# THE EVOLUTION OF FIRE TRAITS IN PLANTS, PLANT INVASIVES AND WILDFIRE CHALLENGES

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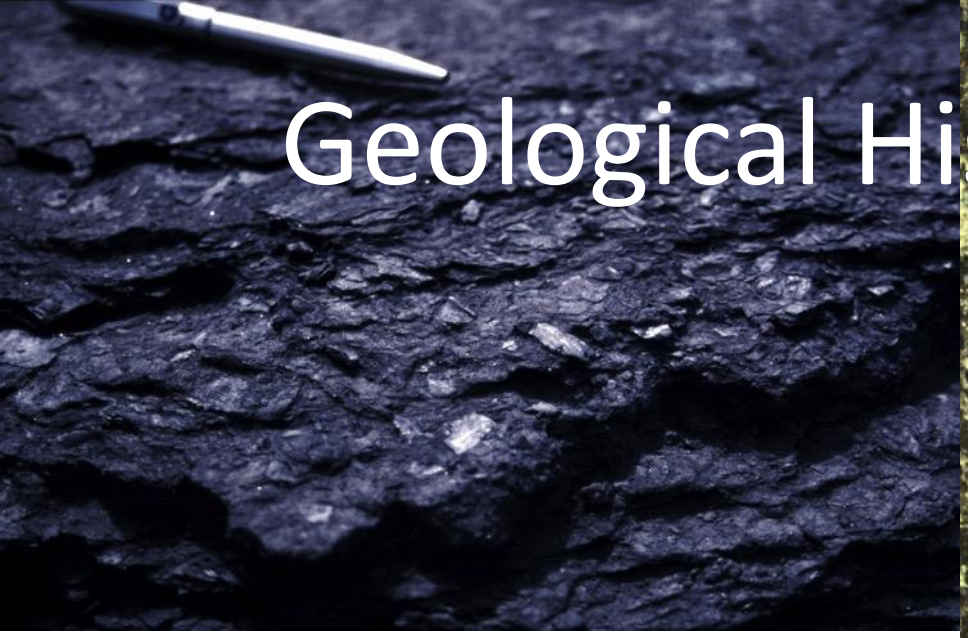
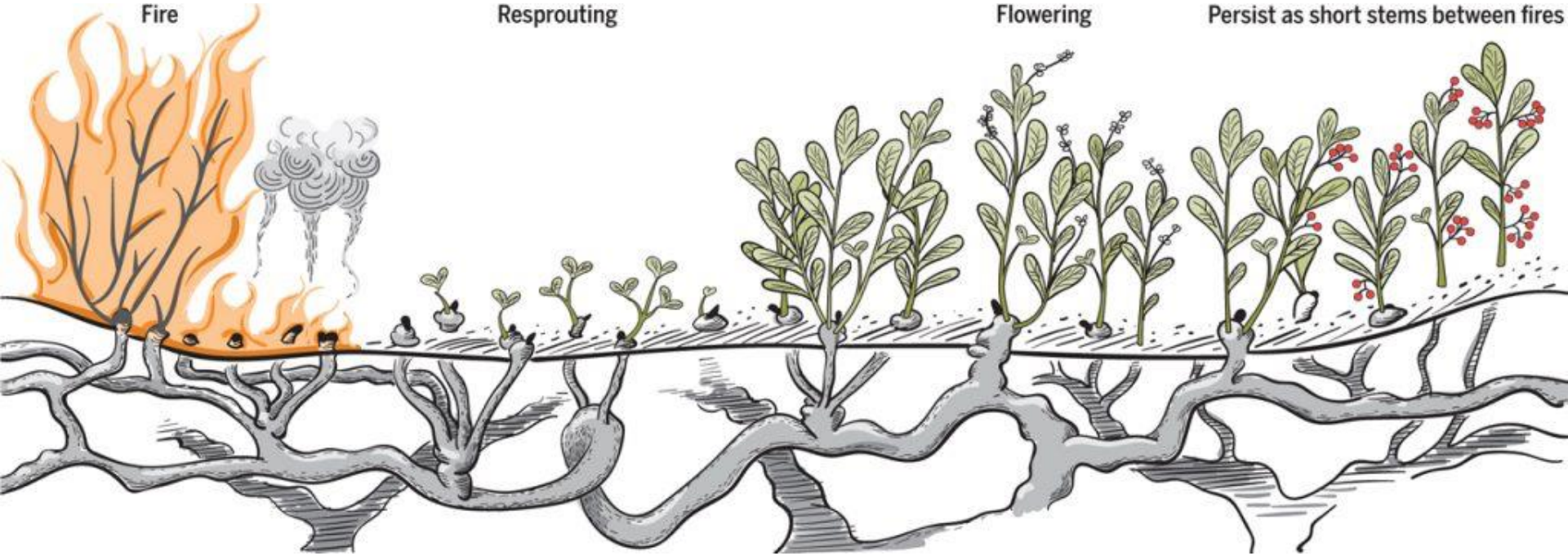
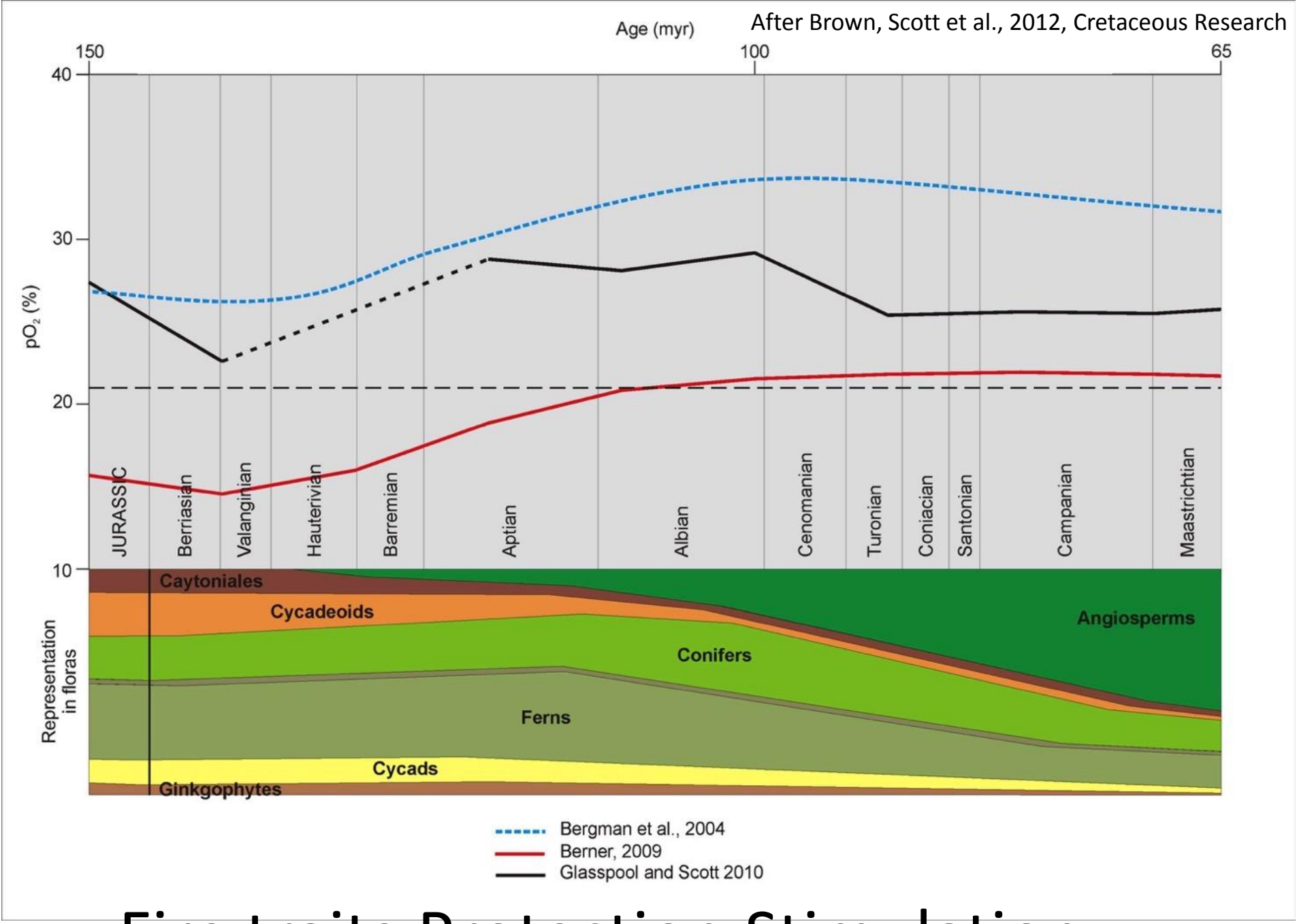
# Geological History of fire



