Hazard reduction burning in Australia

What the evidence says about protection, smoke and ecological costs

A plain-English evidence briefing for the public and elected representatives. Focus: Australian forest fuel reduction, with particular relevance to Sydney and NSW.

The principal finding

There is a sound evidence-based case for reviewing how planned-burning programs account for public health and ecological harm. Important costs are absent from some models and represented by broad assumptions in others. That matters when those models inform spending and treatment targets.

Four findings that deserve attention

Planned-burn smoke has a separately estimated health burden. NSW research separately estimated prescribed-smoke health costs over 2000-2020; wildfire smoke caused a larger total burden. [16]

A prominent economic model omitted smoke. Penman et al. explicitly placed smoke dispersion and population impacts outside their 2020 study. Its financial conclusions therefore do not settle the full health balance. [4]

Repeated fire can affect recovery and habitat. Evidence includes post-megafire biodiversity responses, a long-term prescribed-fire experiment, and species-specific recovery and food-resource studies. Effects vary by ecosystem and fire history. [5,20-22]

Protection depends on location and timing. House-loss research supports examining recent nearby burning and vegetation immediately around homes, rather than judging programs only by hectares treated. [3]

The decision for government

Require a transparent comparison of locally relevant strategies that counts treatment smoke, future wildfire losses, ecological recovery and household costs. Publish assumptions, uncertainty, commissioning and performance.

A targeted evidence review, checked 13 September 2026. It establishes reasons for scrutiny; it does not calculate a new national benefit-cost ratio. References are numbered and linked.

The question and the evidence

The practical question is whether the scale, frequency and placement of planned burning deliver enough protection to justify the full costs for the particular community and ecosystem.

Hazard reduction burning deliberately changes vegetation fuels before a potential bushfire. Backburning is tactical firing during an active fire. Findings about one should not automatically be attributed to the other. Cultural burning has distinct purposes, knowledge and practices and requires its own assessment.

Evidence type	Useful finding	Boundary
Observed house losses	Associations between destruction, fire history and nearby vegetation.	Not a randomised comparison; management, weather and settlement can confound results.
Smoke health-impact assessment	Estimated additional illness and deaths from pollution exposure.	Population estimates derived from exposure-response relationships; not individual death certification.
Economic / fire simulation	Comparisons between treatment scenarios.	Conclusions apply to the inputs and impacts included; omitted costs can change the ranking.
Ecological field study	Measured vegetation, soil or species responses.	Local findings require care when transferred between habitats.
Perspective or scientific reply	Interpretations, critiques and research priorities.	Not interchangeable with a new independent field experiment.

What this review did

Substantive claims were checked against original publications, public abstracts, model limitations and government reports. The aim was to test the underlying findings and their relevance to policy, including evidence that challenges existing assumptions.

This is a targeted evidence review, not a systematic literature search or a reanalysis of raw data. Where only an abstract was accessible, that is identified in the references. Sources were checked on 13 September 2026.

The test of objectivity

Apply the same standard to claimed benefits and harms: identify the source, comparator, period, geography and uncertainty, and ask whether the finding was actually included in the model being discussed.

Smoke: a measurable planned-burning cost

PM2.5 consists of airborne particles no more than 2.5 micrometres across. Both planned burns and wildfires produce smoke. Exposure depends on where emissions travel and how many people breathe them, as well as on hectares burnt.

Study / scope	Finding	Meaning
Sydney hazard reduction, May 2016 [1]	Six smoky days: **14 premature deaths** (95% CI 5-23), **29 cardiovascular** admissions (5-53), **58 respiratory** admissions (0-124).	A specific planned-burning episode. Admission point estimates sum to 87. It is not a toll for every major burn.
NSW fire smoke, July 2000-June 2020 [16]	Prescribed smoke: **$361 million**, or 17.9% of estimated health costs (rounded values). Wildfire smoke: $1,653 million, or 82.1%. Values are in **2018 Australian dollars**.	A health-impact and cost model using historical fire and exposure data to distinguish sources. The total estimate was $2,013 million (95% CI $718-$3,354 million).
Per hectare, same NSW study [16]	Prescribed fire: **$477**; wildfire: **$104** in estimated smoke health costs per hectare.	Per-hectare prescribed-fire costs were about 4.6 times higher. This does not mean the total cost was higher or that every prescribed burn has this ratio.

