportion of the population aged over 45, with unusually high proportions of people older than 65 (ABS 2001d; Figure 101). In contrast, Caboolture has a younger demographic, with a higher frequency and proportion of the population that are younger than 25 years (ABS 2001c), an age group that is more commonly associated with greater numbers of fires (for example, Murphy, Nicolopoulos, & Sandinata 1997). While it is beyond the capacity of this study to conduct a detailed analysis of the relationship between bushfires and how demographics may impact on distribution patterns of deliberate fires generally, this is an avenue of research that requires more attention.

A closer analysis of the Beerburrum data indicates that the number of deliberate fires tended to be concentrated within spatially restricted locations. The logging areas that experienced the highest frequency of fires included Toorbul (n=86), Twins (n=54), Bluegum (n=36) and Coochin (n=36; Figure 102). Higher frequencies in the Toorbul and Twins logging areas principally resulted from increased numbers of deliberate fires during the 2000–01 and to a lesser extent the 2001–02 seasons, consistent with serial firesetting by an individuals within these areas.

A high proportion of the fires in the Toorbul and Twins logging areas resulted from the torching of abandoned or stolen vehicles. In 2000–01 and 2001–02, 11 fires in the Twins logging area were identified as the result of malicious incendiarism, one from mischief-making, and eight from the torching of abandoned or stolen vehicles. During the same interval, 14 of the 30 fires in Toorbul resulted from malicious incendiarism, one from mischief-making, nine from the torching of stolen or abandoned vehicles, with a further five cases being regarded as suspicious. Approximately 50 percent of the fires that occurred in these two districts over the 29-year period related to the torching of vehicles. In the two years 2000–01 and 2001–02, 42 percent of fires the FPQ attended were attributed to malicious incendiarism and 40 percent of all fires involving the torching of abandoned or stolen vehicles occurred in the Toorbul

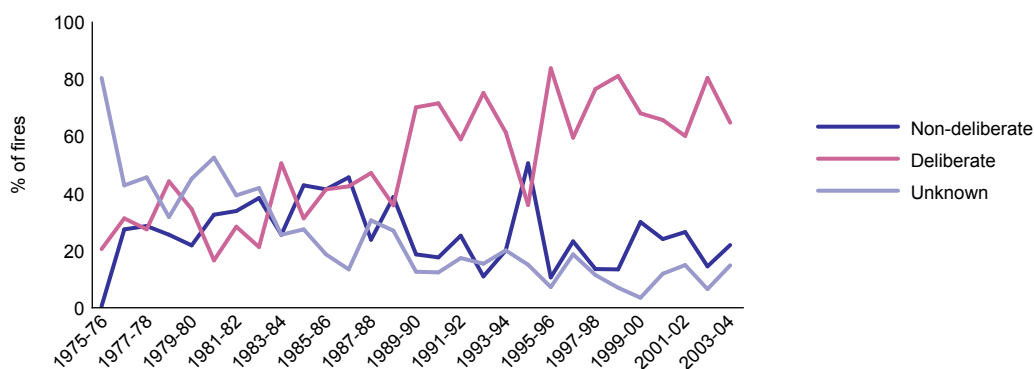
and Twins regions. That a high number of malicious incendiary fires and theft and torching of motor vehicles occurred in the same area is not surprising if we consider that similar triggers give rise to a variety of antisocial behaviours; it is simply the means of expression that varies.

Figure 97: Fires by cause, each year, in the Beerburrum district (number)



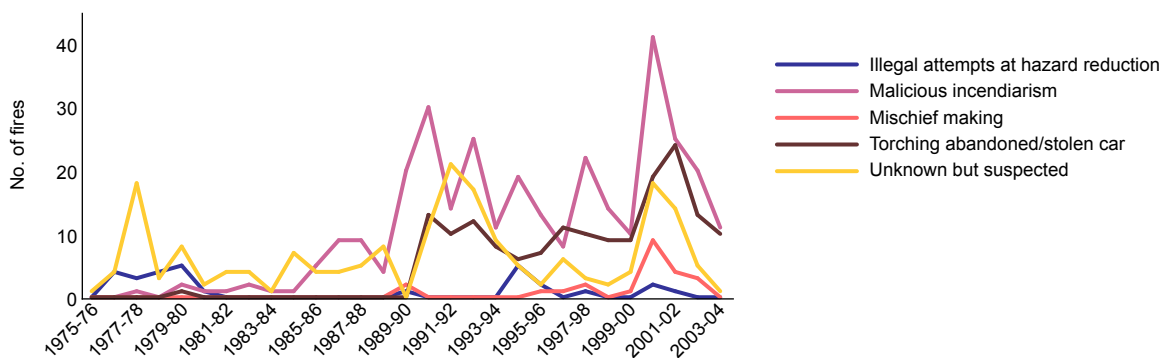
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 98: Fires by cause, each year, in the Beerburrum district (percent)



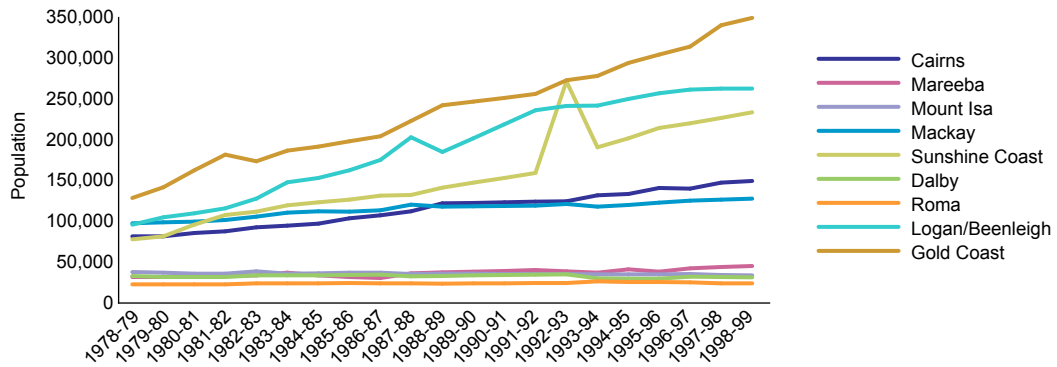
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 99: Fires by cause, each year, in the Beerburrum district (number)



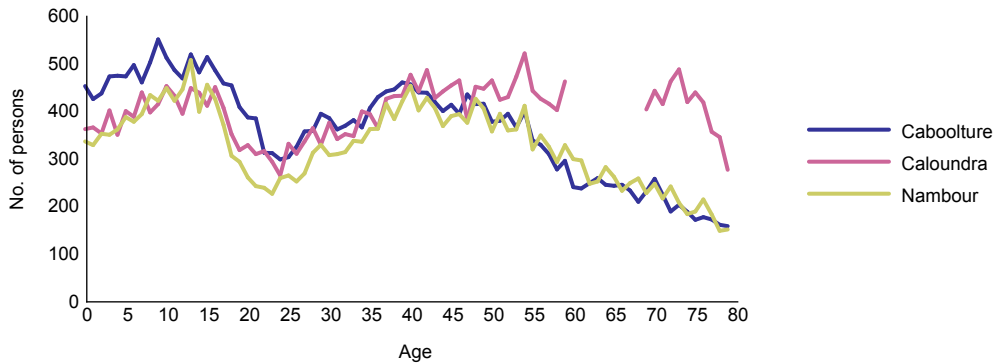
Source: FPQ 1975-76 to October 2004 [computer file]