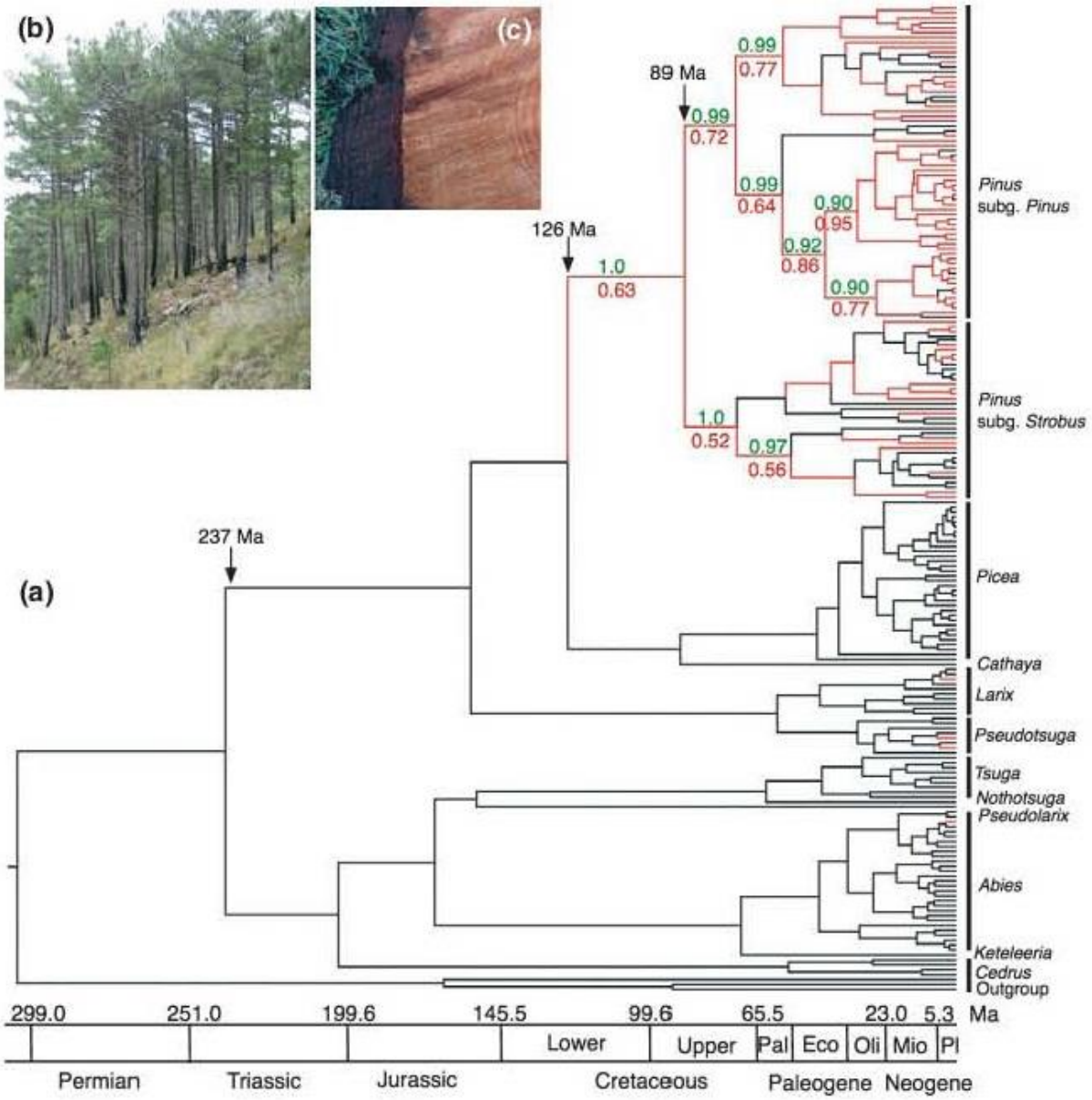
# Clonal habit



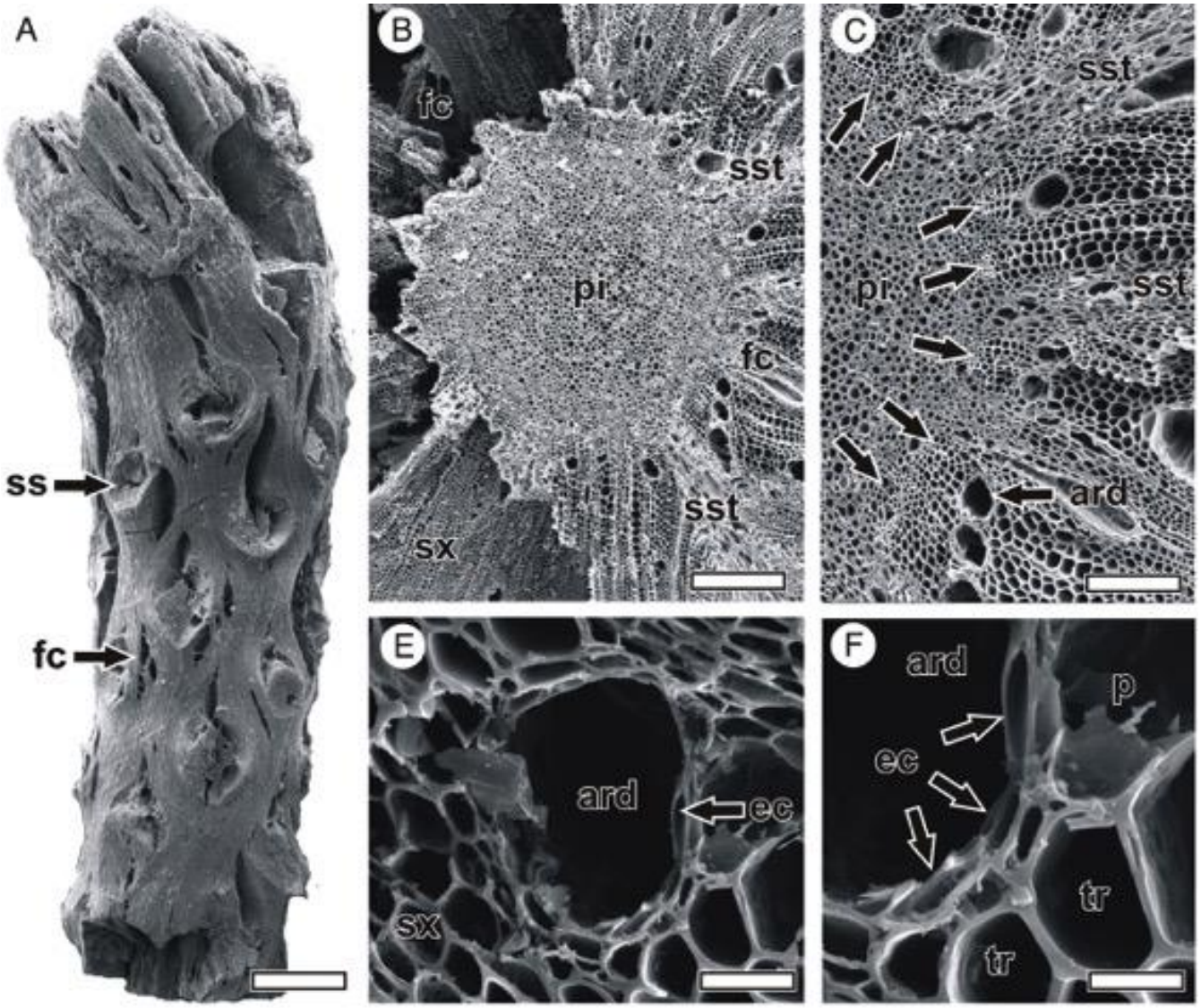
*Populus tremula* - Aspen




# Fire traits:Protection;Stimulation




The origin of thick bark in pines (from He et al. 2011). Figure a) shows a phylogeny of conifers with red lines indicating evolutionary pathways for modern species with thick bark (>15mm). The scale at the bottom indicates time, estimated from molecular dating of the phylogenetic tree. This analysis points to a mid-Cretaceous (89 Ma) origin of conifers with thick bark adapted to surface fires. Serotiny, retention of seeds in closed cones with massed seed release after stand-replacing crown fires, also first evolved at this time. Figure from He et al, 2012, New Phytologist. (b) Pine (Pinus nigra) forest following surface fire, with trees, c.20 m tall, showing old branch shedding. © Cross-section of trunk of Pinus sp. showing bark, 45 mm thick at its maximum.




Falcon-Lang et al 2016 Geology 44,303-6

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# Climate Change and UK Wildfire

Wildfire is any uncontrolled vegetation fire that requires a decision, or action, to suppress it.[1] This POSTnote summarises management of wildfires in the UK, how projected climate changes may affect UK wildfire behaviour, and the environmental, economic, and health impacts of this. It also outlines policy options for increasing the UK's resilience to wildfires.

## Overview

- Wildfire is a natural and essential part of some ecosystems.
- Recently, there has been a global surge of large wildfires and prolonged fire seasons, associated with a complex mix of climate change, changing land management practices and human behaviour.
