Causes & factors in wildfires, impacts & responses
3.1.5.6 Hazards

What you need to know
What the nature of wildfires are: prevailing conditions and fire behaviour
Causes of fires – both natural and human factors
What the impacts are of wildfires: primary and secondary
How short-term and long-term responses reduce the impacts of wildfires

Nature and causes of wildfires:

A wildfire is distinguished from other forms of fire event by being 'beyond control' for an initial period of time, and occurring in a natural environment – even though they can often spread to built human environments. Wildfires are known as **"quasi-natural"** wildfires as they are created both by natural and human factors. There are three conditions that need to be present in order for a wildfire to start and take hold. Firefighters refer to this as the fire triangle: fuel, oxygen, and a heat source.

- **Fuel** is any flammable material surrounding a fire, including trees, grasses and even soil and buildings. The greater an area's fuel load, the more intense the fire.
- **Air** supplies the oxygen a fire needs to burn. Initially provided by prevailing winds, a fire can generate its own continuous oxygen supply when 'fire-tornado' conditions develop; the rising column of super-heated air above the fire draws in air from surrounding areas and creates its own powerful in-rush of wind.
- **Combustible heat** is provided by lightning, volcanic eruptions, burning campfires or cigarettes, decomposing vegetation and even the sun can all provide sufficient heat to ignite a wildfire. They can also be deliberately started – with subsequent accidental loss of control of intended clearance burning, and through arson.

Four out of five wildfires are started by people but it's usually natural physical factors that help to fan the flames and allows the fire to spread.

- Prolonged dry weather and drought convert lush green vegetation into bone-dry, flammable fuel. Fallen branches, pine needles and dead leaves can accumulate beneath a forest to provide depths of very dry materials that act as potential ground fuel.
- Strong winds spread fire quickly over a wide area as incandescent embers of burning material are carried on the wind. Rapidly changing wind direction can cause fires to advance over a wide front and in unpredictable directions.
- Hot air temperatures dry out vegetation and the soil layer and encourage combustion.

When these factors come together all that's needed is a spark, in the form of lightning, a downed power line, farm machinery or a burning campfire or cigarette – or arson. These sparks are enough to ignite a blaze that could last for weeks and incinerate

thousands of acres of land including businesses, homes and many lives of humans and animals are at risk.

Wildfires are rare in areas so dry that little vegetation grows and that which does is sparsely distributed. And where rainfall is high and well distributed throughout the year, conditions are rarely dry enough for wildfires to take hold.

The regions of the world most susceptible to wildfires tend to have a distinct seasonality to their climate regime: a wetter season in which vegetation thrives, and a prolonged dry season characterised by high temperatures and an extended drought. This is typical of 'Mediterranean'-type climates, such as found in southern Spain, southern France, Italy and Greece, but also in south eastern Australia and California. Continental interiors can also experience a similar damp/dry variability with winter snowfall and subsequent melt creating damp winter and spring conditions followed by intense heating and little rain in the summer. Climate change is thought to be responsible for recent wildfires in Canada and Russia as reduced snow-fall is producing drier springs and more extensive dried-out ground conditions with more extreme temperatures in summer.

There are three main levels at which wildfires operate:

- **Canopy fires**: extending through the dense layer of vegetation at the top of trees forming a continuous path for burning vegetation high up.
- **Surface layer fires**: often grass, bushes and small trees forming dense scrub.
- **Ground fires**: these smoulder and creep through dried-out organic material in soils. Peat fires can be a particularly long-lived type of wildfire that may continue for months and be particularly difficult to extinguish.

Impacts

Impacts can be categorised according to whether they are primary or secondary and whether they are a social, environmental, economic or political impacts.

Primary impacts are the direct effects of fire, heat and smoke that occur during and immediately after the wildfire event whereas secondary effects are the after-effects.

Category	Example
Social	• Death toll and loss of income-earners • Increase in respiratory diseases – bronchitis & asthma. • Residential properties destroyed. • Ongoing stress / depression resulting from the event due to experiencing the fire.
Environmental	• Contaminated water supplies with ash. • Crops and animals destroyed. • Habitats affected and some species at the risk of extinction. • Localised climate change. • Faster surface run-off in vegetation-depleted areas.