Why these findings matter to modelling

These source-specific estimates provide a basis for scenario exposure analysis. They do not calculate net benefits. [16]

How to read an estimated premature-death count

Researchers combine pollution exposure, baseline health rates and epidemiological exposure-response relationships. The result estimates deaths brought forward by pollution across a population. It does not identify individuals or measure the lifetime lost by each person.

A complete comparison

Count treatment smoke and future wildfire smoke under each strategy. A historical smoke-cost estimate cannot simply be subtracted from a different region's benefit estimate using different years, prices and assumptions.

Other health burdens and community disruption

Health-service use extends beyond respiratory illness

A 2026 MJA study examined Australian public health-service use over 2014-2020. It found associations between smoke-related PM2.5 and hospital admissions, primary-care use and medication dispensing, including mental-health services. It examined short-term exposure lags. [17]

For cardiovascular and respiratory admissions, the abstract reports a relative risk of 1.014 per 1 microgram/m3 increase in PM2.5 at a one-day lag. This is a modelled relative change in risk, not a percentage of the population admitted. The study does not isolate hazard reduction smoke or establish chronic illness caused by repeated planned burns. [17]

Broader estimates need source boundaries

Sydney landscape-fire smoke in 2001-2013 was associated with an estimated 197 premature deaths (95% CI 101-295), 436 cardiovascular and 787 respiratory hospitalisations. This combines wildfire and hazard reduction sources. [2]

A 2024 city study estimated 1,454 deaths (95% CI 987-1,920) attributable to exceptional PM2.5 events over 2001-2020. It is a broader exceptional-pollution estimate, not a national hazard-reduction death toll. These overlapping studies should not be added together. [24]

Costs requiring better measurement

Potential burden	Evidence needed for public decisions
Symptoms and repeated exposure	Burn-source attribution, measured indoor/outdoor exposure and representative health surveys.
Staying elsewhere or filtering air	Accommodation, travel, filtration and energy costs, including households unable to afford avoidance.
Restricted work, school and outdoor activity	Days disrupted, care arrangements, income effects and unequal impacts.
Community wellbeing	Validated measures that distinguish pollution effects, disruption and anxiety about future fire.

Anonymous illustration - not a study result

A household containing someone with asthma may temporarily stay elsewhere during a smoke episode, incurring travel, accommodation and missed-work costs. Such disruption should be measured. This illustration establishes neither how common displacement is nor the source of any particular episode.

What the models include - and leave out

There is no single "HRB model". Different studies count different outcomes. The strongest criticism identifies an actual omission or assumption in a named model.

Study	Coverage / limitation	Evidence outside that treatment
Penman et al. 2020 [4]	Values houses, lives, powerlines, carbon and ecological assets. **Explicitly excludes smoke dispersion and population impacts.** Uses a coarse ecological dollar proxy; cumulative ecological fire-regime effects could not be estimated. Individual protective behaviour is also excluded.	Prescribed-smoke health costs [16]; service-use associations [17]; species recovery and soil responses [20-22].
Deloitte / AFPA 2014 [18]	Illustrative scoping scenario includes **PM10 and carbon**. Assumes pollution costs halve with the reduction in burnt area; not a spatial assessment of population exposure.	Source-specific smoke exposure and per-hectare health costs [16] challenge reliance on burnt area as a sufficient exposure proxy.
Finity / ICA 2022 [19]	Includes disaster health and social costs and assumes they fall in proportion to avoided annual losses. Fuel-management section recognises air-quality harm but does not separately quantify added treatment-smoke exposure.	Treatment-specific illness and exposure should be assessed separately from avoided disaster trauma. [1,16,17]

What can be concluded

A missing burden means the reported result is incomplete for that purpose. It does not prove that adding the burden reverses the result. An aggregate allowance also does not demonstrate that vulnerable communities or cumulative ecological recovery have been adequately represented.

What a revised assessment should show

Publish a coverage register: each benefit or harm, its data source, valuation method, geographic footprint and uncertainty. Identify any excluded impact and explain how it could affect the choice between strategies.

Keep unlike measures separate

Lives saved, property protected, hospital use, smoke exposure and habitat recovery should be visible before being combined into a dollar total. Report consequences that cannot credibly be priced alongside the economic result.

