Forest Education Foundation
National Forest Learning Centre
The stories behind our trees

Fire and The Tasmanian Forest Environment

The present-day patterning of Tasmania's forest and plant communities is the result of changes in climate, soil fertility and the interplays between humans, fire and vegetation over many thousands of years. Fire – both naturally occurring wildfire and burning by humans – has been of great significance over the last 10,000 years since the end of the last glaciation.

Forest ecosystem

The fire regime (pattern of frequency, intensity, season and extent) within an area will affect the forest types and ecosystems present. A fire regime with short fire intervals will see the fire-tolerant species in a community survive (such as eucalypts and wattles). Fire regimes with long fire intervals will support a fire-sensitive community (such as rainforest). A fire may kill individual examples of a species, but may advantage the long-term survival of that species within a community – eucalypt species are a prime example.

Aboriginal use of fire

Aborigines have been present in Tasmania for at least 30,000 years, and probably always used fire to survive. Aboriginal burning was undertaken to promote open vegetative habitats for game to feed on, to flush game from dense forests, to assist hunting and to clear tracks and paths through dense trees and scrub. Eucalypt forests and woodlands spread throughout Tasmania over the last 10,000 years after the last glaciation, and evidence suggests that Aboriginal burning was coincident with the replacement of some rainforest areas of Tasmania with more open landscape environments.

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The history of fire in Tasmanian forests

Sixty million years ago, Tasmania was connected to mainland Australia, South America and Antarctica, and the climate was wet, cool and constant. Tasmania was covered in dense rainforests. As Australia broke away from this landmass and became an island, it drifted north into a warmer climate zone – the land became drier, rainfall became seasonal rather than continuous, extremes of temperature began to occur, and fire became prevalent during warm, dry seasons. As cold dry winds began blowing in from the ice forming in Antarctica, the rainforests of Tasmania could not cope with the new conditions and began to break up. Patches of woodland and open forest appeared and spread. The new forests contained species of trees such as eucalypts, wattles, she-oaks and cypress pines, which were capable of living in the harsh new environment.

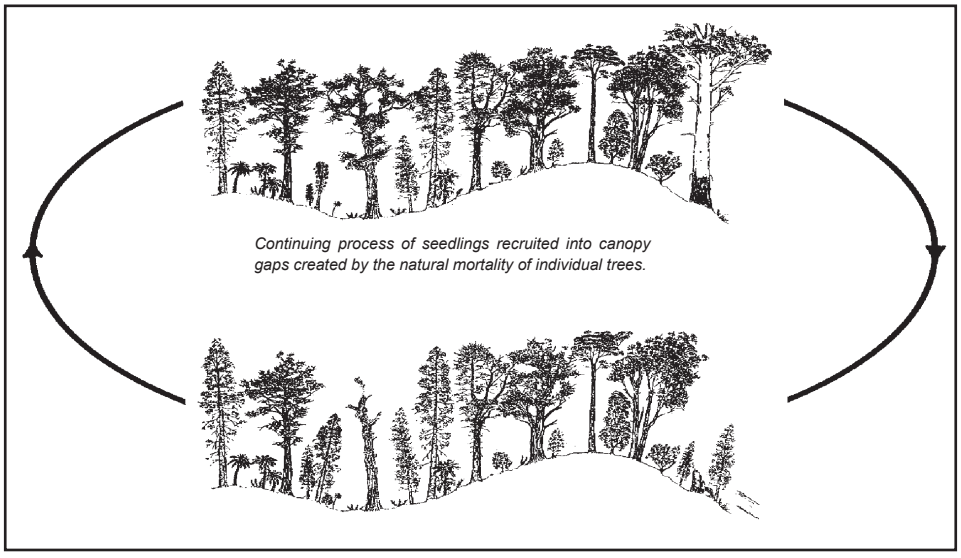
Fire tolerant eucalypts on the north-facing slope where fires occur more frequently, opposite a fire sensitive rainforest community on the sheltered south-facing slope

Fire was probably present in the environment millions of years before eucalypts, and it is likely that it became more prevalent during warm, dry periods during the last few million years. This suggests that the recent evolution of eucalypts occurred in the presence of fire, and that eucalypts developed characteristics that promote fire, which in turn assists their regeneration.

