

## FORESTRY

## INTRODUCTION

Forestry is the protection, utilisation, and management of forest land and the vegetation on it according to demands for the benefits forests can provide and their capability to supply the desired benefits without detriment to their long-term productive capacity. Victoria's diverse forests yield a wealth of timbers and other products, providing protection for water catchments and many environments for wildlife and recreation.

Fire is the main concern of forest protection in Victoria. Virtually all of the State's forests have been affected by severe fire at least once in the past fifty years, and some have been burnt over time and again. Effective fire protection is the keystone of forestry in Victoria.

Sawmill logs remain the prime forest produce but demands for poles and other round timbers, hewn and split products, and firewood from the native forests have diminished a great deal in a generation. Markets for wood for pulp and chip products have developed since 1936 as large factories using eucalypt or pine wood, or both, have been commissioned. Pine plantations, established mainly in the 1930s and since 1961, are yielding an increasing flow of logs for sawmills and plywood mills, pulpwood from thinnings and the tops of log trees, and roundwood for direct use after preservative treatment. Increasing use of the forests by all sections of the public for a wide range of active and passive recreations has been a dominant feature of their utilisation during the past 20 or so years.

Forest management is the planning and implementation of where, when, and how each forest will be utilised while conserving its environmental values. Profound and rapid changes in the technology of transport, communications, mapping, data collection and processing, and the utilisation of wood as a complex raw material, and in the understanding of forest biology, as well as social changes, have resulted in momentous developments in forestry in Victoria.

## DEVELOPMENTS IN FORESTRY SINCE 1934

## 1934 to 1939

*Background*

Before the Second World War, there were plentiful supplies of high quality mature mountain ash timber for sawlog purposes, and the box-ironbark and red gum forests supplied large volumes of poles, piles, railway sleepers, beams, and other naturally durable heavy construction timbers. The stringybark forests yielded general utility milling and miscellaneous timbers. The State Seasoning Works at Newport, established in 1910 to demonstrate potential uses of Victorian hardwoods when properly seasoned, had promoted their general acceptance, but commerce relied heavily upon imported softwoods, wood pulp and papers, plywood, and other wood products. Wattle stripping for tanbark, steam distillation of eucalyptus leaves for oil, and bee-keeping were important forest industries.

Vast tracts of the forests to the east of Melbourne were not traversed by roads. Many sawmills and mill settlements were situated deep in the forests. Steel and wooden tramways,

steam-powered cable systems, and bullocks and horses were used to bring logs to the mills. Timber workers and their families enjoyed few amenities and endured the hardships of isolation.

The silviculture (i.e. the tending of forests) practised in the forests, chiefly in the North and the Central Highlands, consisted of the thinning and liberation of re-growth, and cleaning out of weed species, as adaptations of European practices.

The forests were patrolled to only a limited extent to detect illegal activities, to control the operations of licensees, and to protect the forests from fire. Fires were not often detected quickly, unless they were near settlements or bush workers. For some years the Commonwealth Air Board had provided, upon request, an aeroplane to detect fires in the mountains, messages being relayed through its base at Laverton by telephone to the Forests Commission. By the time firefighters arrived by horse or on foot, remote fires were commonly too large to control with the equipment available, usually only rakes and slashers. There was seldom a telephone line in the vicinity to allow firefighters to keep in touch with headquarters.

Forestry provided work for many unemployed men and youths, especially during the Depression. They constructed tracks and firebreaks, ringbarked unwanted trees, thinned young stands of seedling and coppice re-growth, and cleared land for plantations and planted eucalypts and pines. Since 1925, the Victorian Government had been providing relief funds to employ men in the forests, and in 1933 unemployment relief was extended to employ also youths 16 to 20 years of age. In the winter of 1936 there were some 1,000 youths in 14 camps, and about 2,750 youths had been employed, usually for six months, when the scheme concluded in 1939. Camps for them were set up in the forests and they were supervised by skilled forest workers and foresters. During the six years prior to the Second World War, more than 33,000 men had been given some work in the forests, mostly from unemployment relief funds.

#### *Wood pulping*

Experiments and trials over many years by the Council for Scientific and Industrial Research (CSIR) and private interests had finally demonstrated that strong papers could be made from the short-fibred pulp yielded by lightweight eucalypt wood pulped by the alkaline sulphide or kraft process, but there was no mill in Australia pulping wood during the early 1930s. All wood pulp and paper was imported at a high cost in foreign exchange. The *Wood Pulp Agreement Act* 1936 ratified certain pulpwood cutting rights in specified State forests which would assure the newly created Australian Paper Manufacturers Limited (APM) of supplies of wood for a period of 50 years for a mill to be established at Maryvale. Consignments of wood to the pilot mill were made in 1937, and the main plant commenced production in October 1939.

#### AREA OF RESERVED FOREST: VICTORIA, 1934-35 TO 1981-82 (hectares)

Year	Area
1934-35	1,922,112
1939-40	1,966,830
1944-45	1,984,725
1949-50	2,013,333
1954-55	2,221,253
1959-60	2,249,540
1964-65	2,267,789
1969-70	2,289,173
1974-75	2,295,236
1979-80	2,229,900
1980-81	2,411,151
1981-82	2,889,933

Source: Forests Commission, Victoria.

*Bushfires in 1939*

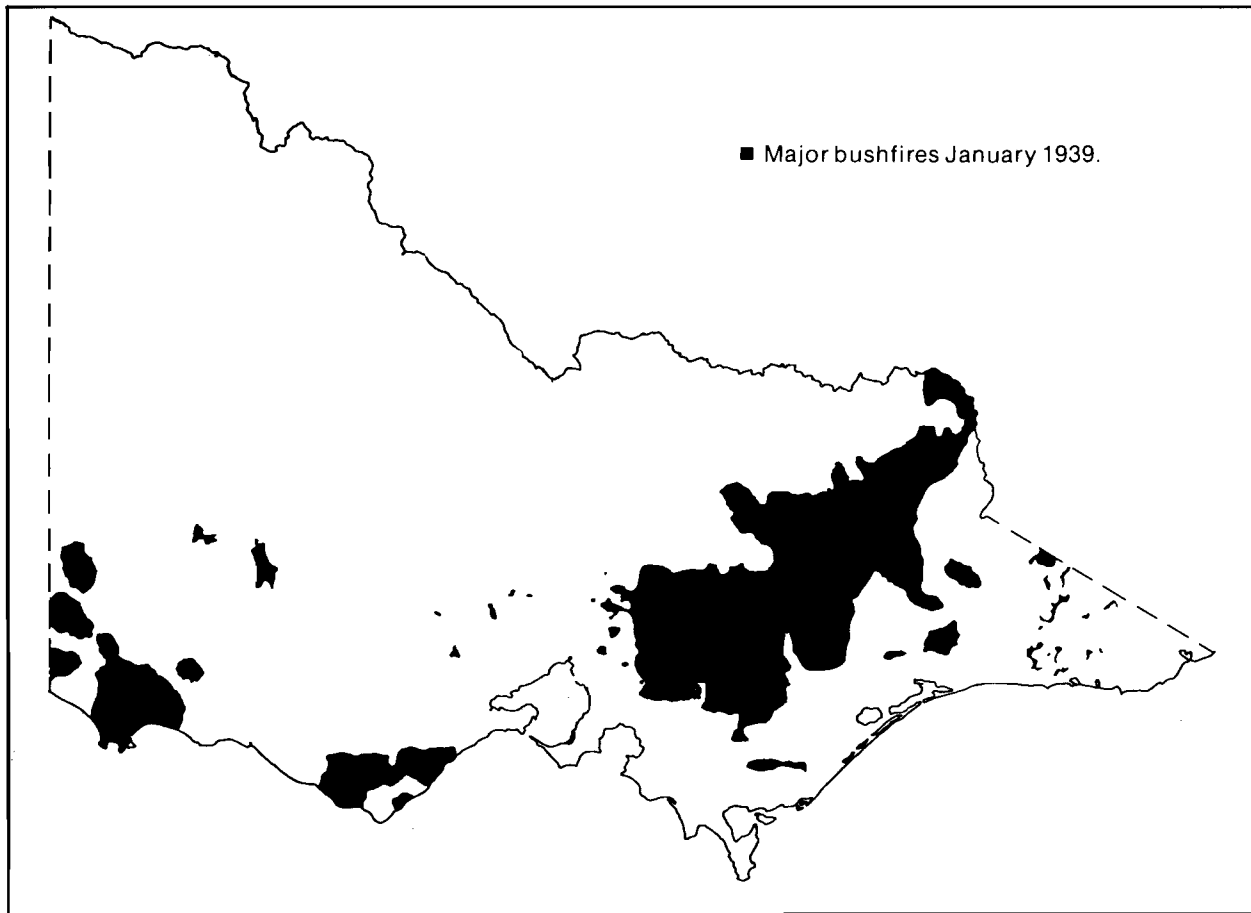
This pre-war period was notable for the fires of January 1939 and their profound after-effects. The Report of the Royal Commissioner, Judge Stretton, has become a classic document in the history of Victoria; the following extracts speak for themselves. "In the State of Victoria, the month of January of the year 1939 came towards the end of a long drought which had been aggravated by a severe hot, dry summer season. For more than twenty years the State of Victoria has not seen its countryside and forests in such travail. Creeks and springs ceased to run. Water storages were depleted. Provincial towns were facing the probability of cessation of water supply. In Melbourne, more than a million inhabitants were subjected to restrictions upon the use of water. Throughout the countryside, the farmers were carting water, if such was available, for their stock and themselves. The rich plains, denied their beneficent rains, lay bare and baking; and the forests, from the foothills to the alpine heights, were tinder. The soft carpet of the forest floor was gone; the bone-dry litter crackled underfoot; dry heat and hot dry winds worked upon a land already dry, to suck from it the last, least drop of moisture. Men who had lived their lives in the bush went their ways in the shadow of dread expectancy. But though they felt the imminence of danger they could not tell that it was to be far greater than they could imagine. They had not lived long enough. The experience of the past could not guide them to an understanding of what might, and did happen. And so it was that, when millions of acres of the forest were invaded by bushfires which were almost State-wide, there happened, because of great loss of life and property, the most disastrous forest calamity the State of Victoria has known.