Figure 100: Population for selected Queensland statistical regions, by year (number)



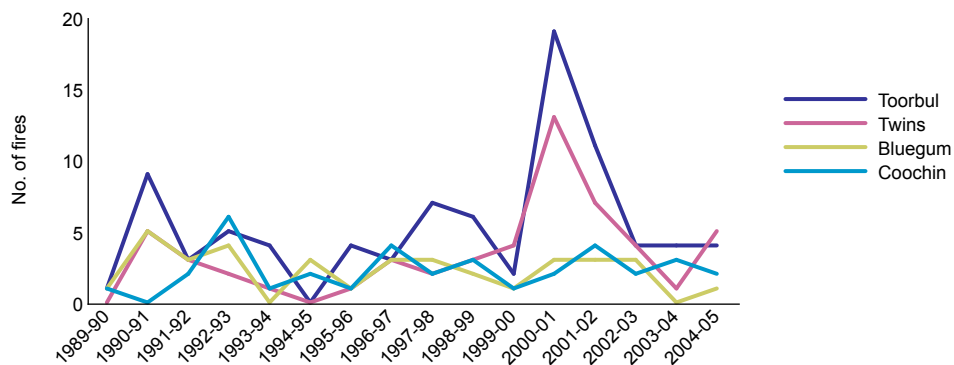
Source: Queensland Police Service 1978-79 to 1998-99

Figure 101: Population age in Caboolture, Caloundra and Nambour postal areas



Source: ABS 2001c,d,e

Figure 102: Deliberate fires in specific logging areas in the Beerburum district



Source: FPQ 1975-76 to October 2004 [computer file]

Queensland Parks and Wildlife Service analysis

Background about the QPWS dataset and its analysis

Data from the QPWS was sourced from their current database structure, ParkInfo. Although this dataset included fires from as early as 1975–76 through to 2003–04, the dataset is incomplete. Entry of fire data into ParkInfo has been occurring retrospectively and a substantive amount of historic data has not yet been entered into the database. Moreover, ParkInfo was not rolled out across QPWS centres until 2003, consequently, pre 1993 data are likely to be incomplete. In addition, the focus of reporting fire incidents has changed markedly for the QPWS. Historically, little rigor was attributed to the causal category as the main focus was on the area burned, fire intensity and damage. In this light it is highlighted that, although the QPWS's capacity to report and record more accurate data continues to improve, both through ParkInfo and its web-based component, Fire Advice Web, there are unavoidable limitations to accuracy available for analysis.

In addition, it is reiterated that the lands under QPWS's jurisdiction have changed markedly during the observation period, from just one million hectares in 1975 to its current estate of nearly 12 million hectares. Transfers have been occurring since the 1975 separation of national parks from forestry including Cooloola, Fraser Island, Wet Tropics, South East Queensland Regional Forest Agreements and will continue with the Western Hardwoods Forest process. The merging of custodial forest management with parks management in 2001 provided the greatest integration of fire management responsibility. The complex arrangements surrounding tenure transfer have meant the area falling under the QPWS jurisdiction has grown markedly. Although attempts have been made to maintain contiguous fire records for individual reserves during those transfers, there are differences in interpretation for data fields even though a common system of reporting is in place. An additional implication of those transfers and complex fire management arrangements is that individual fire records may be duplicated across the various land management agencies. This may be above and beyond that normally experienced by agencies in the same jurisdiction, where two agencies attending the same fire individually record that information in their respective databases.

Given this, analysis of QPWS data has focused on vegetation fires from 1999–2000 to 2003–04, but it is stressed that information prior to 2003 is incomplete, that there is likely some duplication between the FPQ and QPWS databases, and that transfers between agencies have affected data quality. Therefore, any apparent 'trends' should be interpreted with caution; the figures cited in the text should provide a rough guide only, and not represent an absolute or completely accurate guide to the number, cause or temporal and spatial distribution of fires within current QPWS reserves.

Additional important points with respect to the methodologies adopted in the analysis are:

- The dataset provided only included wildfires (vegetation fires).
- The database does not use AIRS classification codes.
- The causal categories used in this analysis were defined using the cause variable provided.
- Deliberate vegetation fires include all vegetation fires classified as incendiary (fires classified as arson where the cause certainty variable was 'known') or suspicious (fires classified as arson where the cause certainty variable was listed as 'suspected').
- All natural fires were the result of lightning.
- No detailed information was available regarding smoking-related fires or fires attributed to children.
- The definition of regions used in the QPWS analysis is based on ABS (2005) tourism regions, being equivalent to that used for the QFRS analysis. The assignation of specific fire events to a tourism region was based on the reserve name. It is, however, highlighted that individual reserves may cross those boundaries, owing to the large extent of individual parcels of land.

- The dataset included information about the area burned, but no information was available about fire restrictions or fire danger index at the time fires occurred.
- Information was available about the tenure of land on which the fire occurred.

For more detail about these methodologies see the methodology chapter.

Overview

Fires the QPWS attended can be summarised as:

- ParkInfo records indicate attendance at 409 fires in the five years incorporating 1999–2000 to 2003–04. As noted, these records may be incomplete, with actual attendances being slightly higher. ParkInfo contained 128 unique fire records for 2002–03 and 126 for 2003–04 (Figure 103). These later years (at least partially in the case of 2002–03) are likely to provide the most accurate guide to QPWS fires as they incorporate fires that post-date ParkInfo's introduction.
- Given the nature of the QPWS, and the fire management responsibilities that lie within its jurisdiction, it is not unreasonable to assume that most of the fires attended were either bushfires or had the potential, under more adverse circumstances, to develop into a bushfire.
- Twenty-six percent of fires were deliberate, comprising 39 percent of cause where the causes were known.
- Although the greatest number of fires occurred in the Brisbane region, fires were spread out across the state, with higher numbers of fires also occurring in the Tropical North Queensland, Northern and Hervey Bay–Maryborough regions.
- Almost six million hectares were burned in fires the QPWS attended in Queensland from 1999–2000 to 2003–04. However, these figures are strongly affected by large-scale fires that dominate the northern savannas of Cape York, where there is greatly reduced potential for damage, and where fires may be allowed to burn to fulfil ecological management goals. Fires of deliberate causes burned less than one percent of the total area. However, this statistic must be viewed in context of where the fires occurred, the ecological impact and the potential for loss of life or property.