Natural regeneration cycles

Cool temperate rainforests:

Rainforests do not require disturbance by fire to regenerate. The retreat of Tasmania's cool temperate rainforests over the past 60 million years has been largely due to climatic changes, but the diminishing area of rainforest over the past few thousand years has had more to do with the occurrence of fire.



Natural regeneration pathway for Tasmanian cool temperate rainforest. Source: Illustration by Fred Duncan

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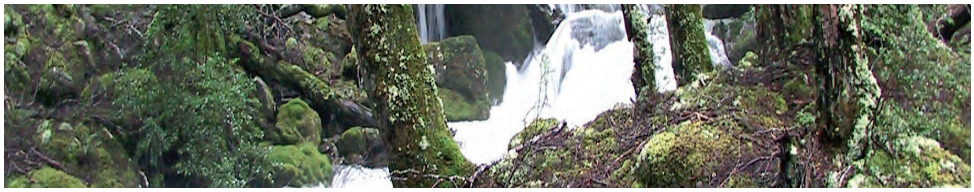
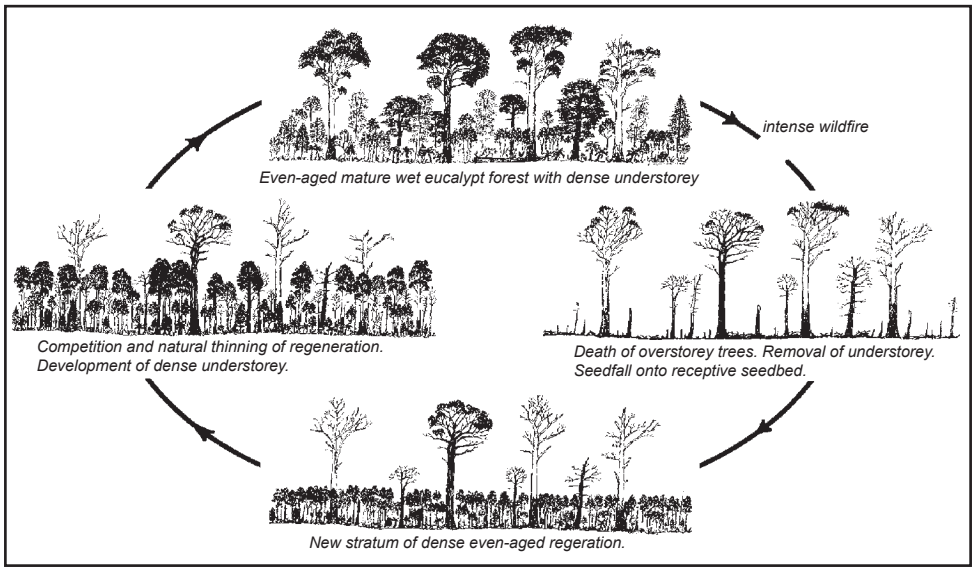


The natural regeneration cycle of rainforest trees does not require fire. Rainforest tree species have developed a 'gap phase' regeneration cycle. Parent trees produce large quantities of seed, which sprout into seedlings on the dark, wet forest floor. Some of these seedlings are able to survive for a number of years in this dark environment, until a gap appears in the overstorey canopy (caused by an old tree falling or loss of trees due to riverbank erosion) and they can take advantage of the extra available light. Small canopy gaps do not allow eucalypts to regenerate, and the darkness of the forest floor ensures that seedlings from eucalypt species will not survive, even if seeds have been brought in by birds or the wind.

Wet eucalypt forests:

In wet eucalypt forests, regeneration of the eucalypt overstorey can only occur with the removal of the dense understorey. This allows light to reach the forest floor. While eucalypt seeds can germinate in very low light, the survival of the seedlings requires at least 10-30% full sunlight. Eucalypt canopies in wet forests allow 30-40% sunlight in, but most of this is blocked by the understorey of dense species, so only between 1-5% actually reaches the seedlings. The failure of eucalypt seedlings under these conditions may be directly due to low light, or result from associated fungal diseases occurring in the dark damp environment. Success levels of germinating eucalypt seeds increase if the seeds fall on disturbed seedbeds, especially when a disturbance agent such as fire also heats the soil bed.