"These fires were lit by the hand of man.

"Seventy-one lives were lost. Sixty-nine mills were burned. Millions of acres of fine forest, of almost incalculable value, were destroyed or badly damaged. Townships were obliterated in a few minutes. Mills, houses, bridges, tramways, machinery, were burned to the ground; men, cattle, horses, sheep, were devoured by the fires or asphyxiated by the scorching debilitated air. Generally, the numerous fires which during December, in many parts of Victoria, had been burning separately, as they do in any summer, either 'under control' as it is falsely and dangerously called, or entirely unintended, reached the climax of their intensity and joined forces in a devastating confluence. The speed of the fires was appalling. They leaped from mountain peak to mountain peak, or far out into the lower country, lighting the forests 6 to 7 miles in advance of the main fires. Blown by a wind of great force, they roared as they travelled. Balls of crackling fire sped at a great pace in advance of the fires, consuming with a roaring, explosive noise, all that they touched. Houses of brick were seen and heard to leap into a roar of flame before the fires had reached them. Some men of science hold the view that the fires generated and were preceded by inflammable gases which became alight. Great pieces of burning bark were carried by the wind to set in raging flame regions not yet reached by the fires. Such was the force of the wind that, in many places, hundreds of trees of great size were blown clear of the earth, tons of soil, with embedded masses of rock, still adhering to the roots; for mile upon mile the former forest monarchs were laid in confusion, burnt, torn from the earth, and piled one upon another as matches strewn by a giant hand.

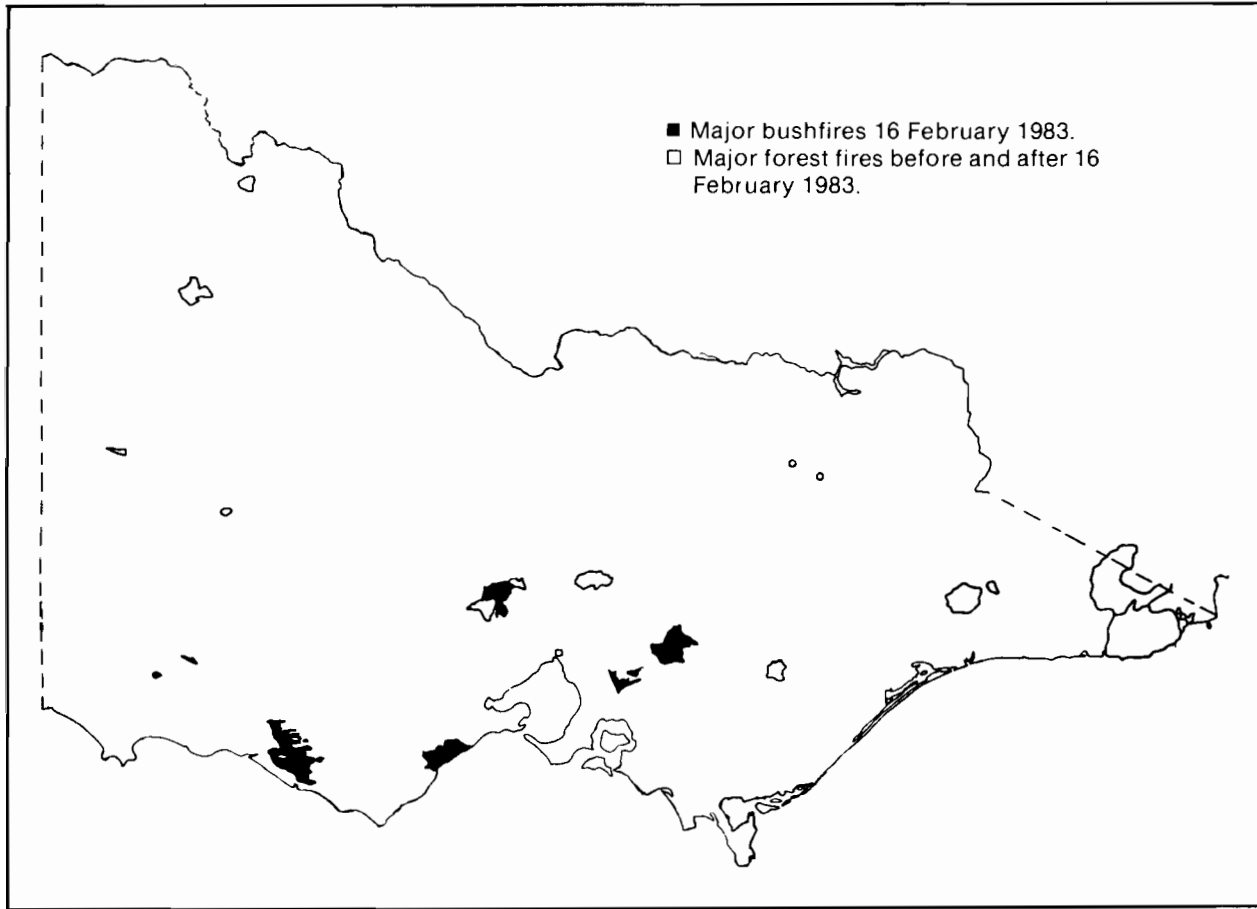
"There had been no fires to equal these in destructiveness or intensity in the history of settlement in this State, except perhaps the fires of 1851, which, too, came at summer culmination of a long drought."

The Royal Commission report prompted drastic revision of forest fire legislation. The *Forests Act* 1939 made it an offence to light a fire at any time of the year in a State forest or national park except by direction or as prescribed. The Forests Commission's responsibility for fire prevention was extended to all unoccupied Crown lands and a strip of land extending 1.6 kilometres beyond the boundaries of forests and parks, except in the Mallee and on land controlled by the Melbourne and Metropolitan Board of Works. Other provisions included declaration by the Minister of Forests of a ban on lighting fires in the open air during periods of acute fire danger and suspension of forest operations, a mandatory duty of the Commission to enforce the construction of fire refuge dugouts at sawmills and the sites of forest operations, and other protective works. The *Bush Fire*



*Source: Natural Resources Conservation League of Victoria.*

FIGURE 19. Victoria — Major fires, Black Friday, 1939.



Source: Natural Resources Conservation League of Victoria.

FIGURE 20. Victoria — Major fires, Ash Wednesday, 1983.

*Brigades Act* 1933 was amended to empower the authorised captain of a registered Bush Fire Brigade to take steps under certain conditions to eliminate fire hazards on private property.

**NUMBER OF FIRES AND AREA BURNT  
IN THE FIRE PROTECTED AREA (a):  
VICTORIA, 1934-35 TO 1981-82**

Year	Total number of fires attended	Number of fires in fire protected area	Fire protected area burnt hectares
1934-35	56	n.a.	4,577
1939-40	144	n.a.	44,930
1944-45	176	150	13,638
1949-50	161	152	9,764
1954-55	316	307	30,871
1959-60	728	684	497,484
1964-65	557	481	326,822
1969-70	304	251	5,089
1974-75	443	371	94,990
1979-80	812	713	31,826
1980-81	875	793	449,977
1981-82	537	468	20,648

(a) Includes State forests, national parks, protected public land, occupied Crown land, and private property.

NOTE: After 1975 there was a change in the basis of classifying fires, e.g., a secondary fire from the same source is counted as a new fire.

Source: Forests Commission, Victoria.