Cause

Of the fires attended from 1999–2000 to 2003–04, 4.6 percent were incendiary with a further 21 percent labelled suspicious (Figure 104). Accidental (23%) and natural fires (8%) were the other principal causes of fires. The cause was unknown in roughly one-third of cases. Hence, deliberate causes accounted for 39 percent of cases where the cause of the fire was assigned.

The proportion of unknown causes varied substantially between seasons, from roughly 55 percent in 1999–2000 and 2000–01 to less than 20 percent in 2003–04, necessarily influencing the proportion of fires that were recorded as deliberately lit (Figure 103). In 2003–04, approximately 40 percent of fires were determined deliberate, whereas in previous years the value was around 20 percent. Deliberate causes typically accounted for between 30 and 50 percent of fires of 'known' cause in a given season. Natural fires were a comparatively small but important component during both the 2002–03 and 2003–04 seasons.

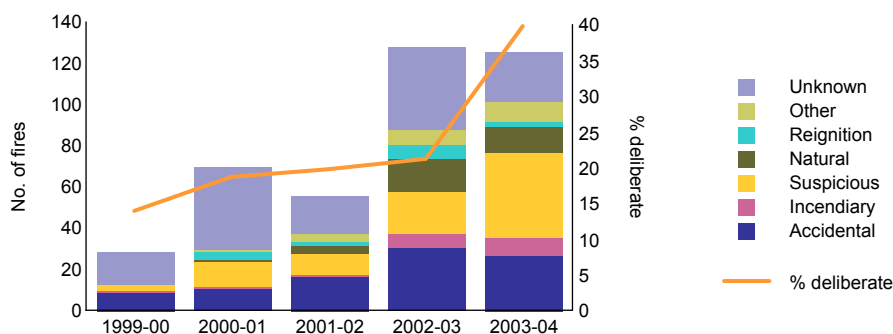
Specific ignition factors

The escape of non-QPWS burn offs was the leading cause of non-deliberate fires, accounting for 23 percent of all QPWS fires, being the largest single cause of fires after deliberate causes. This was a particularly important factor in both 2002–03 and 2003–04 (Figure 105).

Point of ignition: The point of ignition was indicated in 30 percent of cases. In 20 percent of all cases there was a single point of ignition, 4.2 percent related to multiple points of ignition on the same day and 3.7 percent involved multiple points of ignition over more than one day (Figure 106). It is unclear if this reflects the distribution of point of ignition types of the entire population.

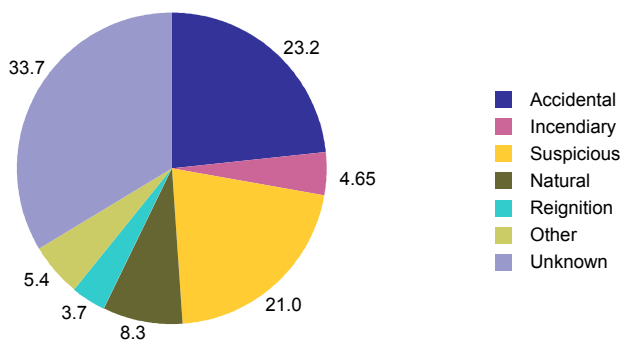
There is no definitive relationship between the patterns of ignition and the cause of fires, although specific causes appeared to be more commonly linked to one pattern of ignition than another. Fires that resulted from the escape of QPWS burns normally had multiple ignitions, either on a single day or over a longer interval (Figure 107). Escapes from non-QPWS burns exclusively resulted from multiple ignitions on the same day. Although lightning strikes may cause multiple points of ignition, the majority of natural QPWS fires were recorded as having a single ignition point. The majority of deliberate ignitions were also recorded as having a single ignition point. However, in six instances (6% of deliberate lightings) multiple points of ignition were recorded. These principally involved multiple ignitions on the same day. Although there is some uncertainty owing to the small number of cases where information is available, these results suggest that for at least six percent of fires the QPWS attended there was an intention of the fires spreading.

Figure 103: Cause, by year



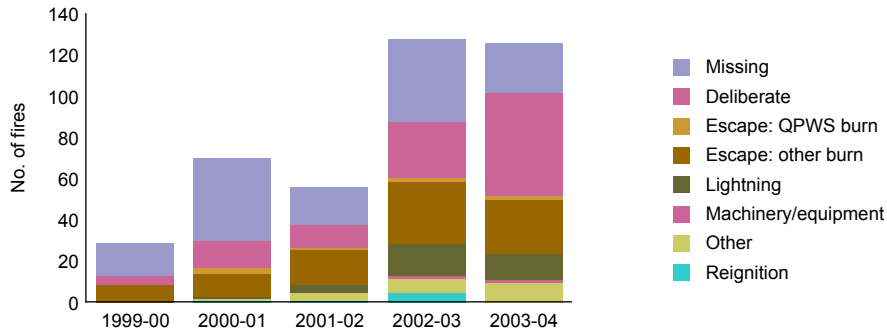
Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 104: Cause (percent)



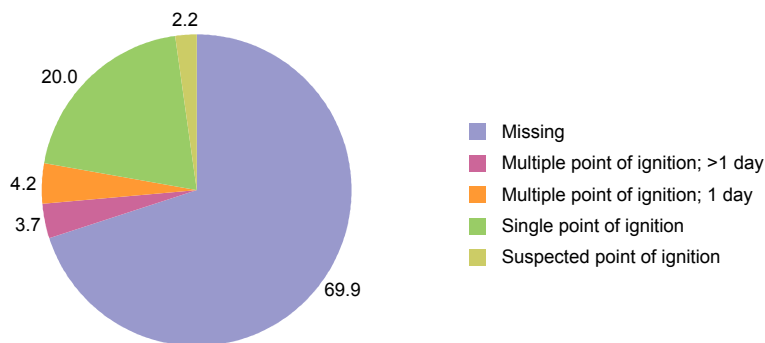
Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 105: Specific causes, by year



Source: QPWS 1999–2000 to 2003–04 [computer file]

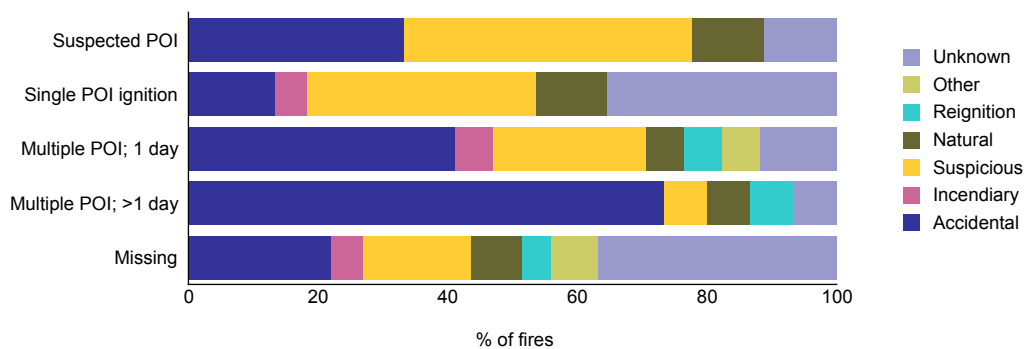
Figure 106: Points of ignition (POI)^a



a: Multiple POI; >1 day = multiple points of ignition occurring over more than one day. Multiple POI; one day = multiple points of ignition occurring on the same day. Suspected POI = suspected point of ignition

Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 107: Causal distribution associated with each point of ignition type^a



a: Multiple POI; 1 day = Multiple point of ignition all occurring on the same day; Multiple POI; >1 day = Multiple point of ignition all occurring on more than one day

Source: QPWS 1999–2000 to 2003–04 [computer file]

Location

Information about the location of fires includes the regional distribution of fires, as well as details about reserves and the tenure of lands on which most fires occurred.

