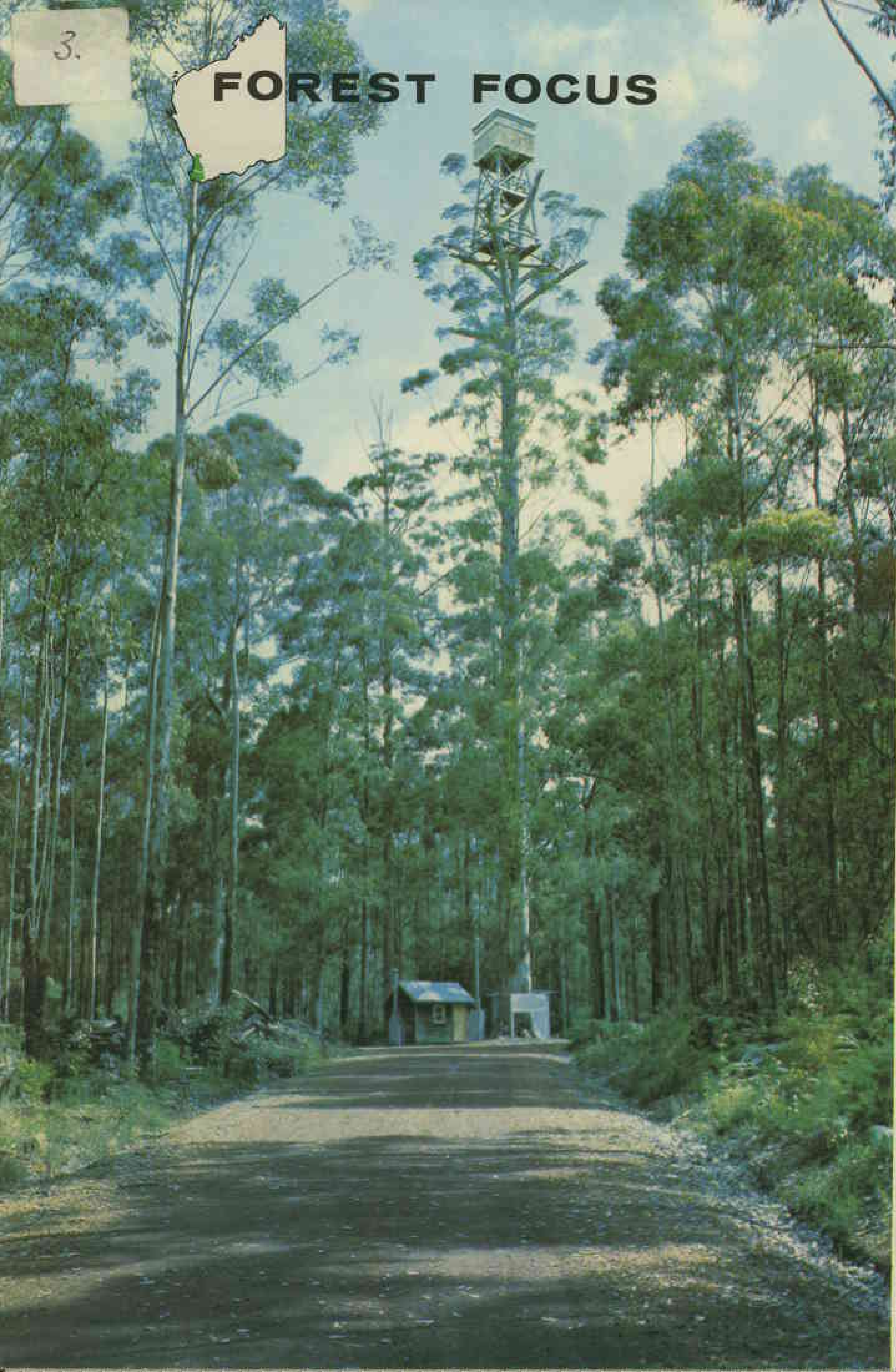
FOREST FOCUS



CONTROLLED BURNING

The devastating intensity of wildfires (left) can readily be compared to the dramatically cooler, less destructive prescribed burn (below).