### 1940 to 1945

#### *Background*

The war years were a period of change for forestry and one of unprecedented activity. Three essential tasks were constructing roads, pushing ahead with salvage logging after the 1939 fires and re-appraising the allocation of resources to fire prevention, fire protection works, and equipment, and planning fire suppression strategies. The amended legislation had given new responsibilities and powers to the Forests Commission and its officers with respect to fire protection. The policy of siting sawmills in townships, to give improved protection and facilities to the mills and the benefits of social amenities to the workers and their families, was implemented progressively to the extent which salvage logging and the overshadowing war allowed. The imperatives to restore sawmill output, supply raw material to the pulp mill, and provide guaranteed deliveries of poles, piles, and other forest products essential for defence purposes tested to the limit the resourcefulness and stamina of the depleted labour force.

#### *Timber salvage*

The Minister of Forests convened a State Timber Salvage Committee to recommend measures for the re-establishment of the sawmilling industry and for the salvage of fire-killed timber. The Committee, comprising representatives of sawmillers, timber workers, timber merchants, the Forests Commission, and the Council for Scientific and Industrial Research, completed its report within three weeks. It estimated that 33 million cubic metres of timber could be salvaged. It recommended that one-third should be moved directly into sawmills, and two-thirds should be felled as soon as possible, logs being made from most of the trees and dragged into storage dumps. Operational recommendations made by the committee included estimates of the financial assistance most of the sawmillers would require to re-establish mills and a proposal that payment of royalty be deferred until a miller had sold the sawn timber. Over-production of sawn timber would require control of prices and marketing to avoid dislocation of the market. There would be 50 sawmills: 11 which had survived the fires, 17 to replace mills burnt out, and 22 new ones.

Road and tramline construction was pushed ahead as quickly as possible. Although the severe winter caused setbacks to the work, salvage began in earnest during the summer of

1939-40, when 48 bush sawmills were cutting fire-killed timber. The salvage programme was highly successful and resulted in the recovery of considerably more timber than had been anticipated.

The volume of high quality timber in the principal sawmilling regions ravaged by the 1939 fires was estimated to exceed 72 million cubic metres, well over 20 years' full supply for the existing mills. In the forests nearest to Melbourne, tramways, bridges, settlements and mills, had gone in a few hours. The effective milling life of the standing dead trees would be about two years owing to cracking, rot, and attacks by insects. If felled to lie in the protection of the scrub tree re-growth and kept moist with water sprays, the millable life of the timber would be extended to six or so years. The largest logs were in fact found to last a decade or more, in good millable condition.

The anticipated glut of timber sawn from mountain and alpine ash killed by the fires in 1939 did not occur; imports of timber were cut off by the war, which increased demands for sawn timber of all kinds. A State mill was built at Erica in 1940 to salvage timber in the Thomson River Valley. Wood for boxes, crates, and light framing sawn from small logs was in strong demand. The greater proportion of the smaller logs were sawn up at mills in Melbourne and some country centres, not at the bush mills. By 1944, 178 kilometres of road and 26 kilometres of tramway had been constructed especially for timber salvage, and the number of sawmills on salvage had increased to about 60. By the end of 1945, the original salvage target of 33 million cubic metres of log for sawn timber had been exceeded.

#### *Departmental logging*

Before the war all hardwood logging in State forest was carried out by licensees or lessees. Felling and log-making in pine plantations had been done by employees of the Forests Commission, who, in many instances, had also snigged the logs to roadsides for collection by contractors. From January 1939, the Commission began some departmental hardwood logging to supply logs for scantling and boards, and material for crates and cases. During the war departmental logging, pole cutting, and firewood production became a major departmental activity. Such operations were to become a feature of forest utilisation in Victoria for many years, where they came to fulfil special silvicultural or marketing requirements better than operations conducted by licensees.

Dispatches of hardwood pulpwood to the pulp mill at Maryvale, which commenced production on the eve of the Second World War, increased from 12,700 cubic metres in 1939-40 to about 65,000 cubic metres in the last two years of the war. Most of this was fire-killed mountain ash. The output of hardwood pulp, and some pine pulp for special purposes, from this new industry was very important to the nation during these years. Pine pulp was used for making guncotton and other cellulose products.

War brought an urgent need for a fuel to replace petrol for motor vehicles, and it was decided to set up a State Charcoal Branch under the Forests Commission to organise the production of up to 45,000 tonnes of hardwood charcoal a year in 500 kilns for gas-producer units. By mid-1942, there were 221 kilns and 12 pits in State forests which produced 39,500 tonnes of charcoal in 1942-43. Private production of charcoal was encouraged, and by 1944 the Commission was able to report that private enterprise could supply all the charcoal required. In addition, the State's pine plantations provided special grades of charcoal for many military and industrial purposes.

#### *Emergency firewood*

A critical shortage of firewood in the Melbourne metropolitan area had developed by the winter of 1941, owing to petrol rationing, reduced availability of railway trucks for civilian use, transfer of woodcutters to charcoal production for gas producers for motor vehicles, and a diversion of coal briquettes from household to industrial use. During the following winter, firewood was so short that the Commonwealth Government agreed to put interned aliens and prisoners of war to work in forest camps cutting firewood. In 1943 there were about 600 internees and 300 prisoners of war in more than 20 camps in Victorian State forests. Hundreds of secondary school boys responded to a call for assistance, and they cut thousands of tonnes of dry firewood. Volunteers unloaded railway trucks at

weekends to aid the distribution of fuel to metropolitan homes. The peak of emergency firewood production occurred in 1943-44 when 242,000 tonnes were cut. Production under the scheme diminished quickly after the war and ceased in 1956.

#### *Fire training and equipment*

Major fire protection works in the forests achieved in the four years after the winter of 1939 included the construction of 174 refuge dugouts, 177 dams and water storages, 23 additional fire lookouts, 420 kilometres of bush telephone line, 1,870 kilometres of road, and nearly 2,000 kilometres of firebreaks and firelines.

Nearly 1,500 kilometres of tracks and firebreaks had been improved to carry motor traffic. By the end of the war, 50 radio sets, about 20 trailer-type water pumps, about 100 portable types of power pump, and 60 kilometres of fire hose (mainly unlined canvas in lengths of just over 15 metres), and stocks of knapsack spray pumps, fire rakes, slashers, beaters, and axes had been distributed to forest depots. There were some tank trailers, of various capacities up to about 1,100 litres, which were usually towed by utility trucks. These provided a supply of water for filling knapsack pumps which were the main equipment for applying water to the edge of the fire, burning trees, and other hot-spots. Annual fire schools, at which forest workers practised dry firefighting, pump operation and hose laying, were becoming part of routine preparations for the summer. The number of Bush Fire Brigades, 396 in 1938-39, reached 700 in 1943-44.

#### *"Save The Forests" Campaign*

Community interest in forest conservation was aroused when a group of parliamentarians and other citizens launched the "Save the Forests" Campaign at a public meeting in Melbourne in January 1944. Primarily this group was concerned that the public be made aware that it was imperative to protect the young mountain ash forests from fire at least until such time as they were old enough to have fertile seed and to regenerate themselves in the event of another fire catastrophe. Their broader purpose was to impress upon the people of the State the fundamental importance of forest conservation in relation to the timber, soil, and water resources of Australia. By 1946, the Campaign had enlisted the participation of some 50 organisations with a membership of 300,000, and had secured the support of government departments for tree plantings, fire prevention, and general forest publicity. This Campaign, which had inspired a popular forest conscience when the re-growth mountain forests were especially vulnerable to fire, was incorporated in the Natural Resources Conservation League of Victoria when it was inaugurated in 1951.

### **1946 to 1956**

#### *Background*

For several years after the Second World War a feature of the sawmilling industry continued to be a high proportion of small mills, typically steam-powered but requiring manual handling of the logs and sawn products. The economic log haulage distance to such mills was still quite limited. The post-war upsurge in private and public building and the accompanying strong demand for timber resulted in the establishment of more than 300 additional sawmills. The number operating in Victoria in 1946 was 332, in 1951 it was 615, and in 1956 there was a peak of 636.

In the late 1940s, it became necessary to relocate sawmills. The anticipated transfer of sawmilling capacity from the burnt forests near Melbourne commenced in 1947 with the release of logs to supply 14 new mills at Mansfield in north-eastern Victoria and Heyfield in Gippsland. In 1950, new allocations were also granted in the Orbost, Bruthen, and Nowa Nowa districts of East Gippsland. By 1955, the traditional milling centres of the Yarra Valley, such as Noojee and Yarra Junction no longer produced the bulk of Victorian output of sawn hardwood. Further releases of timber in the ensuing 15 years from forests opened to large-scale logging for the first time, in the Omeo (1958-59), Cann River (1959-60), Tallangatta (1961), and Orbost (1970) districts, virtually completed the major relocation of sawmills drawing logs from original forests.



*Forest utilisation activities*

The salvage of fire-killed timber had virtually come to an end by 1953, although it continued, mainly for pulpwood, on a restricted scale until 1956. The total volume of fire-killed logs from State forest milled since 1939 exceeded 52 million cubic metres. This co-operative enterprise, despite the depleted labour force and shortages of machinery, liquid fuels, and engineering supplies was a notable achievement.