Deloitte, commissioning and policy influence

The connection is documented

The Australian Forest Products Association commissioned Deloitte Access Economics' 2014 scoping study. It assessed increased burning combined with mechanical removal of trees and other biomass, including revenue from recovered material. This commissioning relationship should accompany references to its conclusions. Here, CBA means **cost-benefit analysis**. [18]

What the headline financial result represents

Its illustrative Blue Mountains scenario projected about $34 million in annual net savings and a benefit-cost ratio of 6.0. It included carbon and PM10 costs, but assumed PM10 costs would halve in direct proportion to burnt area. The authors described it as an example rather than a full CBA and warned that the ratio could fall with fuller analysis. [18]

Commissioning and assumptions should be disclosed whenever this scenario is cited as evidence for treatment targets.

How earlier analysis enters later policy advice

Finity's 2022 ICA report uses the 2014 Deloitte study for fuel-management inputs. It projects $3,065 million in returns from $712 million invested over five years, a ratio of 4.3. Returns cover avoided losses through 2050, discounted to 2022 at 2% annually, including disaster health/social costs. These are scenario estimates. [19]

NEMA describes the Hazards Insurance Partnership as government-insurer cooperation on risk reduction and insurance affordability and availability. [15] Its role in evidence selection and treatment priorities should be transparent.

Transparency request	Purpose
Identify commissioners and funders	Distinguish commissioned policy advice from research with different funding and methods.
Trace assumptions into later reports	Make repeated reliance on one input visible; citation reuse is not independent validation.
Publish sensitivity tests and alternatives	Show whether conclusions survive realistic smoke costs, ecological impacts and different treatment effectiveness.
Disclose commercial revenue and distribution	Show who benefits financially and who bears health, disruption and environmental costs.

Funding, incentives and public communication

Funding can shape which questions receive attention and which outcomes are measured. A government review should examine declared support, research governance, control of the research agenda and the treatment of costs borne outside the sponsoring sector.

Work	Declared commissioning / support
Deloitte 2014 [18]	Commissioned by the Australian Forest Products Association; includes a biomass-removal scenario.
Finity 2022 [19]	Report for the Insurance Council of Australia; uses earlier Deloitte analysis.
Penman et al. 2020 [4]	Two authors' salaries supported by the Bushfire and Natural Hazards CRC; another by NSW RFS. No other funding reported; no commercial/financial competing relationship declared.
Gibbons et al. 2025 [3]	Australian Research Council Discovery Projects support; no competing interests declared.
Borchers-Arriagada et al. 2021 [16]	Reports no funding and no competing interests.
Zylstra et al. reply 2024 [8]; Bradshaw et al. perspective 2026 [23]	Reply reports no funding. Perspective reports no specific funding and no conflict of interest. These statements apply to these papers, not every related project.

Public advocacy and who benefits

The Australian Business Roundtable identifies its founding organisations as Red Cross, IAG, Investa, Munich Re, Optus and Westpac, and describes its reports and advocacy as influencing policy. [27] Finity cites Deloitte's 2016 work for this roundtable in its disaster health/social assumptions. [19]

Avoided insured and asset losses create a financial incentive for risk reduction. Government should examine whether the advocated measures also deliver net community benefit once smoke, ecological recovery and household costs are counted. The distribution of benefits and burdens is part of that assessment.

What government should investigate

Are campaign sponsors and spending fully disclosed? How are grants distributed between burning, alternatives and impact research? Do affected communities have an independent voice? Does messaging fairly present benefits, harms and scientific uncertainty? Examine records and communications to answer these questions; the findings should be public.

Protection: evidence of benefit and its limits

Observed house losses provide an important test

Gibbons et al. (2025) studied 1,617 wildfire-exposed houses in southern Australia. Lower destruction was associated with earlier burning within five years and less than 3 km upwind; that earlier-fire measure included both wildfire and prescribed fire. [3]

Sixty-nine per cent of sampled houses had no prescribed burn in that relevant window. Woody vegetation management within 40 m of houses had a stronger and more certain protective association. The study found limited evidence of protection from prescribed burning as then practised. It does not show that strategically placed burning can never protect houses. [3]

Placement creates a trade-off

Burning close to buildings may increase its protective relevance and also place emissions close to residents. Treatment location should be justified using protection and smoke-exposure outcomes together.