In order to survive, the eucalypts in wet forests require fire to complete their regeneration cycle. Wildfires in wet forests are much less frequent than in dry forests because of the moist fuel and damp conditions. However, due to the build up of large volumes of fuel between fires, along with the development of humus and peat layers, the fires in wet forests are often far more intense and can burn large areas of forest to the ground in appropriate fire weather conditions. Within the wet forest group, there appear to be characteristic intervals between fires:



Natural regeneration pathway for Tasmanian wet eucalypt forest.
Source: Illustration by Fred Duncan

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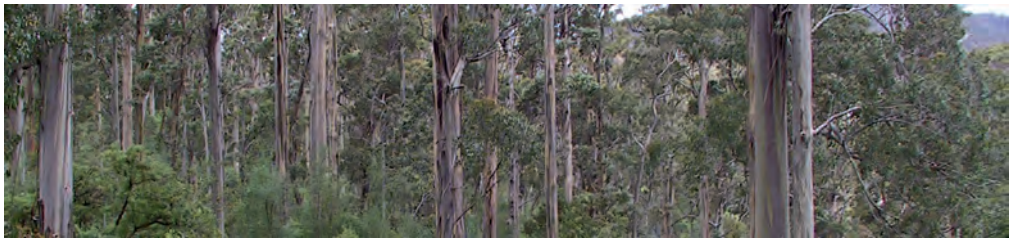
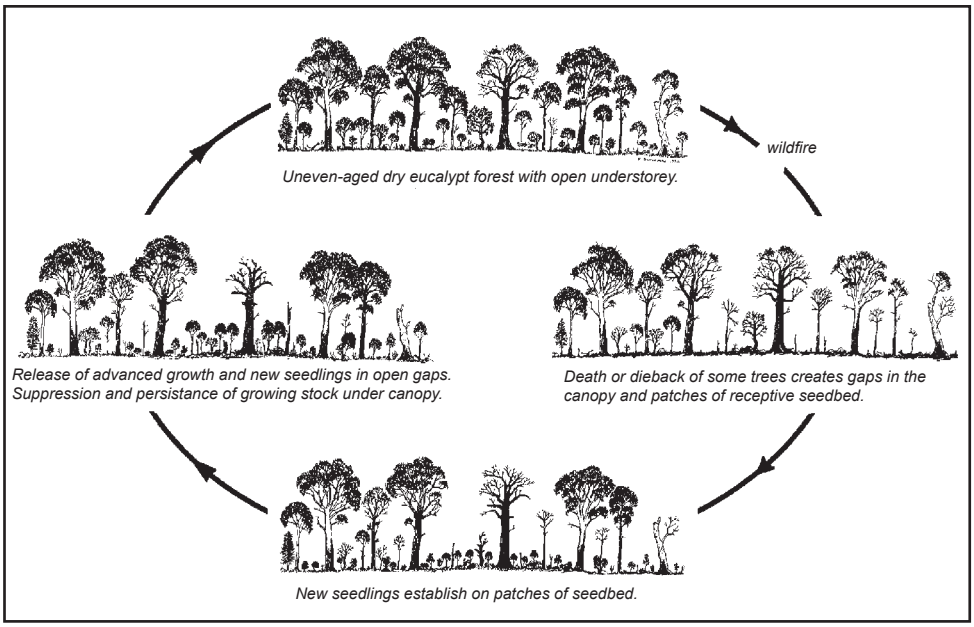


150-400 years for mixed forests and 20-80 years for wet eucalypt (wet sclerophyll) forests. Fire occurring within these intervals provides the optimum natural regeneration conditions for these forests. Fire removes the dense understorey and ground litter to allow sunlight to reach the forest floor, and heats the soil to improve germination of seeds. Fire usually occurs in late summer and prompts a heavy fall of seeds from surviving trees within a month (usually in autumn – the best season for seed germination). Fire also reduces the number of insects that harvest the shed seeds before they germinate – giving the new growth an increased chance of survival.