Burning in forests, particularly in the mountains, by lessees and licensees to improve grazing conditions was severely criticised in 1939. In 1946, a Royal Commission inquiring into forest grazing found that it had harmed vegetation and in some areas greatly accelerated soil erosion. The report recommended stricter control over graziers, and the creation of an authority charged with the duty of protecting all land. A Land Utilization Authority (replaced by the Soil Conservation Authority in 1949) was established in 1947. The provisions of the legislation, especially those establishing a Land Utilization Advisory Council and prescribing its functions, tightened controls over grazing areas and promoted progressive review of their future use.

In fighting fires, foresters in Victoria had for many years tried various hand tools which would perform slashing, raking, pushing, and hoeing actions, and increase the effectiveness of small crews of firefighters, especially where equipment had to be carried long distances from a road. None of these tools had been really successful until 1952 when a combination rake and wide-bladed hoe to a North American design was introduced. This firefighting tool, manufactured in Australia as the "Rakho" was an immediate success and superseded other hand tools during the next few years.

During the 1950s, fire detection from lookouts and aircraft and radio communications were greatly improved, and increasing numbers of water tankers of various capacities were built especially for forest and general rural firefighting.

The increasing use of aerial photographs by forest managers accelerated the topographic mapping and delineation of forest types and various classes of timber stands. Basic maps showing contours and other topographical data were prepared and forest assessment data were superimposed. Where satisfactory aerial photographs were available, stratified random sample plots were located by field parties and the vegetation assessed. This procedure was superior to assessment of the forests by the older method of systematic strip sampling, combined with ground mapping of topographical details.

During the 1950s, substantial areas of forested Crown land were alienated for farming, mainly through applications for individually fairly small areas under selection purchase lease. The total area of timbered land on private holdings was also reduced a good deal to establish new pastures during the post-war years. The Rural Finance and Settlement Commission started development of the Heytesbury Settlement in 1956, for which the total forest area cleared within 20 years amounted to 42,500 hectares.

An important change in the marketing of sawlogs occurred during this period. During the 1930s and 1940s, most sawmillers had paid royalty according to the volume of marketable wood sawn from the logs hauled to their mills. This did not promote careful and maximum conversion of logs to sawn timber. A gradual change to the sale of timber by log measure was introduced in 1935 but this was arrested in 1939 when it was decided to charge royalty on timber salvaged from fire-killed forest on output of sawn timber, to attract investment of private funds to sawmilling. In the immediate post-war years, when the centres of hardwood timber production were beginning to move further east and north-east from Melbourne and other centres of consumption, there were strong moves for increases in timber prices. In January 1950, the present royalty equation system for hardwood logs was introduced, and fully applied to softwood logs in 1960. It set up an equated scale of royalty rates with the aim of enabling sawmillers in remote areas to compete on the Melbourne market. In principle, royalty rates were fixed so that the sum of royalty and transport costs involved in placing a base grade of sawn timber on a specified key market were the same for all operations with access to that market. Adjustments for licensees' roading costs, log quality, species groups, the value of the different grades of sawn timber, and the relative locations of mills, were built into the royalty rate determination for each logging area. The equated royalty system succeeded in promoting the utilisation of distant and low grade log supplies.

*Nurseries*

From early days the Victorian Government had encouraged the owners and managers of land to grow trees for shade and shelter, as well as for timber production. A wide range of trees and shrubs were raised at State nurseries at Macedon established in 1872, Creswick (1886), and Merbein (1916) for sale to municipal bodies and to the rural community. Technical advice on selecting species and establishing trees was made freely available. A nursery was set up at Wail near Horsham, in 1945, primarily to raise stock for farm and town plantings throughout the Wimmera. The catalogues of species available from the four nurseries now offered the public, for the first time, a range of trees and shrubs tested and well suited to all districts of the State.

*Forestry research*

The progress of forestry depends upon a solid foundation of scientific information. The ash eucalypt forests occupy only about 500,000 hectares but their importance far outweighs their proportion of the total forest area in Victoria because of their high productivity and the protection they give to water catchments. Research by the Forests Commission, CSIRO, university departments and other research groups has, since 1955, concentrated on the biology, hydrology, and growth dynamics of these forests. In 1954, the Commission's research branch began its major contributions to this work by investigating the various factors controlling the germination of eucalypt seed and survival of the seedlings, which led to an understanding of the field conditions favouring regeneration of the species. Research to provide knowledge on which to base improved field practices included development of techniques for control of competing vegetation prior to burning and aerial sowing, and for preparing the seed for sowing. Long-range research programmes are necessary in forestry because of the long periods involved in the growth and development of forest systems.

**1957 to 1960***Background*

By the mid-1950s, to improve its efficiency in dealing with expanding activities under more complex circumstances, the State Forests Department revised its administrative structure. An entire re-organisation into central and field divisions took effect in 1957, which set up six functional divisions of the central administration and a number of territorial divisions each directly responsible to the Commission. The State was divided into 45 forest districts, which became the units of executive field management. The direct lines of responsibility for task performance and budgetary control established by the new structure, brought about much closer control of forestry practices and co-ordinated responses to changing conditions during the ensuing decades.

By the late 1950s, much of the general roading required for survey and protection of the forests had been constructed, but extensive areas in the mountains and higher foothills were still inaccessible, even to four-wheel drive vehicles which had become commonly available. Fire crews sometimes walked for a full day to reach remote fires. The men were tired before beginning work on the fire. The possible need to transport an injured man to the nearest road was a constant concern. Supplies, brought in by pack horse or over rough, hastily bulldozed tracks, followed the firefighters slowly. For some 11 years after 1957 efforts were directed to making jeep tracks from roads into inaccessible country, primarily to allow first attack on fires by fresh men while the fires were smaller, and to provide control lines for fuel reduction burning.

*Water catchments*

As many town water supply catchments in Victoria are partly or wholly within State forests, the Forests Commission in 1959 issued a consolidated set of principles to be followed in formulating prescriptions for multiple-use forest management in town water supply catchments, and provided for specific documented measures to adequately protect individual catchments according to local conditions. To provide information for reviewing existing catchment practices, several studies were established during the 1960s of streamflow

and other characteristics of neighbouring catchments during an initial calibration period, as well as of the effects of different silvicultural and land-use practices in the catchments.

The majority conclusions and recommendations of an inquiry by the State Development Committee into the utilisation of timber resources in the watersheds of the State, published in 1960, substantially endorsed the long-standing policy of controlled logging based on established silvicultural practices. The *Soil Conservation and Land Utilization Act 1958* provided for proclamation of water catchments, imposition of conditions for land-use within them, and for determination of the most suitable forms of land-use within catchments.

A complete inventory of State forest resources was commenced in 1960. Beginning in the central districts, field parties mapped all accessible productive forests in stand height and tree size classes by field interpretation of existing aerial photographs and measurement of systematically located sample plots.

#### *Genetic studies*

Seeds for the radiata pine plantations growing in Victoria had been collected from several distinct varieties of the species in California and on islands near the American west coast, and from cone crops in plantations in Australia and New Zealand. There is a good deal of genetic variability in tree form and vigour, branching habit, spiral grain, and persistence of old cones on the trunks of radiata pine. These differences between individual trees in the plantation crops are reflected in growth rates and the quality of timber produced. Buyers of pulpwood were also aware of variation in fibre length, an important paper-making property. In 1958, research foresters began a systematic assessment in plantations throughout Victoria for trees displaying desirable characteristics. From the best trees found in this search about 30 outstanding or "plus" trees were vegetatively propagated in 1959 by grafting buds from them on to ordinary nursery seedlings. The number of "plus" trees used as breeding stock increased during the next few years as the search extended, and also by consignments of buds from other States, the Australian Capital Territory, and New Zealand.

A site for a seed orchard, a special area to be managed for large-scale production of improved seeds, was selected in a forest area south of Daylesford. Isolated from other pines, grafts of the best trees were planted at wide spacing in order that cross-pollination in later years would produce crops of seeds combining the desired genetic characteristics of the original selected trees.

#### *Timber preservation*

For some years prior to 1956 the availability of naturally durable timbers from the forests of box, ironbark, and stringybark eucalypts suitable for electricity supply and telephone poles had fallen far short of the demand. The trees in these forests, most of which are situated in the drier northern districts, grow slowly, and they had been exploited from the early days of the Colony and drawn on heavily during the gold-mining era. The continued availability locally and from other Australian States of strong durable timbers ideally suited for use as piles, poles, bedlogs, sleepers, and other construction timbers had served to delay the establishment in Victoria of commercial preservation plants which had been in operation overseas for many years. Two plants to pressure-treat the sapwood of poles of naturally non-durable species with creosote, established at Trentham in 1956 and Brooklyn in 1957, created a market for poles from the mixed species foothill forests. This market allowed the forest managers to carry out light thinnings over extensive areas of the forests and so improve the quality and growth of the remaining trees. By 1960, several additional plants impregnating fencing timbers and small poles cut from hardwood and softwood thinnings with either creosote or copper-chrome-arsenic had been established in Victoria, and about 15 per cent of all the sawn softwood produced was treated with water-borne or light organic solvent preservatives.