Regional economic results are not a national verdict

Penman et al. found cost-effective burning strategies in three of 11 landscapes: Canberra, Hobart and the Blue Mountains. No additional prescribed burning was cheapest in eight. Modelled life-loss costs exceeded house-loss costs in most regions. [4]

These results warrant regional evaluation, with the omissions shown on page 5. They do not establish that lives were unimportant in the model or that an economic result is a complete measure of public safety.

Florec et al. separately modelled burn placement in south-west WA. Its findings should not be substituted for the eastern-Australian three-of-11 result. [12]

Historical death totals cannot identify lives saved

CSIRO's database records 825 civilian and firefighter deaths associated with 260 Australian bushfires over 1901-2011. It is valuable evidence of fatality circumstances, not a controlled test of hazard reduction. [25]

Comparing a century-wide average with a selected later period cannot isolate a treatment effect. Settlement, population, weather, warning systems, buildings and firefighting change. A credible evaluation must account for them; the absence of a simple downward average is not proof that burning saved no lives.

Repeated fire, regrowth and biodiversity

Fire history affects response to the next wildfire

Driscoll et al. (2024) assessed biodiversity responses to the Black Summer megafires. Negative effects were 87-93% larger at sites with three or more fires in the preceding 40 years than at sites not burnt or burnt once in that period. [5]

The percentage describes a larger measured negative response, not the loss of 87-93% of all biodiversity. Earlier fires were not all necessarily hazard reduction burns. Nevertheless, counting cumulative fire history is relevant when prescribing additional disturbance. [5]

Some WA forests became less likely to burn as they matured

Zylstra et al. (2022) analysed 65 years of fire records over 528,343 hectares in south-west WA. They found an early period of lower burning likelihood after fire, followed by higher likelihood during regrowth and lower likelihood in mature forest after about 43-56 years. The proposed mechanism is natural thinning of the understorey. [6]

This questions the assumption that older vegetation invariably creates greater wildfire risk. It is regional observational evidence and needs testing in other forests. It does not establish one safe age or burn interval for all Australia. [6]

The interpretation is contested

A published comment argues that the skewed distribution of sample areas could bias the estimated decline in risk. The authors' reply disputes that criticism and maintains that maturation reduces flammability. Both form part of the evidence record. [7,8]

A universal "seven times more bushfire" claim is not established by this review. Treatment scale, age distribution, vegetation and the wildfire counterfactual need to be specified before adopting any multiplier.

Beyond hectares treated	Why it matters
Time since all previous fires	Recovery depends on wildfire and prescribed-fire history together.
Vegetation structure and regrowth	Fuel arrangement, shrub development and weather can matter as well as fuel mass.
Long-unburnt refuges and sensitive habitat	Some species require resources that repeated treatment interrupts.
Prospective monitoring	Test whether predicted protection and ecological recovery actually occur.

Field evidence that deserves inclusion

Victorian prescribed-fire experiment: soils and vegetation

The Wombat Forest study compared unburnt controls with three- and ten-year spring/autumn burning cycles. Its 2003 report found lower surface-soil carbon and nitrogen under three-year burning, mainly in the top 0-2 cm. Ten-year treatments did not differ significantly from controls for those surface measures. Soil phosphorus effects were not robustly resolved. [20]

Repeated autumn burning disadvantaged several plant groups. However, no plant species were lost or gained across the reported 14-year period; responses varied, and some groups benefited. This supports measuring changes in soil and vegetation, rather than claiming universal ecosystem collapse after low-intensity burning. [20]

Honey possum: recovery after repeat fire

Bradshaw and Bradshaw (2017) followed a south-west WA population affected by two fires six years apart. Recovery after the first reached 78% of pre-fire catches in six years. After the second, regression projected 25.6 years to full recovery. That was a projection, not a completed 25.6-year observation. Plant disease affected food plants; a long-unburnt comparison population remained stable despite disease. [21]

Carnaby's cockatoo: food supply depends on fire age

Valentine et al. (2014) measured banksia seed resources across different fire ages and estimated how many cockatoos those resources could support. Estimated capacity was highest at 14-30 years since fire, peaking at 20-25 years. Young and very old stands supported less. [22]

The mapped age distribution was estimated to support 2,725 birds, compared with 3,702-5,352 under an idealised distribution. These are energetic model estimates for Carnaby's feeding habitat, not observed population counts or a measured two-thirds decline in all black cockatoos. [22]

Recent WA perspective: useful concerns, provisional numbers

A July 2026 perspective discusses honey possums, western ringtail possums, cockatoos and sensitive habitats, and calls for better independent monitoring. Its tree-collapse comparison of up to threefold relies on an in-press study whose underlying methods were not independently checked here. That figure is provisional, not a core established result in this briefing. [23]

Implication for economic models

A single ecological cost per hectare cannot fully describe interrupted recovery, loss of nesting structures or changes in soil function. Assess these outcomes directly and report them even where credible dollar values are unavailable.