Region

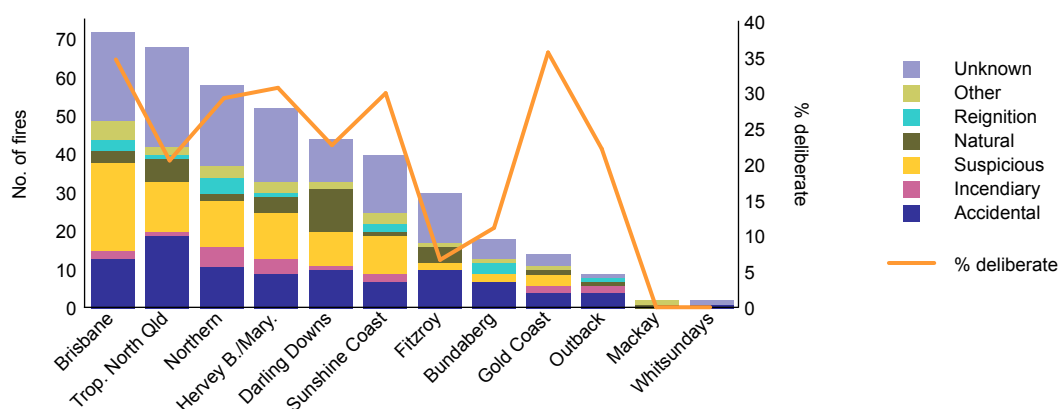
The distribution of QPWS-attended fires is necessarily restricted by the distribution of national parks and other nature reserves in Queensland, but for earlier years, it may also be influenced by data availability. Hence, the data presented in this section can only be used as a rough guide. The regions used in the QPWS analysis are equivalent to those used in the QFRS analysis (Figure 15).

In comparison to both the QFRS and FPQ, QPWS-attended fires were more evenly distributed across the state. The greatest number of fires occurred in the Brisbane region followed by the Tropical North Queensland, Hervey Bay–Maryborough, Darling Downs and Sunshine Coast regions (Figure 108).

The relative causes of fires varied markedly between regions. Deliberate causes accounted for approximately 20 to 30 percent of fires in most regions where total fire numbers exceeded 30 (Figure 108). The greatest number of deliberate fires occurred in the Brisbane region (n=25). A high proportion of fires in the Gold Coast region were also deliberate (35%), but the actual numbers of deliberate fires were low.

The greatest number of natural fires occurred in the Darling Downs (n=11), accounting for 25 percent of fires in that region. This observation is consistent with the FPQ data. Natural fires also accounted for a comparatively high proportion of fires in the Mackay (50%) and, to a lesser extent, Outback (11%) and Fitzroy (13%) regions.

Figure 108: Region, by cause



Source: QPWS 1999–2000 to 2003–04 [computer file]

Reserve

Some caution should be exercised when interpreting the data for individual parks, as the data for some reserves may be incomplete. Based on the available data, 11 aggregations experienced at least 10 or more fires (all causes) in five years, with the Bellthorpe, D’Anguilar South and Lumholtz Southern aggregations experiencing as many as 18 to 20 in that period. Of these, approximately one-third were deliberately lit. The greatest number of deliberately lit fires occurred in the Wondai and Paluma

aggregations where they comprised 75 and 53 percent of fires respectively. Half the fires on Bribie Island were also deliberate lit.

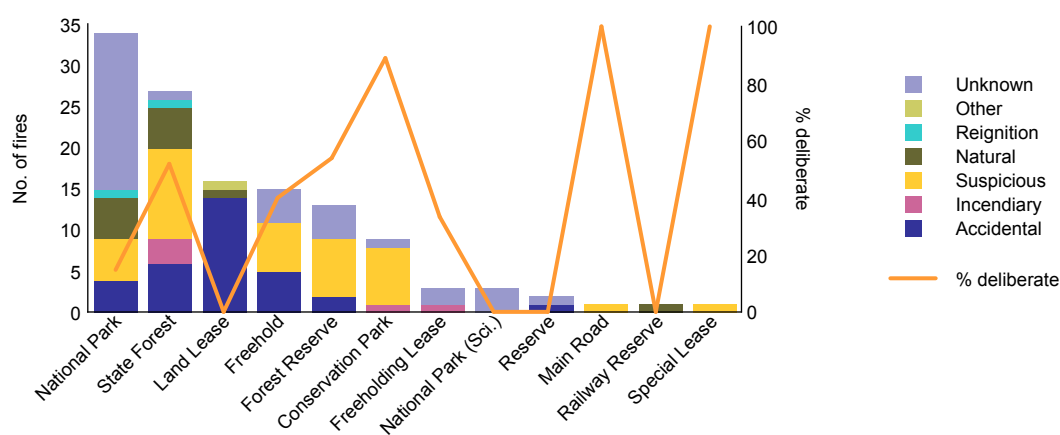
Tenure

Tenure was reported in 31 percent of cases, with unknown attributions being comparatively evenly spread between the non-deliberate, deliberate and unknown causes. Of those where tenure was indicated just over one-quarter occurred in national parks, just over one-fifth in state forests and a further 10 to 13 percent each in land lease, freehold and forest reserve categories. Marked differences in the principal cause of fires were natured across tenure types.

The greatest number of deliberate fires occurred in state forests, conservation parks and forest reserves, national parks, or freehold land (Figure 109). Distribution of deliberate fires between these locations may have been a function of both location and accessibility, but may also have depended on an individual's perception or regard towards land conservation status. Approximately one-half of all fires in state forests and forest reserves were deliberate. In the case of the latter tenure, deliberate fires were responsible for 78 percent of all causal attribution in that tenure type. In comparison, only 15 percent of fires in national parks were deliberately lit. Even taking into account the comparatively lower level of causal attributions in national parks, deliberate fires comprised only one-third of assigned causes, being substantially lower than for state forests. Nevertheless, deliberate causes were the only known cause of fires in conservation areas.