The vigorous young jarrah pole stand (below left) has been controlled burnt for the past 40 years. This stand, not yet sufficiently mature for felling, is situated in the Jarrahdale bauxite mining area, just east of No. 1 crusher.

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Cover

Diamond tree, between Pemberton and Manjimup, with its 20 ft. tower perched 180 ft. above the ground in the branches of this karri tree is one of the 40 fire lookout towers in the Forests Department's Fire Protection Branch.

Although less well known than Gloucester tree near Pemberton, Diamond tree is interesting in that a tower is built on to the tree to support a cabin instead of the cabin being built directly on top of the branches.

Apart from pre-suppression policy and organisation, three of the essentials of fire control are: a detection system which permits the early positioning of fire outbreaks; an efficient and reliable radio and telephone communications network; and a suppression force capable of tackling the sometimes formidable and always urgent problem of forest fires and which can mobilise the whole range of equipment specifically designed to meet the demands of forest protection.

These "demands" vary greatly between forest types and between hardwoods and softwoods.

Back Cover

A wandoo *(Eucalyptus wandoo)* surrounded by regenaration in the Mundaring Forest Division, see page 9.

Focus on Controlled Burning for Forest Conservation

More than one million acres of State Forest in Western Australia were treated by the Forests Department in its rotational controlled burning programme in 1969. At the time of going to press, it was planned to cover a similar area in 1970.

Over half of this was covered by the now routine technique of aerial controlled burning. This has proved to be a major breakthrough in prescribed burning of heavy fuel areas as well as providing an efficient tool for the undertaking of large area burns under ideal conditions.

This example of how wartime developments can benefit man was first demonstrated early in December, 1965, by the W.A. Forests Department and the Bush Fire Research section of the C.S.I.R.O. in the first large scale trials of aerial ignition of forest areas with incendiary capsule techniques.

The successful use of aircraft in routine controlled burning was a notable achievement—a world first for Western Australia.

The State's well known jarrah forest was the testing ground for this operation, which was envisaged almost 12 years previously.

Information obtained from fire behaviour studies permitted the development of the aerial burning technique which fits ideally into the Department's rotational controlled burning programme. This programme is aimed at covering the whole of the forest area of four and a half million acres, once every five years—thereby reducing forest litter fuel quantities so that wildfires may be more readily controlled even during severe fire weather.

Each burn is applied to a predetermined area surrounded by tracks and at a predetermined intensity consistent with the silvicultural condition of the particular forest type.

The scheme involves detailed planning and a thorough understanding of fire and weather behaviour.

For the jarrah forest, fire danger ratings and a controlled burning guide have been prepared and tested in practice. They have proved valuable aids to the planning and execution of rotational controlled burning both by hand and aircraft.

Investigations along similar lines are being carried out in the karri forest.

From pre-1930 days controlled burning was practised in virgin forests and firebreak belts for protection of areas regenerated after trade cutting.

With ever-increasing areas of young growth it was found impracticable to continue with total fire exclusion and a policy of hazard reduction was commenced in 1954 over long-protected stands.

Although a job for specialists only, the aerial controlled burning technique can be briefly summed up as a calculated grid pattern of ignition points, related to forest fuel, scorch height, rate of fire spread, age and type of forest and general weather conditions. The fires burn slowly and at low intensity until they

Aerial incendiary operation—with the priming and timing device in the foreground. On the flight deck are the pilot and a Forests Department officer who does the plotting and navigating.

Controlled burning by aerial ignition, Shannon River. Each area burnt is surrounded by tracks. To ensure control, boundaries are edge-burnt well before the major area is lit—this is illustrated by the lack of fire adjacent to the track. The lighting pattern is parallel strips of spot fires lit across the wind. Weather conditions are chosen to produce low intensity fire—indicated by the white, thin smoke.

connect and burn out by late afternoon or run into barriers of moisture and go out. An area is never burnt out completely.