Burning trends and comparisons with alternatives

Area burnt is an incomplete measure of community exposure

Canadell et al. (2021) reported no prescribed-burning area trend over 1988-2018 in the studied Australian forest ecosystems, averaging about 1% annually. This historical forest analysis does not determine recent neighbourhood smoke exposure. [9]

NSW national-park mapped data show a different local trajectory: RMIT ABC Fact Check reported about 2.3 times as much prescribed burning in the decade to 2018-19 as in the preceding decade. National and local findings can coexist. Neither establishes a current near-monthly smoke trend. [10]

Agencies should publish local smoke days, source attribution, population exposure and cumulative pollution, alongside treated area and changes in wildfire risk.

Compare packages of locally suitable measures

Measure	Potential contribution	Costs / limits
Targeted planned burning	Change fuels in locations relevant to protection.	Smoke, escape risk, renewal needs and ecological recovery.
Vegetation management near homes	Address nearby hazards; supported by house-loss associations. [3]	Maintenance, access, habitat and site-specific design.
Mechanical management	Target accessible vegetation without intentionally generating landscape-burn smoke.	Machinery access, debris, soil disturbance, expense and regrowth.
Building upgrades and home preparation	Address ember entry and vulnerable features; RFS promotes preparation. [13]	Upfront cost, workmanship, upkeep and residual fire risk.
Warnings, evacuation and support	Help people act before dangerous exposure. [13]	Transport, disability access, changing conditions and communications.

Government-published mechanical trials in three forest types found treatment outcomes depended on site and technique. Thinning left slash and could raise surface fuels; fire-risk assessment relied on simulations. Mechanical work should receive fair evaluation, without assuming it is an impact-free substitute everywhere. [26]

Trial design

Compare protection, treatment smoke, ecosystem recovery, maintenance and household costs over several years. Assess combinations of measures, not only a burn-versus-no-burn choice.

Requests that elected representatives can act on

The evidence supports reviewable changes to evaluation and reporting. These proposals are recommendations, not assertions about current legal requirements.

1. Commission a complete, independent comparison

Evaluate strategies with and without added burning, including targeted treatments and household protection. Count smoke from treatment and future wildfire, deaths and injuries, assets, ecology, displacement and public expense. Publish uncertainty and the impacts left unpriced.

2. Publish model coverage and sensitivity tests

Show how the ranking changes with realistic treatment effectiveness, smoke exposure, climate conditions and ecological recovery. Explain when older inputs are reused and whether new evidence changes them.

3. Make smoke safeguards auditable

Publish predicted smoke footprints, decisions to proceed or postpone, measured post-burn exposure and coordination of simultaneous burns. Provide effective notice and support for susceptible residents and facilities throughout the exposure area.

RFS identifies susceptible groups and describes modelling, notifications, advisories and adjusting burns to manage smoke. [11,14] The request is to evaluate those safeguards publicly against measurable exposure outcomes.

4. Protect habitat recovery and test alternatives

Record cumulative fire history, evidence-based habitat intervals and justified exceptions. Retain refuges and monitor soil, vegetation and threatened-species outcomes. Fund trials of locally appropriate alternatives and help households unable to afford protective upgrades.

5. Make commissioning and spending visible

Publish funders, conflicts, stakeholder input and commercial assumptions. Report treatment, preparedness and suppression budgets separately to evaluate their outcomes while maintaining firefighting capability.

Five questions for agencies

What benefit justifies this treatment? What smoke and ecological costs were counted? What was excluded? What alternative was compared? When will observed results and model revisions be published?

The documented omissions, assumptions, commissioning relationships and external impact evidence warrant an independent government review. Its purpose should be to establish the full public benefit and cost of current programs, identify any transfer of burdens, and revise policy where the evidence requires it.

References / 1

Numbered citations identify the study or agency source. Links are clickable. Checked on 13 September 2026.

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