- UK climate projections indicate that climatic factors conducive to elevated wildfire conditions will increase.
- The UK Climate Change Risk Assessment and National Adaptation Programme identified wildfire as a climate change risk.
- The Home Office has responsibility for wildfire risk and focuses on extinguishing fires with other management responsibilities split between government departments.
- Better wildfire prevention in the UK could be achieved through landscape management.

## Background

Fire is a natural and essential process in some global ecosystems.[2–8] Fire regimes are defined by their intensity (energy output from the fire), severity (organic matter consumption), frequency, seasonality, and size of wildfires in an area.[6,7] These regimes change through time according to atmospheric conditions, climate, and vegetation.[2] Weather is a key factor in determining whether wildfire risk is elevated or not.[4] Humans have altered fire regimes for millennia through deforestation and agriculture. This has led to changes in fuels (vegetation) that underpin natural fires, changed ignition rates, and shifted the seasonality (timing) of fires.[8–11]

UK wildfires are not on the scale of some other countries (Box 1). For example, in the US in 2017, over 40,000km2 of area was burnt.[12] However, between 2009 and 2017, the Forestry Commission classified 258,867 events that the fire and rescue services (FRS) attended in the UK as wildfires.[13] Satellites recorded an area burnt of over 180km$^2$ in 2018, and already over 290km$^2$ so far in 2019.[14] Significant wildfires do occur in the UK and even small fires can have major impacts since location is key.