Fire

This information note seeks to explain how fires start and how they are managed once burning. It also considers the positive and negative impacts wildfire can have on the natural environment and local communities.

What is fire?

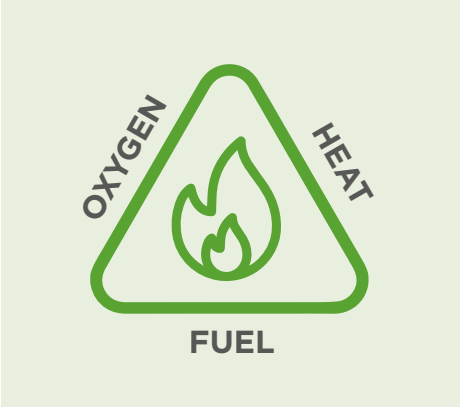
Fire is a special type of chemical reaction and is the visible effect of the process of combustion.

Combustion is also known as rapid oxidation and occurs between oxygen in the air and some sort of fuel. The products from the chemical reaction are completely different from the starting material and the reaction cannot be reversed.

To create fire, you need:

1. fuel
2. heat
3. oxygen

This combination is known as the 'fire triangle'.



The fuel must be heated to its ignition temperature for combustion to occur. Fuel and oxygen combust with the heat, resulting in a flame and often smoke. Flames can be different colours depending on what type of fuel is being burned. The reaction will keep going as long as there is enough heat, fuel and oxygen. If one element is removed the fire will go out.

Fuel

Fire needs fuel to burn. Anything that burns can be fuel for a fire. The characteristics of the fuel affect the behaviour and pattern of a fire. The characteristics and quantity of fuel will help determine how the fire spreads. These characteristics are:

- **Size** – smaller fuels, those with a diameter of up to 6mm such as grass, pine needles and heather, are known as 'fine fuels'. Small fuels dry out more quickly than larger fuels making them easier to ignite. Larger fuels, those with a diameter of more than 6mm, such as logs, branches and tree trunks, are known as 'coarse fuels'. Coarse fuels take longer to dry out and generally rely on an interaction with fire before they will ignite.
- **Shape** – the shape of fuel dictates its available surface area and how quickly it will dry out.
- **Surface area** – fuels with a higher surface area to volume, dry quicker making them quicker to ignite. For example, a small stick's total surface area is similar to its volume which means it will ignite quickly. However, a mature tree's surface area is much smaller than its volume, so it takes more time to heat up before it ignites.
- **Arrangement** – if fuel items are close together, they can ignite each other, causing the fuel to burn readily. But if fuel items are densely packed so that air cannot circulate easily, the fuel will not burn as freely.
- **Moisture content** – a high moisture content will slow the burning process because heat from the fire must first eliminate the moisture. Low moisture content fuels will burn more quickly making it more difficult to control the fire.
- **Chemical makeup** – some types of vegetation contain oils or resins that help combustion, causing them to burn more easily, quickly, or intensely compared to those without.

- **Amount** – the quantity and proportion of available fine and coarse fuels and how they are arranged can influence the speed, extent and intensity of a fire. The percentage of course and fine fuels alter the physical interaction between them. This then affects fire behaviour. If there is a profusion of fine fuels, but less coarse fuels, the fire will burn intensely around the edge of the fire, leaving little burning once the fine fuels have been consumed. A more even mix of course and fine fuels will see more course fuel being ignited.

All materials have a temperature threshold that once reached will make them burst into flames. This temperature is called a material's flash point. For example, the flash point of wood is 300 degrees Celsius. The amount of fuel material available for the fire to burn is known as the fuel load, which regarding wildfire, is usually measured by tonnes of available fuel per acre of land.

A high fuel load will result in a more intense fire that spreads faster. A low fuel load will result in a less intense burn that spreads slowly. The faster the fire heats up the material around it, the faster those materials ignite. How dry the fuel is will also affect how a fire burns and moves. Drier fuel means it burns faster and more intensely, leading to a harder to control fire. Moist, live vegetation burns less readily, whereas dry, dead vegetation is more likely to catch fire and allow the fire to spread. As a fire grows, the heat and smoke dries out the available fuel material just beyond it, making it easier to combust.

Humans and using fire

Exactly when humans discovered how to make, and control fire is unknown, but archaeologist believe it was around 1 million years ago. It's thought that people all over the world discovered how to do this independently. Learning to make and control fire had an important effect on how we developed as a species.

Early humans would have understood the damaging effects of fire long before they learned how to make and harness it. Humans would have learnt to use fires, that broke out naturally following lightning storms, to their advantage, by catching animals fleeing from the flames. The land scorched by the fire would possibly have made it easier to forage for food and natural fires might have been kept burning for their heat by people adding additional fuel such as wood or animal dung. It is possible that from this point, we learned how to spark our own fires from scratch using sparks from flint.

Animals and plants caught in these natural wildfires would have perished and been 'cooked.' This would have made them easier to digest and more nutritious, providing extra calories to help man develop bigger brains.

As well as being important for cooking, fires provided a warm central gathering point and source of light which would have provided opportunities for early humans to develop their cultural identities through art and storytelling.

Since these early attempts at making and controlling fire, mankind has relied upon the household fire as the main source of heat and light up until the 19th century. Fire has also been used as one of the earliest methods of long-distance communication via beacons and smoke signals and has been a vital part of our ability to manufacture goods.

Learning in, learning about, and learning for the natural environment.

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