The greatest number of natural fires occurred in national parks and state forests, followed by land lease, tenure types that experienced the greatest numbers of fires generally. Accidental, natural and other causes were the only assigned origins for fires on property in a land lease arrangement.

Figure 109: Tenure, by cause



Source: QPWS 1999–2000 to 2003–04 [computer file]

Timing

The timing of fires is examined by week of the year and day of the week. No information was available regarding the time of day fires occurred.

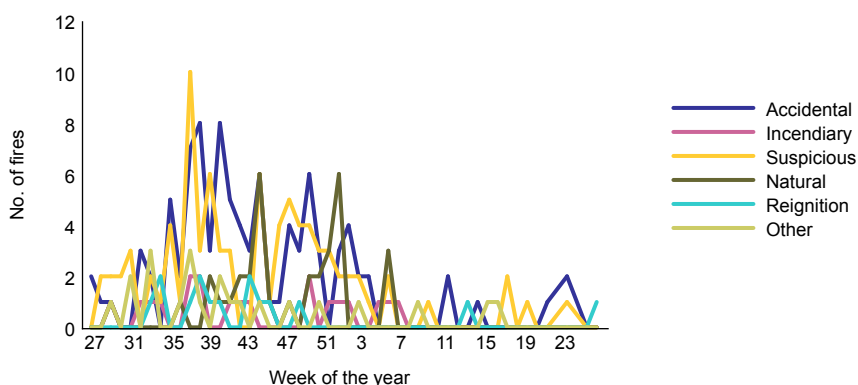
Week of the year

As for other jurisdictions, the QPWS attended the greatest number of fires from early September to late January (Figure 110), similar to the distributions evident for the FPQ and QFRS. Some differences in temporal distributions were evident based on cause. The greatest number of deliberate (principally suspicious) and accidental fires occurred in late September to early October, with lesser numbers of fires occurring through November and December. In contrast, most natural fires occurred in late December through to early February, although a spike in natural fires was also recorded in early October.

Day of the week

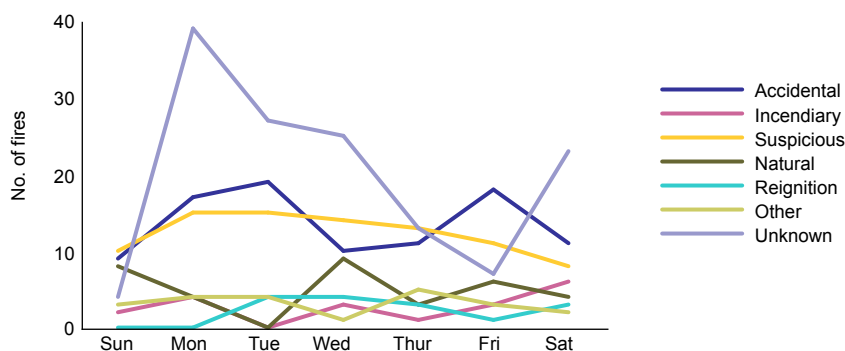
There was no evidence for increased fire frequency on weekends relative to weekdays for either deliberate or non-deliberate fires (Figure 111).

Figure 110: Week of the year, by cause



Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 111: Day of the week, by cause



Source: QPWS 1999–2000 to 2003–04 [computer file]

Area burned

In contrast, to the distribution observed for QFRS and to a lesser extent FPQ fires, comparatively few QPWS fires were less than five hectares. The vast majority of QPWS fires were 10 to 1,000 ha in size, with 100 to 500 ha being most prevalent (Figure 112). This may partially reflect incomplete reporting for the first few years of the period analysed; larger fires were more likely to be recorded. However, it also

evident that land management agencies in other jurisdiction also tended to attend a greater number of moderate and larger fires than their rural and urban counterparts, reflecting differences in the environment in which they occurred, accessibility, etc. In addition, many larger fires in Queensland occurred in remote parts of the state, where there may be a delay in responding, or as is often the case in the northern savannas, where protection of life and property is not a consideration, fires are allowed to burn to achieve ecological outcomes. This is reflected in the large areas burned in the Tropical North Queensland region.

The same general size distribution outlined above was evident for most causal categories, but some differences were evident between different causes. Of note, deliberate causes accounted for a decreasing proportion of fires with increasing fire size (Figure 113). The vast majority of fires larger than 2,000 ha were either accidental or natural in origin, with both these causal categories tending to account for greater proportions of increasingly larger fires.

Almost six million hectares (5,936,509 ha) burned in QPWS-attended fires from 1999–2000 to 2003–04, with more than 800,000 ha burning every year. The total area burned peaked at 2.3 million hectares in 2003–04. Note that these figures included fires that the QPWS attended that lay outside its estate (QFRS, FPQ and other fires).

Accidental causes was a major contributor to the total area burned in all seasons, accounting for 70 percent of the total area burned in the state in the five year period. However, natural fires were a major contributor in both 2002–03 and 2003–04, burning just over one million hectares (18% of the total area burned). In 2003–04, natural fires accounted for 39 percent of the total area burned (Figure 114).

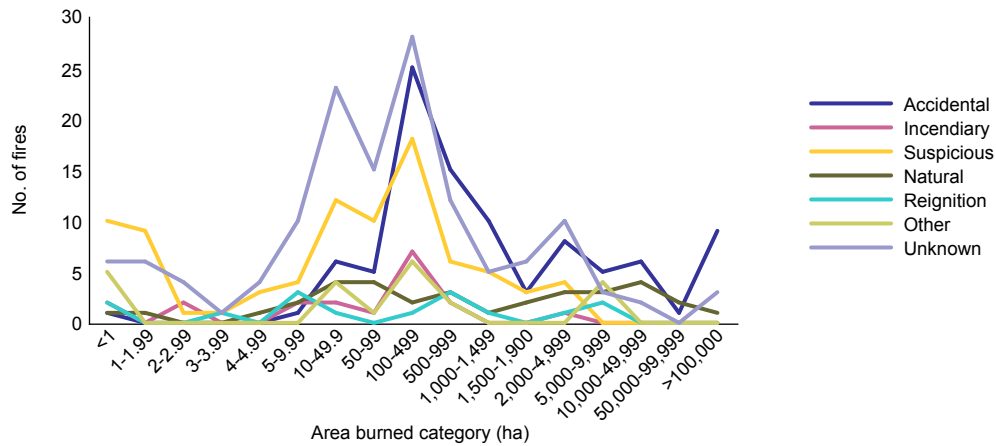
As the vast majority of fires greater than 100,000 ha occurred in the Tropical North Queensland region, it is not surprising that 86 percent of the total area burned was located in that region (Figure 115). This reflects the fact that vast areas of the tropical savannas in northern Queensland burn every year. There were 16 fires greater than 100,000 ha within the QPWS database from 1999–2000 to 2003–04. Eleven of those fires were located in Tropical North Queensland. The other three were in the Northern region, with one each in the Darling Downs and Fitzroy regions. In contrast, the majority of small fires occurred in coastal southeastern Queensland within the Brisbane, Sunshine Coast and Hervey Bay–Maryborough regions. These regions accounted for a decreasingly smaller proportion of fires as area category size increased. It is not valid to compare fire sizes burned in a savanna ecosystem with, for example, those experienced in Eucalypt forests and woodlands in southeast Queensland.