#### *Hardboard production*

Hardboard, for which a pulp is prepared by mechanical processing, requires the utilisation of large volumes of low-grade wood available from sawlog and other fellings in the mixed

species hardwood forests of the Central Highlands. Production of hardboard commenced at Bacchus Marsh following ratification of a 50-year marketing agreement with the Colonial Sugar Refining Co. Ltd (CSR) by the *Forests (Pulpwood Agreement) Act 1959*. This agreement was subsequently terminated and CSR ceased operating at Bacchus Marsh. However, a different agreement was made with another company which operates at this location. This market for eucalypt pulpwood allowed more intensive silviculture to be practised in the regrowth forests embraced by the agreement.

### 1961 to 1970

#### *Plantations*

The need for plentiful supplies of softwood was apparent early in the history of the State. Victoria's native commercial softwood resources are restricted to small areas of slow growing *Callitris* forests in the northern part of the State. Long-fibred pine wood is a versatile medium-density raw material, being used for sawn timber, plywood, papers and other pulp products, particleboards, poles and piles, and small round timbers. Sawn and natural round pine is readily treated with preservatives to protect it against rot, insects, and marine borers.

Of the many exotic softwoods given a trial for forestry, *radiata* pine was outstandingly successful and nearly all the softwood plantations in Victoria are of this species. They provide a large volume of useful wood in a relatively short time on a range of soil types and climates. Little planting had been done from 1939 to 1960, because of the war and then because of lack of funds. The main new post-war plantings, of pine and eucalypt, were to reforest marginal farmland in the south Gippsland hills which had originally carried prime eucalypt forest. Victoria was still importing about one-quarter of its total wood requirements when in 1961 the Victorian Government adopted an expanded programme to lift the annual plantings of pine to 2,020 hectares. These were concentrated into definite production and manufacturing zones, to gain economies in fire protection, roading, establishment and maintenance costs, and to provide future industries with large volumes of sawlogs and pulpwood within short haulage distances.

Hitherto about 20 small nurseries had provided all the pines required for approximately 450 hectares of new State plantations each year. To meet the requirements of the accelerated programme four new regional nurseries were established between 1961 and 1968 at Koetong, Trentham, Benalla, and Narbethong, and an existing nursery at Rennick was extended. The locations of the new nurseries were chosen to utilise a range of climates as much as to be near the main planting areas. The adoption of large regional pine nurseries allowed the introduction of mechanisation and improved nursery practices resulting in a more uniform high quality of seedlings and lower unit costs.

Subsequently a revised total plantation target to be achieved by the year 2000 was proposed, based on projections of the population and projections of consumption per head of wood and wood products. The Commonwealth-States Softwood Forestry Agreements Acts of 1967 supported a new State target of 4,850 hectares annually for 1967 to 1971, the State financing the first 2,430 hectares each year and the Commonwealth the balance with loans which would be interest free for 10 years. When the Softwoods Agreement was renewed in 1972, it provided for a reduced State planting target of 3,500 hectares per year for the period 1972 to 1976. The areas of new plantations established are summarised in the following table:

AREAS OF NEW STATE FOREST PLANTATIONS:  
VICTORIA, 1934-35 TO 1981-82  
(hectares)

Year	Hardwoods	Softwoods
1934-35	13	2,005
1939-40	n.a.	10
1944-45	n.a.	25
1949-50	36	880
1954-55	33	150
1959-60	73	263
1964-65	466	2,180

AREAS OF NEW STATE FOREST PLANTATIONS:  
VICTORIA, 1934-35 TO 1981-82—*continued*  
(hectares)

Year	Hardwoods	Softwoods
1969-70	526	4,675
1974-75	973	4,585
1979-80	329	2,815
1980-81	318	2,608
1981-82	270	3,128

Source: Forests Commission, Victoria.

#### *Regeneration of native forests*

Most of the eucalypt forests are regenerated after timber fellings by natural or induced seedfall from trees of the old crop. For several years, logged areas in some mountain ash forests had been regenerated by seed from scattered or grouped overwood trees (trees which remain after the harvesting of the merchantable trees) temporarily reserved as seed-trees, or by planting out seedlings raised in a nursery. The two-stage harvesting of the mature trees required by the first method was a prolonged operation and relatively expensive. Sometimes the crop of new seedlings was too patchy and further expenditure was necessary to plant large gaps with nursery stock. In view of these disadvantages some trials of direct sowing of eucalypt seed were undertaken, with mixed results, usually because foraging insects, mainly ants, took much of the seed.

An operational outcome in 1964 of research into the biology of eucalypt seeds and seedlings was the aerial sowing of alpine ash seed treated with DDT over nine separate areas totalling 310 hectares in the Gippsland Highlands. Encouraging results stimulated improvement of techniques, and by 1967 this method of sowing eucalypt seed had become an established practice. Seed is hand-sown where an area to be regenerated is too small or awkward to sow from the air, or where the receptive seed bed is very patchy. About one-quarter of the native forest area regenerated each year is sown by hand or from the air. Of the 15,700 hectares which received regeneration treatment in 1979-80, 48 per cent was naturally seeded, 25 per cent was induced from the overwood trees, 11 per cent was hand sown, and 16 per cent was sown from aircraft.

#### *Machinery*

Several new types of machines for forestry work became available during this period, when total output of sawlogs was increasing and new areas were being opened up for timber harvesting. Tractors of greater horsepower equipped with winches replaced stationary winches for extracting logs except in the steepest country. Rubber-tired skidder tractors replaced tracked ones for some purposes. In some plantations pine logs were hauled by specially-built light tractors and various types of winch trucks. One-man chainsaws became widely used in felling and the preparation of logs, pulpwood, poles, and other timbers. Their use allowed logging supervisors to insist that fallers make extra cross-cuts through logs containing pockets of rot, fire scars or other defects, to discard a defective butt or to make a shorter log each side of an unusable section. In a given logging area, more logs thus became available to sawmillers, State revenues were increased, unit harvesting and roading costs were a little less, and the protection of regenerating areas from fire was assisted. The speed with which fallers could produce logs enabled the diminishing labour force of skilled men to fill quotas for the sawmills. This ability was especially important in areas where the logging roads were affected by snow for up to five months every winter, and the use of tractors and trucks in the forests during and after heavy rains was suspended to protect water catchments.

After 1968, the making of jeep tracks into unroaded parts of the forests was a diminishing activity. Most of the jeep tracks needed had now been built. Use of these tracks to transport men and equipment for firefighting and fuel reduction burning had become an essential part of fire protection strategy. The improved access had also accelerated progress with detailed mapping of the forest vegetations, and with timber, wildlife, and other surveys. Public use of the tracks increased as four-wheel drive vehicles and motor cycles became popular for recreation.

SILVICULTURAL TREATMENT OF STATE FOREST  
HARDWOOD PLANTATIONS: VICTORIA, 1934-35 TO 1981-82  
(hectares)

Year	Coppice	Thinning	Regeneration (includes liberation)	Other
1934-35	32,181	11,972	4,547	n.a.
1939-40	19,894	4,715	295	n.a.
1944-45	n.a.	1,441	489	n.a.
1949-50	6,510	3,118	1,310	n.a.
1954-55	5,326	4,640	6,759	n.a.
1959-60	2,650	6,707	3,301	n.a.
1964-65	1,231	4,866	8,198	n.a.
1969-70	1,245	5,597	6,100	718
1974-75	675	5,054	12,786	366
1979-80	623	2,770	18,189	877
1980-81	283	3,565	16,694	1,078
1981-82	508	3,131	17,273	2,363

Source: Forests Commission, Victoria.

SILVICULTURAL TREATMENT OF STATE FOREST  
SOFTWOOD PLANTATIONS: VICTORIA, 1934-35 TO 1981-82  
(hectares)

Year	Cleaning	Pruning	Thinning
1934-35	n.a.	n.a.	n.a.
1939-40	n.a.	n.a.	n.a.
1944-45	n.a.	n.a.	n.a.
1949-50	2,102	1,664	763
1954-55	1,074	102	798
1959-60	625	328	886
1964-65	2,407	250	1,063
1969-70	8,178	393	1,223
1974-75	9,580	470	135
1979-80	6,040	127	1,099
1980-81	4,558	196	1,775
1981-82	4,435	101	2,287

Source: Forests Commission, Victoria.