The benefits of aerial controlled burning are greatest in areas where road and track networks are few, or where access by ground parties is difficult and dangerous due to thick scrub.

Previously, several problems had been associated with extensive controlled burning:

1. Large areas had to be covered on the very limited number of days available for satisfactory burning, as weather conditions are strictly limiting for any given quantity of fuel per acre.
2. During three months of the summer and on any Sunday of spring and autumn, burning is prohibited by law.
3. Burning had to be carried out by men walking the area lighting carefully spaced lines of spot fires. This is a relatively slow process and the limitations had been intensified in recent years due to labour shortages.

4. Inadequate access and heavy undergrowth further limited the area burnt, particularly in the southern regions.

The distinct advantages of the aerial incendiary lighting technique can be readily recognised.

To comply with D.C.A. safety regulations, each incendiary device is inert and safe until primed just prior to dropping. It ignites 28 to 30 seconds after priming. Dropping intervals are controlled by an electric timer.

Flying about 600 to 700 ft. above the ground, the aircraft is in constant touch with a field control centre near the prescribed area, where a small suppression force is located.

Throughout the operation radio contact is maintained with all units involved.

The ground dropping pattern is aligned by the use of A.D.F. (automatic direction finder) radio homing beacons.

The remains of a jarrah forest devastated by fire from the massive accumulation of debris following early logging.

Fire control—an early problem

In Western Australia, with its long, hot and dry summer, fire was the first obvious problem to receive the attention of early foresters. It was apparent that until effective fire control could be practised, the expenditure on regeneration of young crops and planting of exotics could easily be wasted, and the work nullified by uncontrolled wildfires.

This explains the emphasis in the earlier years on fire control work and organisation before other injurious agencies received so much attention. The Forests Department of Western Australia has led in the innovation of new fire techniques.

The climate of the forest belt of the south-west of Australia is such that it is susceptible to fire for at least six months each year.

Colonisation, development and exploitation in the forest areas brought changes which resulted in the massive accumulation of litter and the forest fires which eventually burnt these areas were often of holocaust proportions, causing widespread forest damage.

As forest utilisation and the clearing of adjoining farming land increased in tempo, so also did the size, number and severity of fires.

The first fire truck was equipped in 1934. Methods of controlled burning and fire fighting were developed and in 1936 a fairly comprehensive set of notes on these techniques was issued within the Department.

One of the most important developments in this field was the initiation of a fire weather research station with the objects of devising some simple measure of fire hazard; and exploring the possibility of forecasting fire weather.

Three years of detailed research enabled the present Conservator of Forests to establish in 1936 the first fire weather forecasting service for jarrah forest areas. In another two years the same system was accomplished for the karri areas.

This system identified fire hazard by relating it to moisture content of forest fuel and is currently in use throughout Western Australia. Officers from other State forest services were trained in the procedure.

Detailed studies of fire behaviour were commenced in 1960 and have been actively pursued since that time. As a result, the preparation of controlled burning guides have enabled accurate predictions in fire behaviour to be made.

The development of the aerial burning technique was made possible by information gained from these studies, which were carried out in conjunction with the Bush Fire Research section of the C.S.I.R.O. W.A. fire research is continuing in a number of fields both in native hardwood forests and in softwood plantations.

The value of hazard reduction burns on a large scale was highlighted after the Dwellingup fire in 1961. This fire was the most serious ever in the jarrah forest within memory.

As a result of lightning, 22 known fires were started under extreme weather conditions. Many were suppressed, but others combined and grew to an overall size of 361,000 acres in six days.

Extreme heat conditions made suppression almost impossible.

By the end of the second day, 72,000 acres of forest land had been burnt. On the third and fourth days the fire was gradually being brought under control. On the fifth day, however, a cyclonic windstorm whipped the fire through the townships of Dwellingup, Holyoake and Nanga Brook, causing great destruction estimated at $1 million.

Damage to the forest was estimated at $2 million at that stage.

On the sixth day cooler conditions developed and rain falling in the afternoon allowed the running fire to be stopped.