Owing to their smaller size, deliberate fires appeared to burn trivial areas of land in comparison to accidental and natural fires, accounting for just 0.6 percent of the total area burned (38,800 ha in total). However, it is necessary to take into account where those fires occurred: only 7,322 ha were burned by deliberate fires in the Tropical North Queensland region; a large number of all deliberate fires occurred in southeast Queensland; 7,769, 6,106 and 5,994 ha were burned by deliberate fires in the Brisbane, Darling Downs and Northern regions respectively; and 4,218 ha were burned by deliberate fires in the Gold Coast region (Figure 116).

Although the area was not large, deliberate fires were responsible for 35 percent of the total area burned in the Gold Coast region, 19 percent of the area burned in the Outback, and 21 percent of that burned in the Brisbane region. In other regions deliberate fires accounted for less than eight percent of the total area burned (Figure 116).

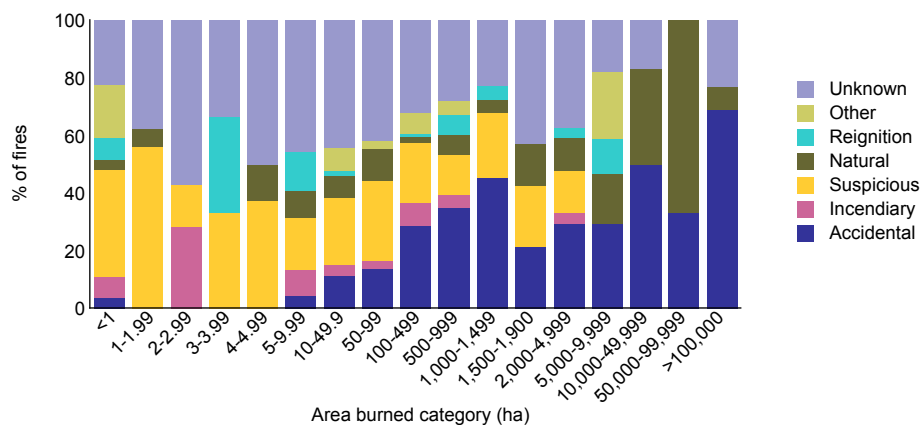
The largest deliberate fire on the Gold Coast burned 2,856 ha. In the Brisbane region, a deliberately lit fire burned 2,230 ha. The largest deliberately lit fire in the Darling Downs region burned 4,220 ha. In the Northern, Tropical North Queensland and Bundaberg regions, the largest deliberate fires burned 2,084, 1,936 and 3,141 ha respectively.

Figure 112: Area burned category, by cause (number)



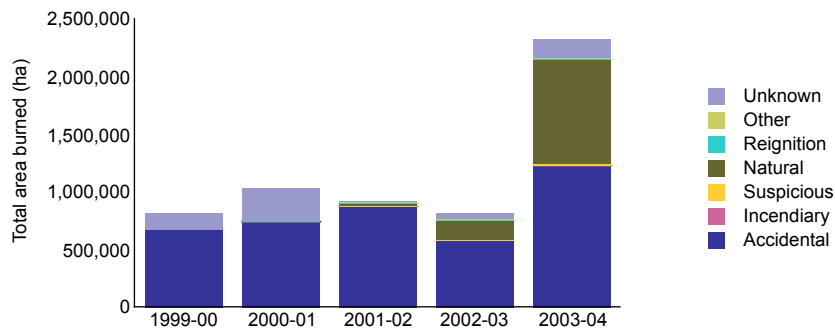
Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 113: Area burned category, by cause (percent)



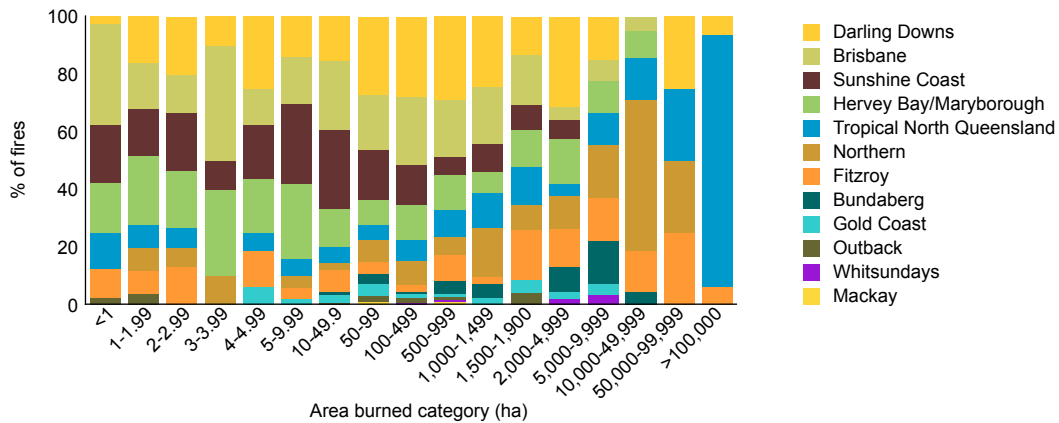
Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 114: Total area burned (ha), by cause each year



Source: QPWS 1999–2000 to 2003–04 [computer file]

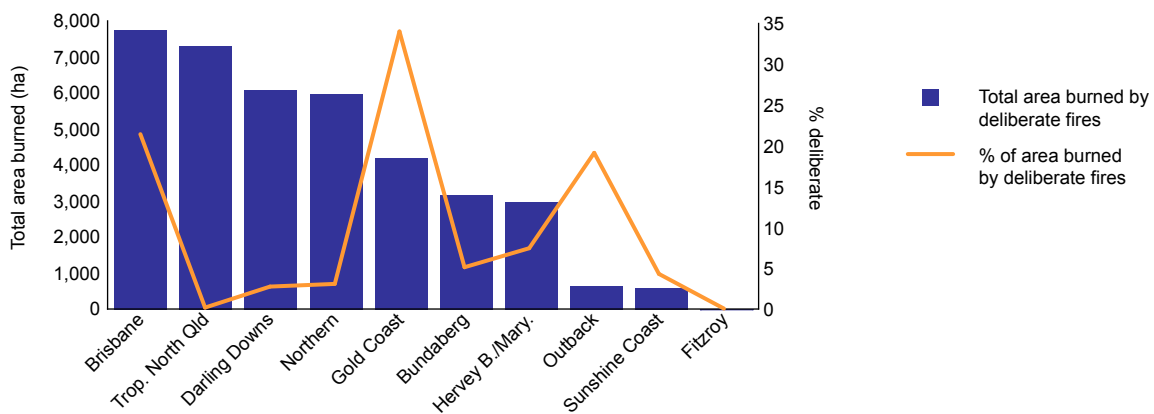
Figure 115: Area burned category, by region^a



Note: a Refers to the regional distribution of fires within each area category; for example more than 80 percent of fires in the greater than 100,000 ha category occurred in the Tropical North Queensland region

Source: QPWS 1999–2000 to 2003–04 [computer file]

Figure 116: Area burned by deliberate fires in each region



Source: QPWS 1999–2000 to 2003–04 [computer file]

Summary

Important points about the incidence, cause, location, timing and type of fires attended by Queensland fire agencies are summarised below. Also included is information about the conditions under which the fires occurred.