*Fuel reduction burning*

The forest managers responsible for controlling forest fires had recognised for some years that widespread, very destructive fires were inevitable unless fuel reduction burning was used on a large scale as an essential part of a balanced fire protection programme. The effectiveness of fuel reduction in allowing wildfires to be controlled in bad fire weather had been proved time and again in various districts of the State. Scientific research into fire behaviour and forest fuels had provided the basic knowledge and techniques for lighting fires, aerially or on the ground, in a definite pattern according to the amount and condition of the fine fuel, the topography, and the prevailing weather, to achieve low intensity firing over large areas within patrolled control lines. Large-scale forest fuel reduction burning in the State forests, national parks, and protected public land began in 1964-65; prior to that, relatively small areas had been burned as protective strips and patches. Since 1964, the annual area of fuel reduction burning has exceeded 150,000 hectares ten times; on two occasions the area exceeded 300,000 hectares.

*Commercial developments*

Long-term wood supply agreements, are subject to revision as circumstances change. For example, the *Forests (Wood Pulp Agreement) Act* 1961 amended the original agreement with Australian Paper Manufactures Ltd (APM) made in 1936 principally by revising the forest area available for supplies of pulpwood (because of changes in forest conditions over the quarter-century), and by providing for increased and differential royalties, and increasing the quantities of hardwood to be made available until 1987. The company, which had invested extensively in freehold forest land, was granted a 60 year lease of 3,533

hectares of State forest land in the south Gippsland hills, mainly covered with scrub and bracken, to reforest within 15 years with hardwood or softwood species suitable for making paper pulp.

#### Particleboard

The successful practice of silviculture depends on markets for the materials produced. Where there is a sustained market for small-diameter roundwood from early thinnings, and for crooked or knotty lengths from older trees, plantation or other even-aged tree crops can be thinned at the best time to increase profitability, to promote the vigour of the remaining trees, and to grow larger logs in a shorter time. Particleboard is a relatively new product which has had far-reaching effects on the furniture and fittings industries. It is a composition board made up largely of individual dried wood chips, splinters, and flakes in various layers which have been coated with an adhesive and hot pressed to form a long, wide smooth sheet. The main raw materials for making wood particleboard are medium density pale woods such as pine and poplar. Roundwood and billets used for particleboard are called pulpwood but the wood is reduced to flakes and chips, not to pulp. The first particleboard plant to be established in Victoria opened in 1964 at Rosedale, and all of its intake of wood came from private pine plantations. Production finished and the plant was sold in 1977. Agreements to supply particleboard plants at Ballarat and at Portland from State plantations were ratified by legislation in 1969 and 1975, respectively.

#### Pests

Protection of eucalypt forests from plagues of insect pests had assumed new urgency in 1958 when nearly 465,000 hectares of messmate-peppermint-gum forest in the north-east were infested by the leaf-eating phasmatid *Didymuria violescens*, a stick insect. Apart from causing the loss of timber, phasmatid infestations can result in deterioration of water catchments, wildlife habitats, and the landscape. Nearly 11,300 hectares of forests in 33 localities were sprayed with insecticide between 1961 and 1970. Since 1967, whenever a large population was predicted, an aerial spraying of malathion in January has been used very effectively to control the phasmatids by killing it in its early nymphal stages.

The wood wasp *Sirex noctilio*, an insect from southern Europe, was found on the Australian mainland in December 1961 in radiata pines at Woori Yallock, near Melbourne. The Sirex wasps insert their eggs under the bark and susceptible trees die within six weeks. The tunnels made by the feeding larvae ruin the wood for most uses. A National Sirex Campaign to co-ordinate a programme to control Sirex populations and support comprehensive research into Sirex biology was launched in January 1962. By 1970, valuable shelterbelts and many trees in some unthinned plantations 16 to 20 years old had been killed. Areas known to be infested had been placed under quarantine, and affected trees felled, cut up on the spot, and burnt. Concurrently the testing was commenced of the potential efficacy of various species of parasitoid wasps to exert biological control of the Sirex populations in pine plantations.

#### Alpine recreation

One aspect of the increasing public use of forests for recreation at this time was renewed public interest in the development of snow resorts. Before the Second World War, Mt Buller was Victoria's most developed ski resort for tough and hardy enthusiasts. By 1957 there were about 50 club lodges on Mt Buller, with an average accommodation of 10 beds. The first ski tow on Mt Baw Baw had been set up in 1955 and the committee of management was formed in 1959. In 1959 all grazing rights on the mountain were cancelled.

#### OUTPUT FROM STATE FORESTS: VICTORIA, 1934-35 TO 1979-80 (cubic metres)

Type	1934-35	1939-40	1944-45	1949-50	1954-55	1959-60	1964-65	1969-70	1974-75	1979-80
Logs for sawing, peeling, or slicing —										
Hardwoods	35,585	249,359	348,234	870,591	1,336,849	1,361,093	1,227,083	1,221,290	1,181,532	1,119,066
Softwoods	1,942	16,848	31,035	31,361	46,182	57,003	107,778	131,780	194,211	315,237
Pulpwood —										
Hardwoods	-	12,390	69,376	93,973	111,925	181,078	231,852	326,821	287,909	296,776

OUTPUT FROM STATE FORESTS: VICTORIA, 1934-35 TO 1979-80—*continued*  
(cubic metres)

Type	1934-35	1939-40	1944-45	1949-50	1954-55	1959-60	1964-65	1969-70	1974-75	1979-80
Softwoods	-	2,646	2,322	320	16,071	31,955	57,645	58,766	59,432	100,414
Firewood	404,279	502,579	961,093	1,248,858	500,232	372,712	393,297	253,272	129,972	92,944
Mining timbers	4,475	3,631	612	870	1,353	1,612	888	433	431	-
Other timber	86,129	50,297	46,800	92,018	125,248	125,447	119,218	94,101	81,636	56,816
Number of sawmills operating in Victoria	n.a.	327	332	615	636	521	441	314	278	245

Source: Forests Commission, Victoria.

### Since 1971

#### *Land-use policy*

In the 1970s, public interest was centred on the potential of undeveloped natural forests to provide some balance in the essentially urban lifestyle of most Victorians. The special interest of some groups in the preservation of forests for the joint conservation of flora and fauna, with a general but not so well defined public interest in the scenic and other natural qualities of forests for their value for recreation, brought about pressure for public participation in forest land-use decisions. The possible loss or deterioration of natural environments and use of forests for wood production in some areas became public issues.

Controversy following proposals to alienate public land for agricultural development in the Little Desert in 1969 led to the establishment of the Land Conservation Council in 1971 with the responsibility of making recommendations to the Victorian Government on the balanced use of public land in Victoria. The function of the Council has been to make detailed investigations of the basic resources of public lands and to receive submissions on land-use from private individuals, organisations, industry, and government departments. Proposed recommendations are formulated and made available for public comment before submission of the final recommendations to the Government through the Minister for Conservation. At 31 March 1981, the Land Conservation Council had prepared final recommendations for 70.8 per cent of the public land in Victoria and the majority of these recommendations had been accepted by the Victorian Government.

Victoria's forests are within relatively short distances of most centres of population and are readily accessible to the public. Forests attract many visitors because they accommodate a wide range of active and passive recreations. During the 1970s a system for managing the visual resources within State forests was introduced. Its aim has been to provide consistent recommendations for objectives and guidelines for minimising the visual impact of timber harvesting, road construction, recreation facilities, and other alterations to forest landscapes. Systematic visual resource inventory and assessment procedures are used for broadscale and project planning.

State forests have been mapped into nine landscape character types, and three scenic qualities, based on variety in landform, vegetation, and waterform, have been delineated within each type. Social factors have been determined by assessing the sensitivity of the public to what is seen. Three levels of public sensitivity to the visual resource have been mapped according to the classes and numbers of observers using an area or travelling in or near it.

A local inventory of features such as vegetation types, regeneration potential, slopes, aspect, and soils is made and then the broadscale landscape objectives are evaluated with other resources of the particular project area, such as timber and wildlife, to determine priorities for multiple use management that properly recognises non-material forest values.

As far as the material forestry values were concerned, regeneration of eucalypts became increasingly important. Sowing of completely logged coupes in alpine ash and mountain ash forests by hand and from aircraft, was calling for increasing quantities of prepared seed. In 1970-71 about 1,620 hectares of ash forest were sown, of which one-third was sown by hand, and in addition about 2,000 hectares of mixed species forests were sown aerially or by hand. To meet the demand for seed, and to accumulate a surplus to make up deficiencies after poor seeding years, new equipment and improved methods were introduced for collecting the eucalypt capsules and extracting the seeds. Whenever it was practicable the seed sown on an area of forest was collected there or in the neighbourhood to preserve genetic continuity in the tree crop.



By the end of the decade six to seven tonnes of eucalypt seed were collected each year by contractors and Forests Commission workers. The capsules were carted to one of several forest depots equipped for seed extraction and storage, and there tumbled in a revolving drum of fine mesh in which a blast of heated air dried the capsules, opening their valves and allowing the seed to fall to a collecting tray.

Substantial areas of mixed species, river red gum, and box-ironbark State forests were also regenerated each year by seed from natural or induced seedfalls. In 1979-80, some 7,500 hectares of these forests received fellings which promoted regeneration from natural seedfall, and seedfall was induced over another 3,900 hectares by the heat from burning logging slash, or by ringbarking or poisoning over-mature trees remaining after logging.