Dry eucalypt forests:

Unlike wet eucalypt forests, which often contain only one or two age classes of eucalypts, dry eucalypt (dry sclerophyll) forests usually contain trees of numerous age classes. This reflects the fire patterning and regeneration cycle of dry eucalypt forests – which is based on a frequent, low intensity fire cycle. Wildfire in dry eucalypt forests usually occurs more than once every 25 years – far more often than in the other types of forests. Many of the tree species in dry forests have developed fire-resistant thick bark to protect stem buds and lignotubers (basal sprouts buried beneath the insulating ground).



Natural regeneration pathway for Tasmanian dry eucalypt forest.
Source: Illustration by Fred Duncan

Because of the frequency of fire, sparser vegetation and lower fuel loads in dry eucalypt forests, fires are usually less intense than in wet eucalypt forests. This is a necessary factor in the regeneration of dry forests.

Lower intensity fires mean that some mature trees can survive a fire, and even scarred and damaged trees can sprout new crown growth from stem buds and continue producing and shedding seeds. For those trees that don't survive, the growth characteristics of lignotuber seedlings prove an excellent form of regeneration after a fire – the seedlings usually outperforming planted seedlings. Lignotubers can survive buried under ground for up to twenty years and still sprout successfully when appropriate, but they can also be destroyed by heavy stock grazing or repeated burning. The survival of some trees after a fire, the frequency of low-intensity fires and the light, open nature of dry forests that allows seedlings to grow without the complete disturbance of the understorey or overstorey are all characteristics of dry eucalypt forests. These characteristics indicate why dry eucalypt forests possess many different age classes of trees at any given time.

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Fire & Regeneration

The Burning Question

Fire has been part of our forest landscape since Australia broke away from the giant supercontinent Gondwana and began to drift into warmer latitudes, tens of millions of years ago.

Much more recently – just a few million years in the past – eucalypt trees evolved. Fire was part of the environment, and eucalypts adapted to it beautifully – so well that some species came to rely on fire for regeneration.

Then, during the last 30,000 years (just the blink of an eye in geological time), Tasmanian Aboriginal people used fire as a land management tool. When they arrived during the last glacial period, the climate was much colder and drier than it is today. Areas of grasslands and buttongrass moorlands were extensive – Aboriginal fires helped to maintain the extent of these open, unforested areas.

During the last 30,000 years, Tasmanian Aboriginal people used fire as a land management tool.

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Fire & Regeneration

How do Tasmanian Forests Respond to Fire?

Wet Eucalypt Forests

In these forests, the dense understorey and shady canopy means that eucalypt seedlings cannot grow. They need light and a clear seed bed to flourish – it takes fire to clear the undergrowth and allow sunlight to reach the forest floor. With a heavy fuel load on the ground and leaves that contain volatile oils, fires in wet eucalypt forests are hot and fierce. Some of the big trees are killed and the vegetation beneath them burns away. Capsules on the surviving trees are opened by the heat of the fire – seed showers down and seedlings thrive.

A few years after a major fire, there are the dead 'stags' and remaining tall trees; beneath them is a dense new growth of regenerating forest. As the eucalypts mature, the understorey of other tree species grows – until the next fire.

If fire doesn't come? Eucalypts can live for several hundred years. If there is no fire in that time then there will be no eucalypt regeneration – the eucalypts die and rainforest trees / species take over.

Dry Eucalypt Forests

These forests need disturbance to regenerate, but they don't rely on fire alone. Storm damage and the death of old trees can also create gaps in the canopy, allowing seedlings to germinate and grow. In dry forests there are often many suppressed seedlings already present on the forest floor and gaps created by fire or by old trees dying releases those seedlings, which grow quickly. Fires in dry forests are more frequent but not as intense as fire in wet eucalypt forests. Some trees may be killed but many survive, sprouting new growth from buds beneath the bark and lignotubers on the roots. This means that dry eucalypt forests usually have trees of a variety of ages.

Cool Temperate Rainforests

Natural regeneration in these forests does not require disturbance by fire. Rainforest seedlings can germinate and survive in deep shade, waiting for years for a gap to appear in the canopy as an old tree falls. Then the race towards the light begins.

Illustrations: Fred Duncan

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