Number of fires: Based on the data provided, there was an average of 12,650 vegetation fires in Queensland every year. This is lower than the average reported by the Australian Productivity Commission (APC 2007), as early QFRS data were incomplete. Nor does this figure include vegetation fires attended by rural brigades. Vegetation fires comprised between 54 and 67 percent of all fires attended by fire services in Queensland (APC 2007).

Less than two percent of documented cases of vegetation fires in Queensland occurred in state forests, national parks, and conservation and forest reserves. Most vegetation fires occurred in the urban and semi-urban environment, as summarised below:

- The **QFRS** attended an average of 9,105 vegetation fires per year for 1997–98 to 2001–02. This is a minimum as early data were incomplete; actual values are likely closer to 12,000 to 13,000 per year. The number of vegetation fires the QFRS attended in rural environments is unknown.
- The **FPQ** attended 3,531 vegetation fires from 1975–76 and 2003–04, representing an average of 122 fires per year, but up to 239 fires were attended in a given year.
- The **QPWS** attended an average of 127 vegetation fires in 2002–03 and 2003–04.

The number of fires individual land management agencies in Queensland attended may have changed markedly following implementation of the South East Queensland Regional Forests Agreement in December 1999.

The cause of fires Queensland fire services attended is summarised in Table 4. Important points about the cause of fires are further summarised below:

- The proportion of deliberate fires varied markedly between agencies, owing to different levels of causal attribution, but accounted for roughly 40 to 50 percent of cases where causal attributions were made.
- Natural fires were responsible for a higher proportion of fires land management agencies attended than urban fire services attended.
- Fires resulting from an open flame or spark accounted for 64 percent of fires the QFRS attended where the form of heat of ignition was determined. Between one-half and two-thirds of these related to use of matches. Most deliberate fires resulted from use of an open flame or spark, whereas the causes of non-deliberate fires were more diverse. Nevertheless, vegetation fires resulting from machinery, electrical equipment, and hostile fires were comparatively minor.
- The causes of accidental fires varied markedly for urban and land management agencies. Smoking-related materials and non-deliberate child fires were a major contributor to accidental fires in the urban environment (collectively accounting for one-quarter of known causes). For the FPQ, the principal accidental cause was cases where all reasonable care was taken (the actual activity contributing to the fire was not known). Within the QPWS data, the greatest single accidental cause related to burn offs conducted outside of QPWS tenures.
- Malicious incendiarism and torching of abandoned or stolen motor vehicles was a major problem for the FPQ in the Beerburrum region of southeast Queensland.
- Smoking-related materials were responsible for two percent of all vegetation fires the QFRS attended. This represented 12 percent of cases where the heat of ignition was delineated, and 14 percent of all non-deliberate fires the QFRS attended. They were responsible for one to three percent of all vegetation fires in any one region. In the Brisbane region, smoking-related materials were responsible for 18 percent of all fires where the heat of ignition was identified. In the majority of urban centres in regional Queensland, such fires contributed to seven to 11 percent of known heat of ignitions. No information was available about smoking-related fires attended by land management agencies.

- **Fires started by children:** The only information available for Queensland relates to non-deliberate fires started by children younger than 16 years of age. These comprised 2.4 percent of all vegetation fires the QFRS documented, but 12 percent of instances where the ignition factor (cause) was assigned. Few fires were started by children younger than six years of age; the numbers of fires started by the six to 12 and 13 to 16 year age groups were comparable. The numbers of non-deliberate fires attributed to children were correlated with the total number of fires recorded in a given year, and with the number of fires within that region generally. The diversity in the forms of heat of ignition and the complexes where fires occurred increased with age. In the case of the latter, the proportions of fires occurring at single dwellings decrease, and in parks, forests, reserves increase, as children become older. Most fires are lit during the bushfire season, comparable to the trends observed generally. More non-deliberate child fires occurred on weekends than on weekdays. The greatest numbers of fires occurred between 4 and 6 pm, principally reflecting weekday patterns.

The FPQ has recorded an increase in the number and proportion of deliberate fires in state forests and other reserves under its jurisdiction since the late 1980s. This is particularly evident for the Beerburrum region, an area that was increasingly affected by massive population growth. It is not possible to draw conclusions about long-term changes in the incidence of deliberate fires from either the QFRS or QPWS data.

Location: Vegetation fires are heterogeneously distributed at regional and district levels as well as within individual postcodes. Most vegetation fires (all causes) documented for Queensland occurred near major urban centres, with approximately half occurring in the Brisbane region alone. Other areas to experience comparatively high numbers of fires included the Gold Coast, Fitzroy and Northern regions. High numbers of fires were also observed within specific locations within individual regions (such as the Outback region).

Within the Brisbane region, fire frequencies were lowest in the centre of the metropolitan area, and tended to increase outwards. The greatest density of fires occurred in the Logan City, Ipswich City and Caboolture Shire (Part A) statistical region sectors, areas that lie on the outer margins of the rapidly expanding urban development.

The maximum number of fires recorded in a postcode was commonly greatest in those statistical region sectors that, overall, recorded the highest numbers of vegetation fires. Moreover, many postcodes within that statistical region sector recorded elevated numbers of fires. Postcodes with the highest numbers of postcodes accounted for the highest proportion of all fires within a region. The maximum number of vegetation fires recorded in a single postcode, and the proportion of vegetation fires hosted within high fire frequency postcodes, overall, declined as the number of vegetation fires recorded in the statistical region sector decreased.

Overall, the number of vegetation fires increased with increasing population; individual postcodes typically recorded between one and 100 vegetation fires per 10,000 people per year, with the maximum rate being comparatively constant across postcodes with high varying population sizes.

The distribution of fires land management agencies attended was governed by the distribution of lands under their jurisdiction, but there was also an intimate relationship with population distributions; for example, the FPQ attended the greatest number of fires in the Beerburrum (near Caboolture) district, while the QPWS attended the greatest number of fires in the Brisbane region. For both agencies, those areas reporting the highest numbers of fires overall, also tended to record the highest proportion of deliberate fires.