By 1973, the annual plantings of selected radiata pines in seed orchards, commenced in 1961, had built up 112 hectares of parent trees in three separate orchards to provide seed for genetically superior commercial plantations. The orchards yielded 625 kilograms of seed in 1974, and the average since has been about 500 kilograms, enough to raise the seedlings required for 4,000 hectares of new State plantations each year and the areas replanted after clear felling of mature crops. Studies of the natural variation of eucalypts, notably mountain ash, alpine ash, shining gum, and messmate stringybark, also received much attention from several research groups during the decade.

Timber harvesting in hardwood forests by the Forests Commission, which had been introduced after the fires in 1939, had become an established practice where sawmillers or pulpwood cutters could not operate in the ordinary way as forest licensees because of special marketing or silvicultural requirements. The main departmental operation was the integrated harvesting of mountain ash for sawmill and pulpwood lengths. Notably in east Gippsland, it was necessary to remove scattered old trees and to salvage whatever marketable timber could be cut from very defective unwanted trees to regenerate cut-over areas satisfactorily. For these operations the Commission usually engaged labour and equipment by contract, which enabled close control to be exercised of the work itself and also of the cost of bringing timber to the point of sale.

Metric measures for logs, pulpwood, firewood, and sawn timber were introduced in July 1974. The old Hoppus measure for round timber, which had its origins in England 250 years ago and was used widely in the British Commonwealth, was replaced by the cubic metre as the unit of timber measurement. The measures for pulpwood are cubic metre or tonne, and for firewood they are cubic metre of stack or tonne. Cubic metre replaced the superficial foot as the unit of sawn timber.

#### *New forest industries*

An objective of forestry has been to provide a flow of roundwood in a region sufficient to sustain integrated wood-using industries, that is, manufacturing plants having complementary demands upon the mixed yield of wood sizes and qualities from the forests. In the case of new commercial forests, such as pine plantations grouped into a production zone, the planners anticipate that the forest resource will attract large capital investments in forest industries which will generate regional development based on the long-term productivity of the land, as well as produce goods which otherwise would be imported. The opportunity to carry out first thinnings at an early age allows forest managers to maintain the vigour of the main crop, thus increasing its resistance to the Sirex wood wasp and to diseases, and enhancing the value of the sawlogs yielded by later thinnings and the final felling at maturity.

During the decade there was substantial restructuring of the sawmilling industries through amalgamations. Acquisitions by one company of softwood sawmills drawing logs from pine plantations in the Beechworth, Bright, and Myrtleford forest districts and the consolidation of milling at one site prepared the way for a fully integrated sawmill, pulp mill, and preservation treatment complex. The *Forests (Bowater-Scott Agreement) Act 1971* provided legislative authority for the supply of softwood pulpwood for the manufacture of paper pulp at Myrtleford. Long-term contractual marketing of small roundwood from the State pine forests in the Portland-Rennick plantation zone for conversion to particleboard at Portland was secured by the *Forests (Softwood Holding Agreement) Act 1975*. The establishment of a mill at Albury which began manufacturing paper pulp for newsprint in

1981 was negotiated late in the 1970s. This mill draws its supplies from the pine plantations in the Ovens and Upper Murray zones and in New South Wales.

Companies have been afforded financial opportunities to invest in forestry. The companies associated with established wood-using industries, and the co-operative forestry companies which have also established wood-using industries, own approximately half the plantations in the State. Only small areas have been established by other forms of company. Industrial plantations totalled 68,000 of the 77,400 hectares of private plantations in December 1978, over three-quarters of which had been planted since 1964. They are largely of radiata pine and are concentrated in Gippsland, the south-west regions, and the Otway Ranges.

FORESTRY, GROSS VALUE  
OF PRODUCTION:  
VICTORIA, 1934-35 TO 1979-80  
(\$'000)

Year	Gross value of production
1934-35	1,802
1939-40	2,949
1944-45	5,769
1949-50	12,318
1954-55	21,442
1959-60	37,174
1964-65	29,271
1969-70	30,010
1974-75	48,781
1979-80	66,747

*Farm forestry*

Tree planting assistance to landowners was extended in 1964 through the introduction by legislation of a Farm Forestry Loan Scheme. This scheme provides management and technical advice as well as long-term loans for commercial timber growing. Its main aims were to offer land-owners additional and diversified income from land which would otherwise be unproductive or only part-productive, and to increase substantially the timber reserves of the State. By 1982, the total agreements completed under this scheme were 339; the net loan commitment was \$1.4m; and the net area planted was 6,924 hectares.

More than 95 per cent of the plantations established were radiata pine. The remaining area had been planted with eucalypts, mainly mountain ash and blue gum, after the legislation was amended in 1975 to allow loans for plantations of trees other than softwood species.

In 1980, the Victorian Government initiated by legislation a tree growing assistance scheme through which farmers and graziers, municipal authorities, service clubs, schools, sporting clubs, and other groups could receive grants and other assistance to establish and maintain trees. The scheme has been designed to provide benefits to the wider community, including improvement of soil, water, and landscape values, and the extension of honey flora, wildlife habitats, shade, shelter, and places for recreation. The scheme was based on the premise that a combination of grants and technical advice would result in the establishment and rehabilitation of many trees, especially in countryside where tree decline had become serious.

*Pests*

The practice of monitoring phasmatid populations by egg counts, which began in 1967, continued to provide the basis for the restrained control programme of aerial spraying of insecticide. In 1971, there were heavy infestations of stands of mountain ash and alpine ash at 29 localities and nearly 7,500 hectares were sprayed. During the ensuing nine years, a total of just over 9,000 hectares at 65 locations were sprayed. Since the mid-1970s, phasmatid populations have remained at low levels in Victorian forests.

Although by 1980 the Sirex wood wasp was established wherever radiata pine was growing in Victoria, it had not caused a great deal of economic damage to timber crops,



Timber mill workers carried three fire victims eighteen kilometres through bush to the nearest road after the 1939 "Black Friday" bushfires near Moe.

*The Herald and Weekly Times Ltd*



Burned cars and destroyed buildings in the main street of Macedon — the aftermath of the "Ash Wednesday" bushfires of 1983.

*The Herald and Weekly Times Ltd*

Firefighters wait in battle formation at Pantmon Hills. Eight people were burned to death, hundreds of homes destroyed, and many towns evacuated as bushfires swept through the Dandenong and nearby ranges in January 1962.

*The Herald and Weekly Times Ltd*





Staff of the State Fish Hatchery at Snobs Creek net trout for liberation into Victoria's lakes and streams.

*The Herald and Weekly Times Ltd*

A leisurely picnic in the forests of the Dandenong Ranges near Melbourne.

*The Herald and Weekly Times Ltd*





Firefighters using a water tanker and hand tools to secure a fire edge.

*Forests Commission, Victoria*

New firefighting techniques are constantly tested and evaluated. Here, a Hercules aircraft fitted with a MAFFS (Modular Airborne Fire Fighting System) attacks a forest fire with chemical retardant.

*Forests Commission, Victoria*



A Bell 212 helicopter carrying a 1,900 litre bucket drops water on a fire in a mountain forest.

*Forests Commission, Victoria*



Loading sawmill logs cut from 50 year old mountain ash trees in State forest near Powelltown.

*Forests Commission, Victoria*

Commercial Danish seine fishing for school whiting off Lakes Entrance.

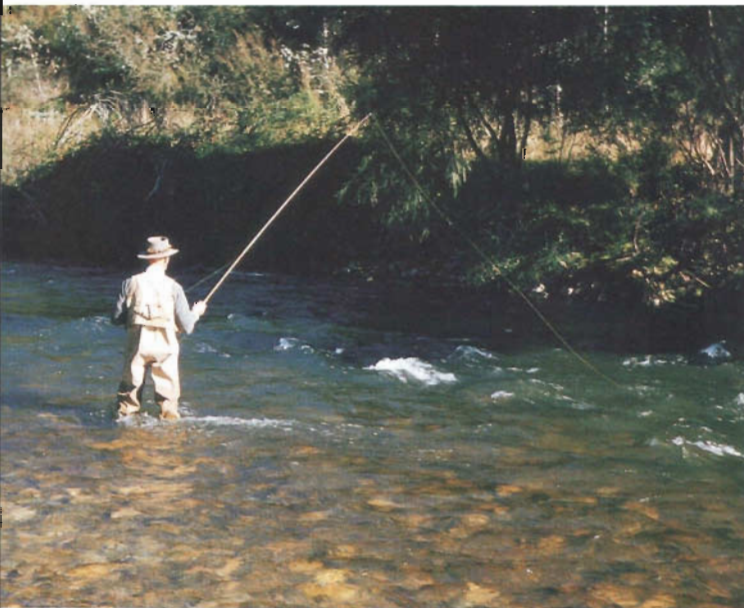
*Ministry for Conservation*





Twin circular saws about to make the first cuts through a messmate stringybark log at a small hardwood mill.