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Economic	• Cost of damage to businesses and homes. • Tourism decreased. • Damage to infrastructure and lines of communication. • Loss of economic production • Insurance costs rising
Political	• Conflict between neighbouring countries as a result of transnational fires and cross-border air pollution. • Reduced confidence in the government as a result of fire. • Implementation of new regulations as a result of fire.

Human response techniques:

Human response can be categorised into short and long term response.

Short term response refers to the hours and days following a wildfire.
Short-term responses are always centred around preserving life. The uncontrolled nature of wildfires means the main focus of authorities is to ensure that people within the potential paths of the fire evacuate quickly. This is problematic, as often wildfires can change direction without warning and this can further endanger life, so authorities have to have a reactive approach to this hazard. Another issue is that in many areas, people refuse to leave their property as they believe that they can protect it. Often this leads to loss of life as people become overwhelmed by smoke and flames and underestimate how quickly wildfires can consume an area.

Search and rescue, recovery of bodies and the provision of essential supplies (food, water, shelter & medicines) also fall under this category. Depending upon how developed a country is, much of the response may come from the local communities themselves or from organised fire personnel. International help is less common from other countries than in many other types of natural disaster but there are instances of neighbouring countries providing fire personnel and equipment to help tackle widespread fires.

To extinguish the fires, professional firefighters will use a range of strategies. The most common one is to create a fire-break (fireline). This is where the vegetation is removed at the perimeter of the fire to remove the fuel element of the fire triangle. In some cases this works; yet in the windy conditions, embers can be blown from the fire and across the divide to another section of vegetation where it reignites. The use of water, both on the ground and from the air, is also implemented. Fire retardant may be sprayed from aircraft onto the fire frontier but the most common response is low-tech beating with hand-held leather paddles.

Long term response refers to the weeks and months following the wildfire.
This type of response focuses on rebuilding but also looking at mitigation techniques to prevent damage from future wildfires being as damaging.

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3.1.5.6 Hazards

The four categories of long term response are:

- **Preparedness** - the action of organising strategies to ensure people know what to do during a wildfire. This can include having evacuation plans and making local people aware of escape routes. In addition to creating an evacuation plan encouraging home and business owners to create a safety zone around their property can help prevent fires spreading. Within a 30-foot zone of buildings, remove combustible material and reduce the amount of vegetation to a minimum. Covering the ground with gravel and watering it during a wildfire can also help to protect properties from damage.

- **Mitigation** – the action of reducing the severity of a future event. This can involve fire proofing buildings with fire retardant to prevent them being at risk. Also improved satellite monitoring of areas at risk prior to a wildfire starting can help to minimise spread as authorities can be directed out to critical areas immediately to tackle the fire.

- **Prevention** – the action of stopping the event from happening to a place. In Texas, regular community clearing of brushwood under woodland is carried out to reduce the fuel potential. Land use zoning is an example of this by restricting building construction in high-incidence areas or controlling tourist access. Also, as the majority of wildfires are started by a human cause, such as a campfire or a discarded cigarette, having regular fire-watching patrols in commonly-used areas where fires start.

- **Adaptation** – the action of being able to react in a more organised and knowledgeable way, such as having an evacuation plan or fire-shelters dug into the ground close to remote houses. In Australia the policy of 'stay or go' encourages householders to make a plan in advance of a fire and stick to it – either staying to protect property or evacuating at the first warning; but not to change their mind halfway through. Those who choose to 'stay' usually have a deep fire-shelter (similar to tornado storm shelters) dug into the ground into which family members can be evacuated for the duration of the passing fire. Also, making sure new buildings are more resistant to fire hazards is a way of adapting. Clearing vegetation away from homes and using fire retardant materials to build the houses etc. help people to adapt and live more safely in an area at risk of wildfires.

Psychological damage from a hazard such as this is high and lots of money and health expertise is needed after an event to treat people who were involved. Also, many people who have experienced these fires often feel that more could have been done. This is due to the unreliable nature of a wildfire. Despite prevention, preparedness and mitigation, the sporadic and rapidly escalating nature of fire will often cause much destruction for people caught unprepared despite efforts to avoid that. Increasing global temperatures, changing patterns of precipitation, more regular occurrences of droughts and therefore drier vegetation, is likely to lead to an increased intensity and frequency of wildfires in the future.