Timing: Information about the week of the year, day of the week, and time of day fires occurred is summarised below.

Week of the year: most fires Queensland fire agencies attended occurred between August and January, with peak numbers occurring in September. However, subtle differences existed between agencies, namely:

- **QFRS:** most fires occurred from early August to late November with a peak in September. However, with peak frequencies occurring over a shorter period than for land management agencies. The timing of non-deliberate and deliberate fires was comparable but varied between seasons.
- **FPQ:** most human-caused fires occurred from mid August to mid January, with peak numbers occurring in September. However, the timing of fires varied between regions; for example, peak numbers of fires in the Dalby and Roma regions occurred around December–January. Timing also varied between seasons.
- **QPWS:** fires occurred from September to late January, peaking in September.

Day of the week:

- **QFRS:** 35 and 52 percent more deliberate fires occurred on Sunday and Saturday respectively than the weekday average; 25 to 29 percent more non-deliberate fires also occurred on Saturday and Sunday; non-deliberate child fires were 70 percent higher on a weekend than on a weekday.
- **FPQ:** 34 percent more deliberate fires occurred on Sunday and 26 percent more deliberate fires on Saturday than on the average weekday. The degree of weekend bias varied between regions.
- **QPWS:** no weekend bias was observed.

Time of the day: Information about the time of day fires occurred is summarised for the QFRS and FPQ below:

- **QFRS:** Deliberately lit fires peaked between 3 and 6 pm with 37 percent occurring between 6 pm and 6 am; non-deliberate fires peaked between 12 and 3 pm with 24 percent occurring between 6 pm and 6 am. Many fires in the Outback region occurred at night; 44 percent and 17 percent of deliberate fires occurred between 6 pm and 6 am, and midnight and 6 am, respectively. Deliberate fires occurring at night were also an issue in the Brisbane region, although to a lesser extent than observed in many other state capitals.
- **FPQ:** peak numbers of non-deliberate fires occurred between 11 am and 4 pm, whereas the peak for deliberate fires was 3 to 4 pm. This is marginally earlier than observed by the QFRS. Greater numbers of deliberate as compared with non-deliberate fires occurred at night, although interpretation is hampered by the delay between time of ignition and detection for many fires that occurred at night. Deliberate causes of fire at night included both malicious incendiary and torching of abandoned or stolen motel vehicles. Both were particularly problematic in the Beerburrum region.

Area burned: The majority of vegetation fires were small. Typically the number of fires attended decreased as the size of the fire increased, but size distribution varied between agencies; the QFRS attended a higher proportion of small and very few large fires, whereas the QPWS and to a lesser extent FPQ recorded greater numbers of moderate and large fires (a reflection of the environment, suppression capabilities, access, environment benefits, etc.).

Data about the total area burned (where, when, how) are dominated by the largest fire events. The largest fires occurred in the northern half of the state (Tropical North Queensland, Northern regions) larger fires in the south tended to occur further inland (for example, Dalby). Most large fires were of natural, accidental or unknown origins; deliberate fires tended to account for a decreasing proportion of fires as fire size increased. Hence, deliberate fires burned comparatively smaller areas than did other causes. This in no way takes into account the impacts, costs and potential dangers deliberate fires pose. Although large

areas have been burned during droughts concurrent with El Niño events, the disproportionate data contribution from the large savanna fires makes it difficult to assess any systematic relationship between weather and bushfires in Queensland. This does not mean it does not exist; rather the relationship with the total area burned is not necessarily systematic.

It was impossible to establish the total area burned within Queensland for a particular period due to the potential duplication of fire data across agencies, an absence of rural data and because of the limited temporal overlap between the available databases. Statistics about the total area burned by fires attended by each agency are summarised below:

- **QFRS** fires from 1997–98 to 2001–02 burned 2,166,640 ha, with the greatest total area burned in 1998–99; incendiary fires accounted for 1.6 percent and suspicious fires 9.7 percent of the area burned by fires of known causes.
- **FPQ** fires from 1975–76 to October 2004 burned 1,580,444 ha, with the greatest total area burned in 1982–83, 1989–90 and 1994–95; 18 percent of this was burned by fires of deliberate (principally suspicious) origin.
- **QPWS** fires from 1999–2000 to 2003–04 burned 5,936,509 ha, with the greatest total area burned in 2003–04; less than one percent was burned by fires of deliberate causes.

Type of incident: The type of vegetation fire incidents attended may vary markedly across fire services depending on their responsibilities and the environment in which they operated (for example, urban versus land management) as summarised below:

- A high proportion of fires the FPQ and QPWS attended could be classified as a bushfire or had the potential to develop into a bushfire under more adverse conditions.
- The types of incidents attended by the QFRS were variable; 30 percent of fires attended were small vegetation fires, 30 percent grass fires, 33 percent scrub, bush and grass fire mixtures, and six percent were classified as other vegetation/outside fires.
- The proportion of all fires the QFRS attended that were occurred in scrub, bush, grass mixed and solely grass environment, combined, was comparatively uniform across regions of Queensland; that is, the data were not simply biased by those locations that recorded the most fires.
- The QFRS data indicate that the principal causes of fires were broadly similar across different incident types (small vegetation fires, grass fires, forest/woodland, etc.), although slightly higher percentages of deliberate fires were recorded for fires that occurred in ‘scrub, bush, grass mixed’ and ‘orchards/vineyard/nurseries’.
- Most fires the QFRS attended occurred on unused property or Crown land (34%), followed by parks, forests and reserves (19%), and around road complexes (roads, lots, etc.; 13 percent).

Bushfire danger: The greatest number of fires in the urban environment occurred under conditions of moderate bushfire danger with the number of fires decreasing as fire danger increased. This occurred irrespective of cause. The greatest number of all fires the FPQ attended were also under conditions of moderate bushfire danger, but most deliberate fires occurred when there was a low fire danger index. Deliberate causes accounted for decreasing proportions of fires with increasing fire danger index. This reflects contributions from higher proportions of night-time fires, but also differences in daytime fires.

The proportion of fires under conditions of high to extreme fire danger varied between regions. Greater proportions of fires under these conditions principally reflected increasing contributions from non-deliberate causes. However, those areas that documented the highest number of fires generally accounted for the greatest proportion of all fires that occurred under the most adverse conditions.

Table 4: Summary of fire cause for each fire agency

Agency	% unknown	% incendiary	% suspicious	% deliberate (known)	% natural (known)
QFRS	79.3	1.6	7.6	9.2 (45)	0.8 (3.9)
FPQ	28.0	19.8	16.4	36.2 (50)	12.4 (17)
QPWSa	33.7	4.6	21.0	25.6 (39%)	8.3 (12.5)

a: 1999–2000 to 2003–04

Source QFRS 1997–98 to 2001–02 [computer file]; FPQ 1975–76 to October 2004 [computer file]; QPWS 1999–2000 to 2003–04 [computer file]

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