*Forests Commission, Victoria*



Re-stocking of rivers and lakes with trout and other fish has increased success and pleasure for many anglers.

*Ministry for Conservation*



Cape Schanck Coastal Park — view from Jubilee Point towards Sorrento.

*National Parks Service*

Organ Pipes National Park — school children studying the rock formations.

*National Parks Service*





except in some older unthinned plantations at Beechworth and Delatite. Infestations had been diminished by thinning susceptible plantations where practicable to increase the vigour and resistance of the trees, and by controlling *Sirex* populations with parasitoids, chiefly *Ibalia* wasps, and nematode parasites which sterilise female *sirex*. Nematodes had become a major agent of control since their first field releases in Victoria in 1973. Total funding of the national *Sirex* campaign by the Commonwealth and Victorian Governments and private plantation owners had exceeded \$4.5m and the extent of biological control of *Sirex* that had been achieved in Victoria was a notable achievement in forest protection.

#### *Mountain ash forests*

The 1939 fires greatly changed the pattern of use of Victoria's timber resources. Until that time most of the mountain ash timber was being cut in the forests of central and near-eastern Victoria, mainly between Toolangi and Erica. After the fire-killed timber had been salvaged most of the sawmillers moved to the Mansfield, Heyfield, and east Gippsland areas.

The re-growth mountain ash has reached a size and level of maturity which once again allows harvesting of logs from forests close to Melbourne to produce structural and appearance grades of fine hardwood timber. Barring another calamity it is predicted that the forests of 1939 re-growth will, if managed for log production, eventually sustain an output of seasoning quality timber at about the level supplied from mature mountain forests in the 1970s.

#### *Fire research*

Fire research by the Forests Commission covers fire behaviour, the use of fire in forest management, fire suppression, and the ecological effects of fire.

Improved knowledge of the conditions under which low intensity fire can be used to reduce hazardous accumulation of fuel in eucalypt forest, combined with refined techniques for igniting large areas, has established broad-area fuel reduction burning as a major element of forest protection. Procedures for fuel reduction burning, on a smaller scale, in softwood plantations have also been developed.

High intensity fires are often used in regenerating eucalypt forest following logging. The conditions under which such fires can be lit with safety while still achieving the desired intensity were derived from the results of systematic research. Remote ignition techniques, which have advantages on some forest sites in terms of both fire control and crew safety, have been similarly developed.

Probably the most important advances in fire suppression technology have been the introduction and continual refinement of methods of aerially applying long-term fire retardants. Fire bombing is a very effective suppression technique, particularly during the early stages of containing remote fires.

Extensive research into the effects of both prescribed and other fires on various elements of forest ecosystems is continuing. This work includes the effects of periodic or repeated low intensity burning on a wide range of vegetations and wildlife communities, the succession of vegetation and recolonising by wildlife after fires, and their effects on timber quality and its rate of growth.

#### *Fire detection*

The high and increasing costs of fire detection from towers and lookouts in the mountains led to a systematic assessment of the relative cost and effectiveness of using light aircraft patrols along regular flight lines, the number of patrols over an area depending on the fire danger index prevailing that day. The fixed system developed over 40 or so years is effective and reliable for detecting forest fires and fires in farmlands, but the area seen from even well-located towers is interrupted by many large blind spots and places where smoke must rise above intervening high ground before being observed. The value of regular aerial patrols, as a complement to detection from a reduced number of towers, was continually evaluated during the early 1980s.

*Fire suppression*

In 1982, further attention was given to reducing the time between detection of remote forest fires caused by lightning and the arrival of the first fire crew. In the 5 year period to 1981 nearly 30 per cent of fires in the forests of the eastern ranges were not fought within three hours of being reported, and 12 per cent of them not within twelve hours.

Helicopters had been used for forest firefighting in Victoria since 1967, and many helipads constructed for their use. Instead of travelling as far as practicable in four-wheel drive vehicles and then walking, often for many hours with tools and equipment, men could usually be set down fairly close to the fire, in a far shorter time. An added advantage of the helicopter was that inaccurate fire detection from a distant lookout could be overcome by direct observation from the air.

Hovering helicopters had been used in North America for several years to lower firefighters into forests from winches and by rappelling, a technique of lowering a man using a harness running down a rope at a rate he controls with a friction device. Although the commercial helicopters in Victoria in 1982 were not equipped for winching men they were suitable for rappelling. "Helitack" by rappelling offered a quick and versatile means of deploying firefighters for fast initial attack on fires, with an effective radius of operation of 160 kilometres in one hour from base.

All of the main lightning belt in the eastern ranges would be within 30 minutes flight from one base in the vicinity of, say, Mt Tamboritha. All the eastern ranges from Melbourne to Corryong and from Mansfield to Orbost would be within 160 kilometres of that fire attack base.

A crew of two to six men can often control a small lightning fire very quickly. Providing helicopters and maintaining trained rappellers throughout the fire danger season could greatly reduce the costs of suppressing large fires, quite apart from the damage fires cause and their potential threat to life and property. Accordingly, the Forests Commission undertook "helitack" trials using rappelling, with a view to adopting it as a standard practice in fire suppression.

*1982-83 fire season and "Ash Wednesday" fires*

Because of drought throughout most of Victoria, following the driest autumn and winter on record, the 1982-83 fire season was extremely hazardous during hot, windy weather. For the Country Fire Authority (CFA) it was the worst season since its establishment in 1944. Summer fire risk is very serious when the rainfall deficit compared to the average rainfall exceeds 30 per cent. Over most of Victoria the deficit exceeded 50 per cent, and in some cases it was 80 per cent.

In December and January, the largest fires were at Wyperfeld National Park (19,000 hectares destroyed), Greendale (2 Forests Commission employees died, 11 homes and 16,300 hectares destroyed), and Cann River (120,000 hectares destroyed).

On 1 February 1983, the first Macedon fire burnt over 6,000 hectares and destroyed 24 homes. February proved to be disastrous for Victoria with 11 major outbreaks which resulted in the deaths of 48 persons, 13 of whom were volunteer firefighters with the CFA.

"Ash Wednesday" (16 February 1983) was a day of extreme fire danger with temperatures exceeding 40°C in many parts of the State, relative humidities dropping to 10 per cent, and hot north winds reaching 70 kilometres per hour. Fire behaviour was too erratic for early control of the fires. Most of the fires spread rapidly southwards, then during the evening, a gale force south-westerly hit the main fire areas at velocities of up to 120 kilometres per hour, fanning the fires on wide fronts towards densely populated areas. The firefighting forces that were mobilised comprised 15,000 CFA volunteers, 1,200 Forests Commission personnel, 500 Defence Department personnel from all three Services, and forces provided by the National Parks Service, Fisheries and Wildlife Division, Department of Crown Lands and Survey, Melbourne and Metropolitan Board of Works, Country Roads Board, State Electricity Commission, National Safety Council, Australian Paper Manufacturers and other forest products industries and contractors, local government, and all bodies forming part of the State Disaster organisation.

In addition to hundreds of tankers, trucks, and bulldozers, the equipment deployed included the Hercules aircraft firebomber; small agricultural aircraft as firebombers;

helicopters for observation, command, burning back operations, bucketing of water, and troop movements; and infra-red equipment in both a CSIRO Fokker Friendship aircraft and National Safety Council helicopter to plot firefronts through dense smoke.

All of the major fires were under control or nearly so by the evening of 21 February 1983 or the morning of 22 February 1983 when a severe lightning storm swept across the State causing a spate of lightning fires. It was necessary to immediately re-deploy the already tired firefighters.

Between 16 and 18 February, fires destroyed 1,761 houses and 82 commercial properties. They damaged 1,238 farms, burnt out 85,000 hectares of public land, and destroyed 5,900 kilometres of fencing. They killed some 7,000 cattle and 19,000 sheep. Losses exceeded \$200m, and operating costs incurred by State agencies in three days were \$5m. The following are statistics on the "Ash Wednesday" fires:

#### MAJOR "ASH WEDNESDAY" FIRES: VICTORIA, 16 TO 22 FEBRUARY 1983

Location	Area burnt (hectares)	Fatalities	Homes destroyed
Cudjee/Ballangeich	80,000	7	83
Otway Ranges Area	37,000	3	729
Moonlight Head	1,400	-	1
Macedon Ranges Area	20,000	8	399
Belgrave/Upper Beaconsfield	10,000	22	223
Cockatoo	2,000	7	300
Monivae (Buckley Swamp)	2,000	1	3
Warburton	40,000	-	23
<b>Total</b>	<b>192,400</b>	<b>48</b>	<b>1,761</b>

Source: Country Fire Authority.

A total of 93 fires was reported to CFA Headquarters on "Ash Wednesday", but only eight of these reached major proportions. The total area burnt was approximately 210,000 hectares.