[15,16] Notable wildfires in 2018 included Saltybridge Moor and Winter Hill Moor which covered over 19 km$^2$.[17,18] UK climate projections indicate more climatic factors conducive to wildfire but there is a lack of recorded evidence on the environmental, economic, and health impacts of wildfire events.[19]

### Effects of Climate Change on Wildfires Globally

Under all emissions scenarios for climate change projections, global surface temperature will rise over the 21st century, with extreme precipitation events and more frequent and longer lasting heatwaves becoming more likely (PN594).[20] The danger of wildfires in the Mediterranean

**Box 1: Global Surge in Wildfires**

In the last few decades, there has been a global surge of large wildfires and prolonged fire seasons, with extensive environmental, economic and social costs.[21,22] In Europe, there has been a change in fire rate of spread (total perimeter),[23] and intensity.[24] Recent wildfires in Portugal, Spain, the US, New Zealand, and Tasmania have been widely reported, and areas of peat in Southeast Asia burn for months at a time.[25] A large majority of fires in the US and across many European countries are human-caused,[26,27] and many in Southeast Asia are intentional.[25] Over-suppression (extinguishing) in some areas has led to fuel accumulation and less frequent but more intense fires.[28–31] There has been a loss of indigenous techniques to control fire and to use it to manage the landscape.[32,33] These changes to the fire regimes are associated with climate change, but also with changing land management practices and human behaviour.[34,27,33–36]