The fire showed very clearly the effect of fuel quantity on fire intensity. Areas which were still carrying heavy fuel suffered severe damage. Approximately ten per cent of the Dwellingup Division had been controlled burnt each year between 1953 and 1961, and areas with less than three years litter showed relatively little damage.

Fire, forests, flora, fauna

In October, 1969, Forests Department research officers made a study of the effects of aerial controlled burning on kangaroos and wallabies in the jarrah forest. (Previously, other animal, bird and wildflower observations have been carried out over wide areas of State Forest in respect to prescribed burning.)

Approximately two thirds of the kangaroo population left the area of the burn for cover in adjacent forest outside the unit, while only five per cent of the wallabies left the area. No evidence of injury or mortality was found.

In the study, a 60 per cent burn was achieved. Even under the best conditions there are always pockets of forest unburnt due to insufficient and moist forest litter. These moist areas and swamps in the forest give

Controlled burning in softwood forest. Forest officers check relative humidity and wind force.

shelter to numerous small animals and birds. In autumn burning a more even and more intense burn will result, with consequent danger to forest wildlife.

A very detailed study of fauna carried out by the W.A. University on the Popanyinning reserve near Beverley pointed out the danger of complete absence of fire. The Forests Department was asked how it might be burnt under controlled conditions so that the habitat could be rejuvenated.

Without this rejuvenation burn the animals would have been unable to continue to find food and the type of shelter they needed.

The native flora of the south-west forest belt, having evolved in a fire environment, has inbuilt mechanisms to ensure its survival of occasional fires—in fact many depend on fire for continued existence. Examples of these mechanisms can be seen in the lignotuber of eucalypt trees and the variable seed coat hardness of the Proteaceae family (e.g. grevillea, hakea, banksia) which results in only a portion of each seed crop germinating each year for several years.

As early as the 17th century the logs of such navigators as Pelsart, Vlaming, Jonk and Volkerfen made reference to smoke and fires on the mainland of this country. From these reports it must be assumed that the aborigines of this State, in common with those of eastern Australia, were well acquainted with fire.

Evidence points to the use of fire by Aborigines as a hunting aid. Summer lightning is responsible for a number of uncontrolled fires each year and it must be accepted that this source of fire was also present.

In 1930-31, a fire which started in early December moved steadily through virgin forest covering a distance of some 15 miles in three months. There was virtually no damage to the forest crop from this quietly moving low intensity "natural conditions" fire. This is a direct contrast to the Dwellingup fire in 1961 which covered 15 miles in 15 hours, causing complete defoliation and serious material loss.

The rotational controlled burning programme undertaken by the Forests Department is largely done in spring—on a four to six year cycle. This decision is influenced by a number of factors.

Research has shown that satisfactory weather conditions occur most frequently and most reliably in spring, starting during October in the northern forest areas and progressing through to December in the southern karri forest.