## Overview

- Wildfire is a natural and essential part of some ecosystems.
- Recently, there has been a global surge of large wildfires and prolonged fire seasons, associated with a complex mix of climate change, changing land management practices and human behaviour.
- UK climate projections indicate that weather conducive to wildfire will increase.
- The 2017 UK Climate Change Risk Assessments and 2018 National Adaption Programmes identified wildfire as a cross-sector climate change risk.
- Responsibility for wildfire is fragmented in the UK, and generally focuses on extinguishing fires rather than prevention.
- Better wildfire prevention in the UK could be achieved through landscape management.

# PYROPHYTIC VEGETATION TYPES:

**Grasses:** Any cured (dry) grass. Nonirrigated, annual grasses are typically more flammable than perennial grasses. Irrigated grasses are fire resistant.

**Herbs:** Any cured herb.

**Ferns:** Any dry or cured fern, particularly cured bracken and sword ferns.

**Brush:** Any brush with excessive deadwood. Any over-mature, dying or dead brush.

**Trees:** Any forest, stand or urban forest that is over-dense, under stress or over mature.

# Flammability of UK Plants

# Thursley, Surrey

October 2006

March 2012

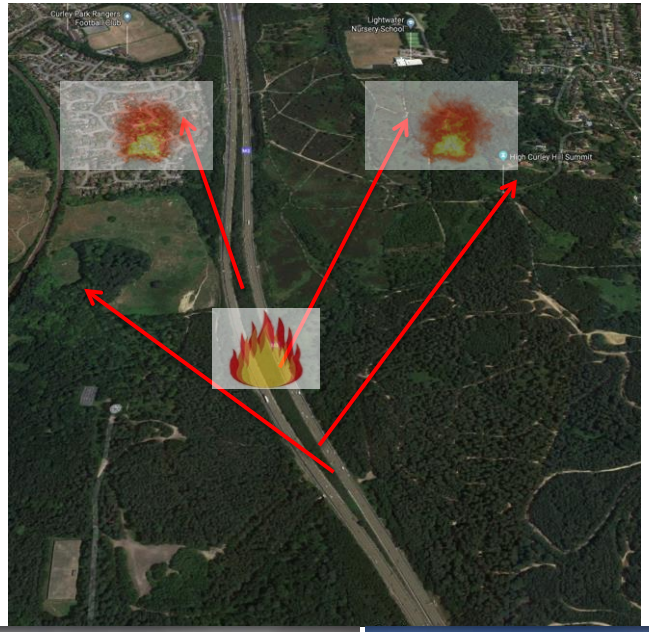
# The problem of Gorse

Burning in itself is not an effective means of control of:

**Gorse**. Burning is of little benefit for long term control. Its effect is to bring about a break in seed dormancy resulting in the appearance of young seedlings as a carpet to re-invade the burned area.

**Bracken**. Burning is of no benefit. Burning of dead litter is unlikely to affect the buds below the surface.

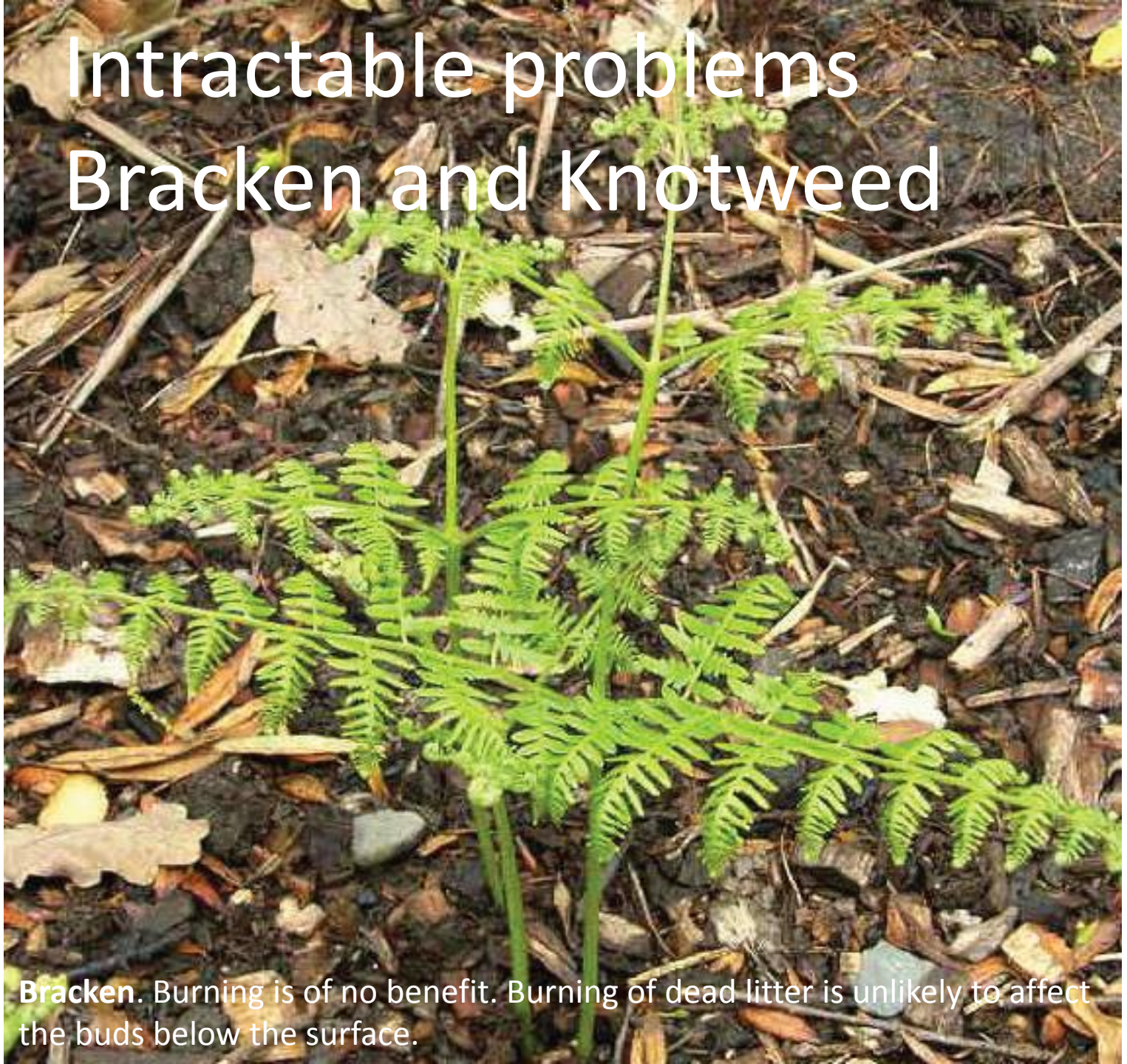
Problem of Gorse as fire hazard on M3 near Windlesham





Note extreme flame height when gorse burns

# Intractable problems Bracken and Knotweed



**Bracken**. Burning is of no benefit. Burning of dead litter is unlikely to affect the buds below the surface.

Bracken has the potential to significantly alter tree–grass interactions in montane grasslands. Adie et al 2011 Plant Ecology


Bracken should not be treated by fire. Bracken spread will be stimulated by burning

Re-growth of fern and grass two weeks after Rushmoor fire, Surrey
June 1995

Re-growth of heather
March 2012

First, an intractable weed like *P. aquilinum* can be eradicated and a vegetation more suited for grazing can be achieved by the continuous application of some treatments over many years. Here, success was achieved by cutting twice/ thrice annually, or by a single asulam application followed by annual spot spraying of all emergent fronds for 8 years.

MILLIGAN et al 2015 Weed Research

# Japanese Knotweed – a warning

1. Collect every little peace you cut of the plant, every stem, every leaf, all of it.

2. Dig out the crown out and all the thick rhizomes as much as you can.

3. Leave all the material out to dry on a waterproof surface making sure any material will not be washed off by rain or blown on by wind.

4. You must burn all the waste on the land the weed came from, you **MUST NOT** move it onto any other land to burn, you will face large fines and in some cases a possible prison sentence if you're found transporting Japanese Knotweed.