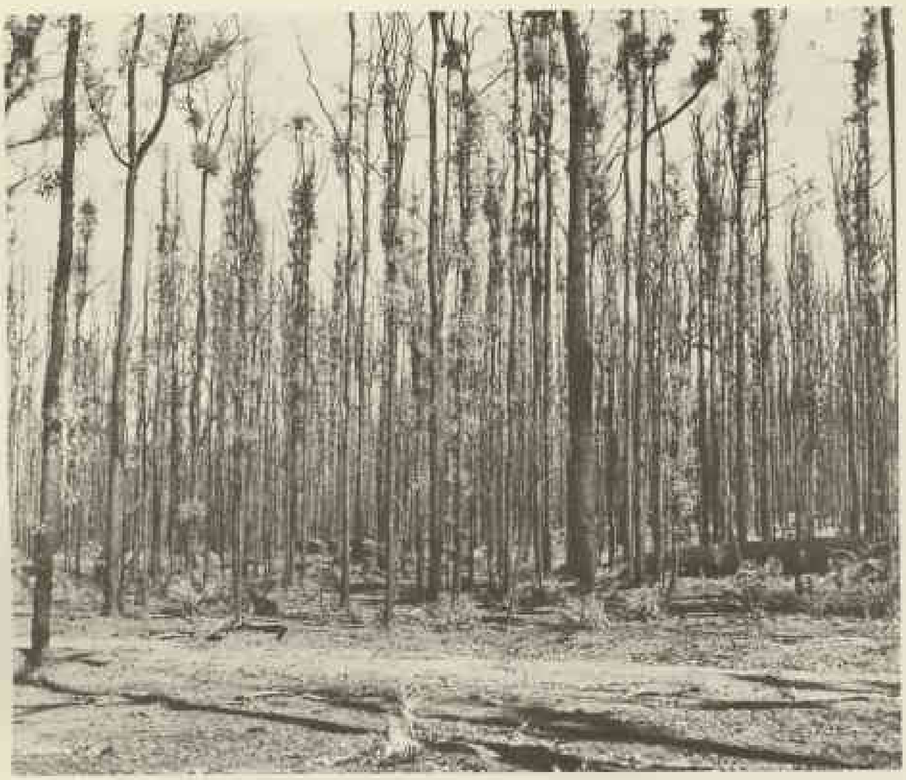
To achieve a similar fire intensity and safety from "breakaways" in autumn burning, the summer drought effects must first be alleviated. This generally requires three or more inches of rain to return tree bark, scrub foliage and heavy fuels such as ground logs (which when wet provide safe refuge for many small animals and insects) to the low inflammability levels of late spring.

Occasionally such rain falls in early April and extended suitable burning weather may follow. However, this is unreliable, as further rain may preclude further burning. Pre-planning is essential for extensive controlled burning, to prevent disasters of the type which occurred recently in Tasmania and New South Wales, at Dwellingup and Karridale in 1961, and Victoria in 1939.

For these reasons, reduced scenic values are justified once every five or six years when rotational burning is being carried out on an area. Even then, the conditions conducive to good controlled burning occur after the main flush of spring flowering so that burning begins as the wild-flower display wanes.

There is still much to be learnt about the effect of fire intensity, frequency and seasonal timing on natural flora in the south-west.

The intensity of a wildfire can be seen by these defoliated karri crowns 230 ft. above the ground, after a fire east of Pemberton in 1959. This photograph shows epicormic growth after ten months as the trees struggle to recover. Apart from its effects on flora and fauna, the fire caused considerable damage to the standing crop of trees and retarded their growth rate.



Good jarrah regrowth on Duncans Road, about 14 miles east of Dwellingup. Top photograph taken six months after the 1961 fire shows already well developed epicormic shoots.
The bottom photograph (two years later) illustrates jarrah's fire resistant ability, although the fire concerned here was quite severe, resulting in both setback of growth and bole length, as well as physical damage to the tree crop and the forest ecosystem as a whole.

Despite the fact that each problem area should be treated on its own merits, a policy of autumn burning is not generally justified.

Rotational controlled burning every four to six years whether in spring or autumn, allows seed-set and seedling establishment in the intervening years. This type of burning may change only the proportion of each species but not the number of species.

Different fire frequencies favour different species and where only native flora exists without introduced annual weeds and grasses, the rate of ground litter build-up is slow enough to prevent annual burning.

Where annual burning is practised in the presence of grass and weed seeds, season is of little significance since that part of the native flora dependent on seedlings will eventually be killed out and annuals will take over. Once this occurs the annual grass fuel frequently results in sufficiently high fire intensity to cause damage and ultimate death to trees.

Factors other than fire are of equal or greater significance in the case of roadside flora where only a thin strip remains after the natural forest cover has been cleared in an adjoining paddock. The dramatic reduction of width to this strip of native vegetation causes major changes in the environmental conditions to which it is subjected. Increased sun lighting, more intense heat and access to wind are three of many changes in factors to which plants are sensitive, and these changes strongly favour invasion by, and establishment of, annual weeds and grasses.

It is obvious that where annuals are now established, autumn burning would fail to achieve the purpose of hazard removal served by spring burning. It is therefore more logical to turn to other means of hazard reduction than to autumn burning.