5. Anything left from the fire other than ash you must burn again. A Japanese Knotweed crown is known to survive multiple fires.

6. Return to the site monthly in the growing season for the next 5 years ready to treat with weed killer.


FIRE DANGER
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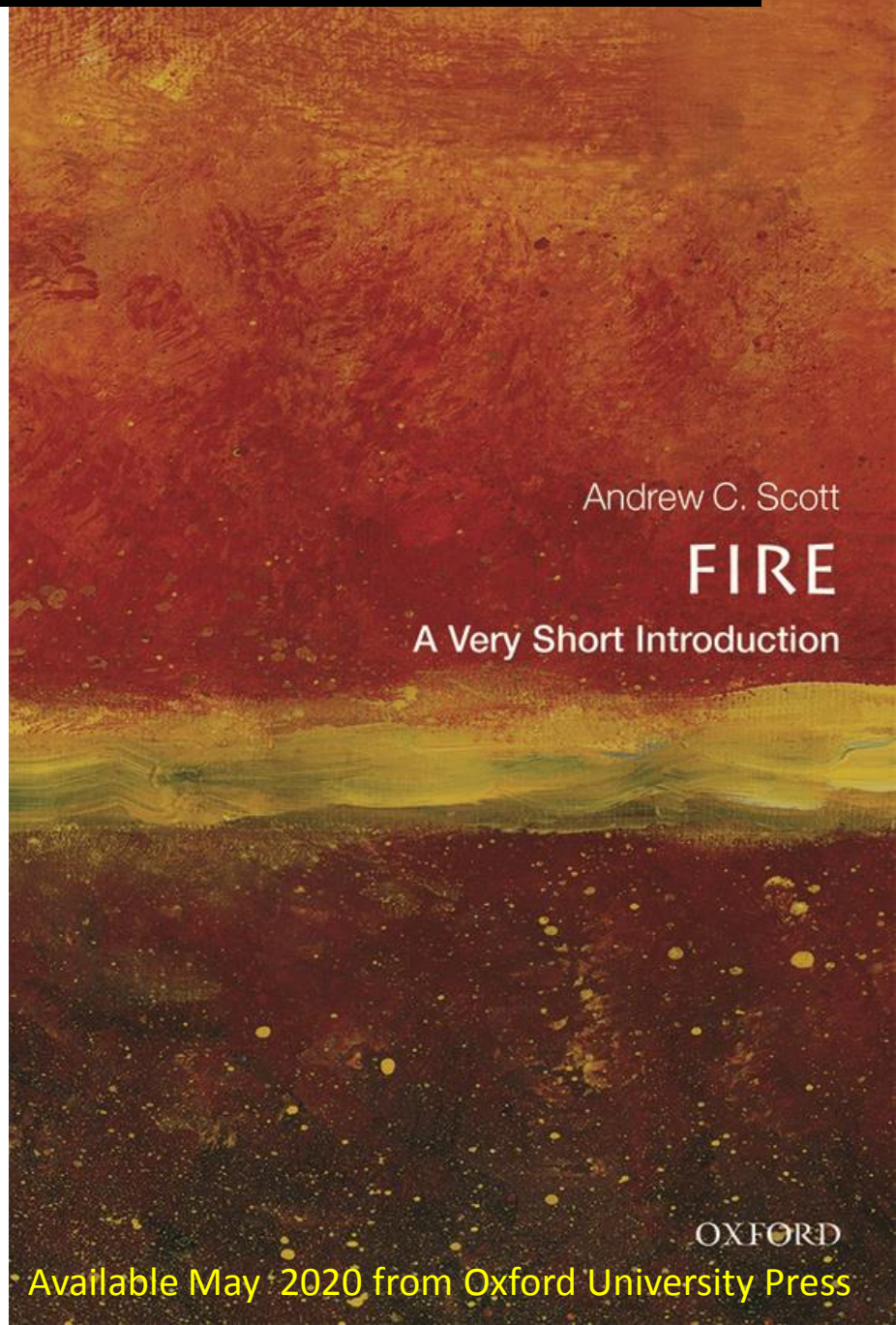


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